1. Electrick: Low-Cost Touch Sensing Using Electric Field Tomography

SESSION:Innovative Sensing

Current touch input technologies are best suited for small and flat applications, such as smartphones, tablets and kiosks. In general, they are too expensive to scale to large surfaces, such as walls and furniture, and cannot provide input on objects having irregular and complex geometries, such as tools and toys. We introduce Electrick, a low-cost and versatile sensing technique that enables touch input on a wide variety of objects and surfaces, whether small or large, flat or irregular. This is achieved by using electric field tomography in concert with an electrically conductive material, which can be easily and cheaply added to objects and surfaces. We show that our technique is compatible with commonplace manufacturing methods, such as spray/brush coating, vacuum forming, and casting/molding enabling a wide range of possible uses and outputs. Our technique can also bring touch interactivity to rapidly fabricated objects, including those that are laser cut or 3D printed. Through a series of studies and illustrative example uses, we show that Electrick can enable new interactive opportunities on a diverse set of objects and surfaces that were previously static.

> 目前的触摸输入技术最适合于小型和扁平应用，如智能手机、平板电脑和售货亭。一般来说，它们太昂贵，无法扩展到大的表面，例如墙壁和家具，也不能为具有不规则和复杂几何形状的物体（如工具和玩具）提供输入。我们介绍了电动、低成本、多功能传感技术，使触摸输入在各种各样的物体表面，无论是大的还是小的，平的或不规则的。这是通过与导电材料一起使用电场层析成像来实现的，这种导电材料可以容易且廉价地添加到物体和表面。我们表明，我们的技术是兼容一般的制造方法，如喷涂/刷涂层，真空成型，铸造/成型，使广泛的可能用途和产出。我们的技术还可以为快速制造的物体，包括那些激光切割或3D打印的物体带来触摸交互作用。通过一系列的实例研究和使用，我们发现，虽然可以使一组不同的物体和表面以前静态互动新机会。 article link

2. GhostID: Enabling Non-Persistent User Differentiation in Frequency-Division Capacitive Multi-Touch Sensors

SESSION:Innovative Sensing

Current touch devices are adept at tracking finger touches, but cannot distinguish if multiple touches are caused by different fingers on a single hand, by fingers from both hands of a single user, or by different users. This limitation significantly reduces the possibilities for interaction techniques in touch interfaces. We presentGhostID, a capacitive sensor that can differentiate the origins of multiple simultaneous touches. Our approach analyzes the signal ghosting, already present as an artifact in a frequency-division touch controller, to differentiate touches from the same hand or different hands of a single user (77% reliability at 60 fps) or from two different users (95% reliability at 60 fps). In addition toGhostID, we also develop a framework of user-differentiation capabilities for touch input devices, and illustrate a set of interaction techniques enabled byGhostID.

> 目前的触摸设备擅长追踪手指的触摸，但无法辨别多个触摸是由一只手的不同手指、单个用户的手指或不同的用户所引起的。这种限制大大减少了交互技术在触摸界面中的可能性。我们presentghostid，电容式传感器，可以区分多个同时触摸的起源。我们的方法分析信号的重影，已经出现在频分触摸控制器的一种神器，区分触及从单用户相同或不同的手手（77%的可靠性在60 FPS）或从两个不同的用户（95%的可靠性为60帧）。此外toghostid，我们还开发了一个用户的分化能力框架的触摸输入设备，并说明一组交互技术，使byghostid。 article link

3. Essence: Olfactory Interfaces for Unconscious Influence of Mood and Cognitive Performance

SESSION:Innovative Sensing

The sense of smell is perhaps the most pervasive of all senses, but it is also one of the least understood and least exploited in HCI. We present Essence, the first olfactory computational necklace that can be remotely controlled through a smartphone and can vary the intensity and frequency of the released scent based on biometric or contextual data. This paper discusses the role of smell in designing pervasive systems that affect one's mood and cognitive performance while being asleep or awake. We present a set of applications for this type of technology as well as the implementation of the olfactory display and the supporting software. We also discuss the results of an initial test of the prototype that show the robustness and usability of Essence while wearing it for long periods of time in multiple environments.

> 嗅觉也许是所有感官中最普遍的一种，但它也是HCI中最不被理解和利用最少的一种。我们展示了第一个可以通过智能手机远程控制的嗅觉计算项链，它可以根据生物特征或上下文数据改变释放出来的气味的强度和频率。本文讨论了嗅觉在设计影响睡眠和清醒时情绪和认知能力的普遍系统中的作用。我们提出了一套应用程序，这种类型的技术，以及实施的嗅觉显示和支持软件。我们还讨论了原型的初步测试结果，它显示了在多个环境中长时间佩戴本质的健壮性和可用性。 article link

4. Group Touch: Distinguishing Tabletop Users in Group Settings via Statistical Modeling of Touch Pairs

SESSION:Innovative Sensing

We presentGroup Touch, a method for distinguishing among multiple users simultaneously interacting with a tabletop computer using only the touch information supplied by the device. Rather than tracking individual users for the duration of an activity, Group Touchdistinguishesusers from each other by modeling whether an interaction with the tabletop corresponds to either: (1) a new user, or (2) a change in users currently interacting with the tabletop. This reframing of the challenge as distinguishing users rather than tracking and identifying them allows Group Touch to support multi-user collaboration in real-world settings without custom instrumentation. Specifically, Group Touch examines pairs of touches and uses the difference in orientation, distance, and time between two touches to determine whether the same person performed both touches in the pair. Validated with field data from high-school students in a classroom setting, Group Touch distinguishes among users "in the wild" with a mean accuracy of 92.92% (SD=3.94%). Group Touch can imbue collaborative touch applications in real-world settings with the ability to distinguish among multiple users.

> 我们presentgroup触摸，用于区分多用户同时与只使用触摸信息由设备提供桌面计算机的方法。而不是一个活动的时间跟踪个人用户，通过建模是否与桌面交互对应于彼此touchdistinguishesusers组：（1）一个新的用户，或（2）在用户当前使用的桌面的变化。这种重构的挑战作为区分用户而不是跟踪和识别他们允许组触摸支持多用户协作没有在现实世界中的设置自定义的仪表。具体来说，组触摸检查两对触摸，并使用方向，距离和时间之间的差异，两次触摸，以确定是否同一个人执行两个触摸在这一对。与高中学生在课堂环境中的现场数据进行验证，小组接触区分“野外”的用户，平均准确率为92.92%（SD = 3.94%）。集团联系可以为协作联系在现实世界中的设置应用程序来区分多个用户的能力。 article link

5. What Makes Live Events Engaging on Facebook Live, Periscope, and Snapchat

SESSION:Interruptions and Email

Live streaming platforms bring events from all around the world to people's computing devices. We conducted a mixed methods study including interviews (N = 42) and a survey (N = 223) to understand how people currently experience events using Facebook Live, Periscope, and Snapchat Live Stories. We identified four dimensions that make remote event viewing engaging: immersion, immediacy, interaction, and sociality. We find that both live streams and the more curated event content found on Snapchat are immersive and immediate, yet Snapchat Live Stories enable quickly switching among different views of the event. Live streams, on the other hand, offer real time interaction and sociality in a way that Snapchat Live Stories do not. However, the interaction's impact depends on comment volume, comment content, and relationship between viewer and broadcaster. We describe how people experience events remotely using these social media, and identify design opportunities around detecting exciting content, leveraging multiple viewpoints, and enabling interactivity to create engaging user experiences for remotely participating in events.

> 实时流媒体平台将来自世界各地的事件带给人们的计算设备。我们进行了混合方法研究包括访谈（N = 42）和调查（N = 223）了解人们目前的经验事件使用脸谱网Live，潜望镜，与Snapchat的生活故事。我们确定了四个维度，使得远程事件观察具有吸引力：沉浸感、即时性、互动性和社交性。我们发现，生活流和更多的策划活动内容发现Snapchat是身临其境的和直接的，但Snapchat生活故事使事件的不同视图之间快速切换。生活流，另一方面，在某种程度上，Snapchat生活故事不提供实时互动性和社会性。然而，互动的影响取决于评论量，评论内容，以及观众和广播员之间的关系。我们描述了人们如何使用这些社交媒体体验远程事件，并识别围绕探测令人兴奋的内容、利用多个视点、以及利用交互性创建远程参与活动的用户体验的设计机会。 article link

6. Reducing Interruptions at Work: A Large-Scale Field Study of FlowLight

SESSION:Interruptions and Email

Due to the high number and cost of interruptions at work, several approaches have been suggested to reduce this cost for knowledge workers. These approaches predominantly focus either on a manual and physical indicator, such as headphones or a closed office door, or on the automatic measure of a worker's interruptibilty in combination with a computer-based indicator. Little is known about the combination of a physical indicator with an automatic interruptibility measure and its long-term impact in the workplace. In our research, we developed the FlowLight, that combines a physical traffic-light like LED with an automatic interruptibility measure based on computer interaction data. In a large-scale and long-term field study with 449 participants from 12 countries, we found, amongst other results, that the FlowLight reduced the interruptions of participants by 46%, increased their awareness on the potential disruptiveness of interruptions and most participants never stopped using it.

> 由于工作中断的数量和成本高，建议采取几种方法来降低知识工作者的成本。这些方法主要集中在人工和物理指标，如耳机或一个封闭的办公室的门，或者对工人的interruptibilty自动测量与计算机的指标组合。点是一个物理指标的自动测量，可中断其在工作场所的长期影响，结合已知的。在我们的研究中，我们开发的FlowLight，将一个物理的交通灯LED提供了一个基于计算机的交互数据自动中断能力的措施。在一个大型的、长期的来自12个国家，449的参与者的研究发现，在其他的结果，使FlowLight减少参与者的中断46%，增加他们的意识中断的潜在破坏和大多数参与者从来没有停止使用它。 article link

7. MyriadHub: Efficiently Scaling Personalized Email Conversations with Valet Crowdsourcing

SESSION:Interruptions and Email

Email has scaled our ability to communicate with large groups, but has not equivalently scaled our ability to listen and respond. For example, emailing many people for feedback requires either impersonal surveys or manual effort to hold many similar conversations. To scale personalized conversations, we introduce techniques that exploit similarities across conversations to recycle relevant parts of previous conversations. These techniques reduce the authoring burden, save senders' time, and maintain recipient engagement through personalized responses. We introduce MyriadHub, a mail client where users start conversations and then crowd workers extract underlying conversational patterns and rules to accelerate responses to future similar emails. In a within-subjects experiment comparing MyriadHub to existing mass email techniques, senders spent significantly less time planning events with MyriadHub. In a second experiment comparing MyriadHub to a standard email survey, MyriadHub doubled the recipients' response rate and tripled the number of words in their responses.

> 电子邮件扩大了我们与大群体交流的能力，但并没有同等地扩大我们听和回答的能力。例如，给许多人发送反馈信息需要客观的调查或手动的努力来进行许多类似的谈话。为了扩大个性化对话，我们引入了利用会话中的相似性来回收先前会话相关部分的技术。这些技术减少了创作负担，节省了发送者的时间，并通过个性化响应维持收件人参与。我们介绍myriadhub，邮件客户端，用户开始对话，然后人群职工提取基本会话模式和规则，加快对未来类似的电子邮件。在一个实验中比较myriadhub现有大量的电子邮件技术中，发送者花费更少的时间规划与myriadhub事件。在第二个实验中比较myriadhub到标准的邮件调查，myriadhub翻倍的接受者的反应率和反应词的数量增加了一倍。 article link

8. "If a person is emailing you, it just doesn't make sense": Exploring Changing Consumer Behaviors in Email

SESSION:Interruptions and Email

Much of the existing research literature on email use focuses on productivity or work settings. However, personal use of email has rarely been studied in depth. With the growth of messaging platforms being used for an increasing amount of personal communication, yet email use remaining high, we were interested in learning what Americans are using email for in their daily lives in 2016. To explore this topic, we use qualitative data from over 150 interviews with personal email users as well as quantitative data from several larger survey-based studies. We will show that personal email use is very different from what has been previously studied by workplace researchers and that daily use is largely focused on receiving and viewing B2C messages such as coupons, deals, receipts, and event notifications with personal communication over email diminished to a rarer, less-than-daily occurrence. We discuss the implications of this for the design of email and communications clients and present a design and prototype for an application that seeks to support these more frequent uses of consumer email.

> 现有的关于电子邮件使用的研究文献大多集中在生产力或工作环境上。然而，个人使用电子邮件很少被深入研究。随着信息平台越来越多地用于个人通信，而电子邮件的使用仍然很高，我们有兴趣了解美国人在2016的日常生活中使用电子邮件的方式。为了探索这一主题，我们使用了150多份个人电子邮件用户访谈的定性数据以及来自一些较大的基于调查的研究的定量数据。我们将表明，个人电子邮件的使用是从已被研究人员和工作场所的日常使用主要集中在接收和查看B2C信息如优惠券、交易、收益研究非常不同，和事件通知以邮件减少到一个罕见的个人通信，小于日常发生的事情。我们讨论了这一点对电子邮件和通信客户端设计的影响，并提出了一个设计和原型的应用程序，旨在支持这些更频繁地使用消费者的电子邮件。 article link

9. 'Maker' within Constraints: Exploratory Study of Young Learners using Arduino at a High School in India

SESSION:Learning to be Makers

Do-it-yourself (DIY) inspired activities have gained popularity as a means of creative expression and self-directed learning. However, DIY culture is difficult to implement in places with limited technology infrastructure and traditional learning cultures. Our goal is to understand how learners in such a setting react to DIY activities. We present observations from a physical computing workshop with 12 students (13-15 years old) conducted at a high school in India. We observed unique challenges for these students when tackling DIY activities: a high monetary and psychological cost to exploration, limited independent learning resources, difficulties with finding intellectual courage and assumed technical language proficiency. Our participants, however, overcome some of these challenges by adopting their own local strategies: resilience, nonverbal and verbal learning techniques, and creating documentation and fallback circuit versions. Based on our findings, we discuss a set of lessons learned about makerspaces in a context with socio-technical challenges.

> 自己动手做的活动激发了人们对创意表达和自我导向学习的热情。然而，在有限的技术基础设施和传统的学习文化的地方，DIY文化是很难实现的。我们的目标是了解在这样的环境中学习者对DIY活动的反应。我们目前的观测物理计算车间的12名学生（13-15岁）在印度的一所高中进行。我们观察到这些学生在处理DIY活动时遇到了独特的挑战：探索的金钱和心理成本高，自主学习资源有限，难以找到智力上的勇气和假设技术语言能力。然而，我们的参与者通过采用自己的本地策略克服了一些挑战：弹性，非语言和口头学习技术，以及创建文档和回退电路版本。根据我们的研究，我们讨论一系列的经验教训在社会技术挑战的背景下创客空间。 article link

10. 'I Make, Therefore I Am': The Effects of Curriculum-Aligned Making on Children's Self-Identity

SESSION:Learning to be Makers

Prior research investigating the effects of incorporating Making into educational contexts has been limited to snapshot studies. These studies however do not allow for the investigation of aspects that require longer-term development and nurture. We present a longitudinal study that investigates the effects of Making on children's degree of science self-efficacy, identity formation as possible scientists and engineers, and academic performance in science. Designed interactions with Making technology were integrated into the science curriculum of elementary school classrooms in a public school with a high proportion of students from minority populations for a year. Results showed significant differences between the "Making classrooms" and the control classrooms, and from pre- to post-test on the students' inclination towards science. The results support the promise and potential of incorporating Making into formal schooling on the growth and long-term attitudes of children towards science and STEM in general.

> 以前的研究调查纳入教育环境的影响已限于快照研究。然而，这些研究不允许对需要长期发展和培育的方面进行调查。我们提出了一个纵向研究，调查的影响，使儿童的科学自我效能感，身份形成可能的科学家和工程师，在科学和学术表现。设计与科技互动的课程被整合到一所公立学校的小学教室的科学课程中，一年中来自少数民族学生的比例很高。结果表明：“造教室”与“控制教室”、“前后测试”对学生的科学倾向有显著性差异。这一结果支持了将正规教育纳入儿童对科学的发展和长期态度的承诺和潜力。 article link

11. "It's a Bomb!" -- Material Literacy and Narratives of Making

SESSION:Learning to be Makers

This paper analyses a series of events in which a discarded box found in a garbage room is examined and taken apart in the context of a makerspace. The participants' inquiry provided a rich and multifaceted experience in various settings, including puzzle-solving, exploring physical and digital materials, engaging people with different skills. The social engagements with and around the artifacts brought certain interpretative aspects to the fore. Situated acts of interpretation worked as ways of building a coherent narrative and a meaningful experience. In the paper, we highlight the relationship between on the one hand the subjects' skills and motivations to understand and make sense of the technology at hand which we callmaterial literacy, and on the other hand the specificmaterial qualitiesthat encourage or trigger certain interpretations and experiences. The qualities we discuss are: opacity, risk, authenticity, uniqueness, age, and hybridity. This study allows us to reposition the contemporary understanding of makerspaces beyond that of being places for innovation and learning.

> 本文分析了一系列的事件中，被丢弃在垃圾箱里找到了被拆开的Makerspace语境。与会者的调查提供了丰富多样的经验，在各种设置，包括解谜，探索物理和数字材料，吸引不同技能的人。在工件周围和周围的社会接触带来了一些解释性的方面。作为解释连贯的叙述和有意义的经验的方式的位置解释行为。在本文中，我们强调一方面之间的关系的学科技能和动机的理解和在手，我们callmaterial素养使科技感，另一方面物质品质鼓励或触发某种解释和经验。我们讨论的品质：不透明度、风险、真实性、独特性、时代性，和。这项研究使我们重新认识当代的创客空间之外，是创新和学习的地方。 article link

12. MakerWear: A Tangible Approach to Interactive Wearable Creation for Children

SESSION:Learning to be Makers

Wearable construction toolkits have shown promise in broadening participation in computing and empowering users to create personally meaningful computational designs. However, these kits present a high barrier of entry for some users, particularly young children (K-6). In this paper, we introduce MakerWear, a new wearable construction kit for children that uses a tangible, modular approach to wearable creation. We describe our participatory design process, the iterative development of MakerWear, and results from single- and multi-session workshops with 32 children (ages 5-12; M=8.3 years). Our findings reveal how children engage in wearable design, what they make (and want to make), and what challenges they face. As a secondary analysis, we also explore age-related differences.

> 可穿戴式建筑工具箱在扩大参与计算和增强用户创建个人有意义的计算设计方面显示出了希望。然而，这些试剂盒目前一些用户的进入壁垒较高，特别是年轻的孩子（K-6）。在本文中，我们介绍一种新的makerwear，儿童使用有形的可穿戴的施工工具，可穿戴创新的模块化方法。我们描述了我们参与设计过程，对makerwear迭代开发，从单和多届研讨会，有32个孩子的结果（年龄5-12；M = 8.3年）。我们的发现揭示了儿童如何从事可穿戴设计，他们做什么（想做什么），以及他们面临什么样的挑战。作为次要分析，我们也探讨了年龄差异。 article link

13. Self Harmony: Rethinking Hackathons to Design and Critique Digital Technologies for Those Affected by Self-Harm

SESSION:Mental Health

In this paper we explore the opportunities, challenges and best practices around designing technologies for those affected by self-harm. Our work contributes to a growing HCI literature on mental health and wellbeing, as well as understandings of how to imbue appropriate value-sensitivity within the digital design process in these contexts. The first phase of our study was centred upon a hackathon during which teams of designers were asked to conceptualise and prototype digital products or services for those affected by self-harm. We discuss how value-sensitive actions and activities, including engagements with those with lived experiences of self-harm, were used to scaffold the conventional hackathon format in such a challenging context. Our approach was then extended through a series of critical engagements with clinicians and charity workers who provided appraisal of the prototypes and designs. Through analysis of these engagements we expose a number of design challenges for future HCI work that considers self-harm; moreover we offer insight

into the role of stakeholder critiques in extending and rethinking hackathons as a design method in sensitive contexts.

> 在本文中，我们将探讨为自我伤害影响的人设计技术的机会、挑战和最佳做法。我们的工作有助于增长的HCI文学对精神健康的认识，以及如何为适当的值的灵敏度在这些语境的数字化设计过程。我们研究的第一阶段是集中在一个活动中团队的设计师被要求的概念和原型的数字产品或服务对于那些自我伤害的影响。我们讨论价值敏感的行为和活动，包括那些约会过自我伤害的经验，用于脚手架的常规Hackathon格式在这样一个具有挑战性的环境。然后，我们通过与临床医生和慈善工作者进行了一系列关键性的谈判，对原型和设计进行了评估。通过这些活动，我们暴露了一些设计挑战未来的人机交互工作，认为自我伤害的分析；此外，我们提供了洞察利益相关者批判延伸作为一个敏感的情境的设计方法对黑客马拉松的作用。 article link

14. Changing Moods: How Manual Tracking by Family Caregivers Improves Caring and Family Communication

SESSION:Mental Health

Previous research on healthcare technologies has shown how health tracking promotes desired behavior changes and effective health management. However, little is known about how the family caregivers' use of tracking technologies impacts the patient-caregiver relationship in the home. In this paper, we explore how health-tracking technologies could be designed to support family caregivers cope better with a depressed family member. Based on an interview study, we designed a simple tracking tool called Family Mood and Care Tracker (FMCT) and deployed it for six weeks in the homes of 14 family caregivers who were caring for a depressed family member. FMCT is a tracking tool designed specifically for family caregivers to record their caregiving activities and patient's conditions. Our findings demonstrate how caregivers used it to better understand the illness and cope with depressed family members. We also show how our tool improves family communication, despite the initial concerns about patient-caregiver conflicts.

> 以前对健康技术的研究表明健康追踪如何促进期望的行为变化和有效的健康管理。然而，家庭护理人员如何使用跟踪技术影响家庭中的照料者关系却知之甚少。在本文中，我们探讨了如何跟踪健康的技术，以支持家庭照顾者更好地应付一个郁闷的家庭成员。根据采访的研究中，我们设计了一个简单的跟踪工具叫做家庭的情绪和保健跟踪器（停产）和部署了六个星期在14个家庭照顾谁照顾家庭成员的家庭抑郁。”是一个追踪工具专为家庭照顾者照顾活动和记录病人的情况。我们的研究结果表明，照顾者如何利用它更好地了解疾病和应付郁闷的家庭成员。我们还展示了我们的工具如何改善家庭沟通，尽管最初的关注病人照顾者的冲突。 article link

15. Modeling and Understanding Visual Attributes of Mental Health Disclosures in Social Media

SESSION:Mental Health

Content shared on social media platforms has been identified to be valuable in gaining insights into people's mental health experiences. Although there has been widespread adoption of photo-sharing platforms such as Instagram in recent years, the role of visual imagery as a mechanism of self-disclosure is less understood. We study the nature of visual attributes manifested in images relating to mental health disclosures on Instagram. Employing computer vision techniques on a corpus of thousands of posts, we extract and examine three visual attributes: visual features (e.g., color), themes, and emotions in images. Our findings indicate the use of imagery for unique self-disclosure needs, quantitatively and qualitatively distinct from those shared via the textual modality: expressions of emotional distress, calls for help, and explicit display of vulnerability. We discuss the relationship of our findings to literature in visual sociology, in mental health self disclosure, and implications for the design of health interventions.

> 在社交媒体平台上共享的内容已经被发现对于深入了解人们的心理健康体验是有价值的。虽然有了照片分享平台Instagram等近年来广泛采用，视觉意象为自我披露机制不理解的作用。我们研究视觉属性表现在有关Instagram心理健康披露图像的性质。利用计算机视觉技术在成千上万篇文章的语料库中，我们提取和检查了三个视觉属性：视觉特征（例如颜色）、主题和图像中的情感。我们的研究结果表明，使用独特的自我表露需求的图像，定量和定性不同于通过文本形式共享：情绪困扰的表达，呼吁帮助，并明确显示脆弱性。我们讨论了我们的研究结果与文学在视觉社会学，心理健康自我表露，以及设计的健康干预措施的影响。 article link

16. The Social Lives of Individuals with Traumatic Brain Injury

SESSION:Mental Health

Traumatic Brain Injury (TBI) can affect all aspects of an individual's life, including physical ability, communication, and mental health, and present chronic health conditions that persist throughout the lifespan. Although prior work documents a decrease in social interaction following brain injury, little is known about how individuals with TBI engage in social behavior during their recovery, how others in their lives participate, and how these interactions occur in both online and offline contexts. We examine these issues through an interview study involving individuals with TBI, as well as caregivers and social contacts of individuals with TBI. Our analysis identifies the concept of social re-emergence, a non-linear process of developing a new social identity that involves withdrawing from social life, developing goals for social participation, disclosing health information for social support and acceptance, and attaining social independence.

> 创伤性脑损伤（TBI）可以影响个人生活的各个方面，包括身体能力、沟通和心理健康，以及持续存在于整个生命期的慢性健康状况。虽然以前的工作文件减少了脑外伤后的社会交往，但很少有人知道TBI个体在康复过程中如何参与社会行为，以及其他人如何参与他们的生活，以及这些互动在在线和离线环境中是如何发生的。我们通过一项涉及TBI个体的访谈研究，以及对TBI患者的照顾者和社会接触，来研究这些问题。我们的分析确定的社会重新出现的概念，一个非线性发展的一个新的社会身份，包括退出社会生活的过程中，社会参与的发展目标，提供健康信息的社会支持和接受，并获得社会独立性。 article link

17. User-Guided Synthesis of Interactive Diagrams

SESSION:Perceptions of Visualizations

Interactive diagrams are expensive to build, requiring significant programming experience. The cost of building such diagrams often prevents novice programmers or non-programmers from doing so. In this paper, we present user-guided techniques that transform a static diagram into an interactive one without requiring the user to write code. We also present a tool called EDDIE that prototypes these techniques. We evaluate EDDIE through: (1) a case study in which we use EDDIE to implement existing real-world diagrams from the literature and (2) a usability session with target users in which subjects build several diagrams in EDDIE and provide feedback on EDDIE's user experience. Our experiments demonstrate that EDDIE is usable and expressive, and that EDDIE enables real-world diagrams to be implemented without requiring programming expertise.

> 交互式图表很昂贵，需要大量的编程经验。构建这种图表的成本常常阻止新手程序员或非程序员这样做。在本文中，我们提出了用户引导技术，将静态图表转换为交互式图表，而无需用户编写代码。我们还提供了一个工具，称为埃迪，这些技术的原型。我们对埃迪进行了评估：（1）一个案例研究，我们使用埃迪从文献中实现现有的真实世界图表，（2）一个可用性会话，目标用户在埃迪中构建多个图表，并提供关于埃迪用户体验的反馈。我们的实验表明，埃迪是可用的和富有表现力的，埃迪可以实现真实世界的图表，而不需要编程专门知识。 article link

18. Peripheral Popout: The Influence of Visual Angle and Stimulus Intensity on Popout Effects

SESSION:Perceptions of Visualizations

By exploiting visual popout effects, interface designers can rapidly draw a user's attention to salient information objects in a display. A variety of different visual stimuli can be used to achieve popout effects, including color, shape, size, motion, luminance, and flashing. However, there is a lack of understanding about how accurately different intensities of these effects support popout, particularly as targets move further from the center of the visual field. We therefore conducted a study to examine the accuracy of popout target identification using different visual variables, each at five different levels of intensity, and at a wide range of angles from the display center. Results show that motion is a strong popout stimulus, even at low intensities and wide angles. Identification accuracy decreases rapidly across visual angle with other popout stimuli, particularly with shape and color. The findings have relevance to a wide variety of applications, particularly as multi-display desktop environments increase in size and visual extent.

> 利用视觉弹出效果，界面设计人员可以迅速吸引用户的注意，突出信息对象在显示。各种不同的视觉刺激，可以用来实现弹出效果，包括颜色、形状、大小、运动、亮度、闪烁。然而，有一个缺乏了解如何准确不同强度的这些影响支持弹出，目标将进一步从中心视野特别。因此我们进行了一项研究来检验精度弹出目标识别使用不同的视觉变量，每个在五度的水平不同，在很宽的角度范围内的展示中心。结果表明，运动是一种强烈的气孔的刺激，即使在低强度和宽角度。识别精度迅速下降在视角与气孔的刺激，特别是形状和颜色。这些发现与各种各样的应用有关，特别是随着多显示桌面环境在尺寸和视觉范围上的增加。 article link

19. Attention Allocation Aid for Visual Search

SESSION:Perceptions of Visualizations

This paper outlines the development and testing of a novel, feedback-enabledattention allocation aid (AAAD), which uses real-time physiological data to improve human performance in a realistic sequential visual search task. Indeed, by optimizing over search duration, the aid improves efficiency, while preserving decision accuracy, as the operator identifies and classifies targets within simulated aerial imagery. Specifically, using experimental eye-tracking data and measurements about target detectability across the human visual field, we develop functional models of detection accuracy as a function of search time, number of eye movements, scan path, and image clutter. These models are then used by the AAAD in conjunction with real time eye position data to make probabilistic estimations of attained search accuracy and to recommend that the observer either move on to the next image or continue exploring the present image. An experimental evaluation in a scenario motivated from human supervisory control in surveillance missions confirms the benefits of the AAAD.

> 本文概述了一种测试的发展，反馈enabledattention分配援助（AAAD），采用实时生理数据改善的现实顺序的视觉搜索任务绩效。事实上，通过优化过搜索持续时间，该援助提高了效率，同时保持了决策准确性，因为操作员在模拟空中图像中识别和分类目标。具体地说，我们利用实验眼跟踪数据和人眼视野中目标可探测性的测量，建立了搜索时间、眼球运动次数、扫描路径和图像杂波等功能的检测精度函数模型。这些模型是通过与实时眼球位置数据一起进行了自动化的搜索精度概率估计和建议观察者移动到下一个图像或继续探索现有的图像。在一个场景中有人监控在监视任务的实验评估确认的自动化的好处。 article link

20. Steering Through Sequential Linear Path Segments

SESSION:Targets and Paths

The steering law models human motor performance and has been verified to hold for a single linear and/or circular path. Some extensions investigated steering around corners. Yet, little is known about human performance in navigating joined linear paths, i.e., successions of path segments with different widths. Such operations appear in graphical user interface tasks, including lasso operations in illustration software. In this work, we conducted several experiments involving joined paths. The results show that users significantly changed their behavior, and that this strategy change can be predicted beforehand. A simple model summing the two indexes of difficulty (IDs) for each path predicts movement time well, but more sophisticated models were also evaluated. The best model in terms of both ofR2andAICvalues includes theIDof the crossing operation to enter the second path.

> 指导律模型的人的运动性能，并已证实持有一个单一的线性和/或圆形路径。转向角研究的一些扩展。然而，鲜为人知的人类表现在加入线性路径，即，不同宽度的路径段序列。这种操作出现在图形用户界面任务中，包括插图软件中的套索操作。在这项工作中，我们进行了几个实验，包括连接路径。结果表明，用户显著改变了他们的行为，这种策略变化可以提前预测。一个简单的模型，这两个指标的困难（IDS）的每一个路径预测运动时间，但更复杂的模型也进行了评估。在两ofr2andaicvalues方面最好的模型包括theidof交叉操作进入第二路径。 article link

21. Modeling User Performance on Curved Constrained Paths

SESSION:Targets and Paths

In 1997, Accot and Zhai presented seminal work analyzing the temporal cost and instantaneous speed profiles associated with movement along constrained paths. Their work posited and validated the emph{steering law}, which described the relationship between path constraint, path length and the temporal cost of path traversal using a computer input device (e.g. a mouse). In this paper, we argue that the steering law fails to correctly model constrained paths of varying, arbitrary curvature, propose a new form of the law that accommodates these curved paths, and empirically validate our model.

> 1997，AccOT和Zhai提出了开创性的工作，对时间成本和瞬时速度分布与沿路径运动相关的约束。他们的工作定位和验证的重点转向法}{，描述之间的路径约束的关系，利用计算机输入装置的路径遍历的路径长度和时间成本（如鼠标）。在本文中，我们认为，转向律未能正确地模拟不同的任意曲率的约束路径，提出了一种新的形式，可以容纳这些弯曲路径，并验证了我们的模型。 article link

22. Free the Hands! Enhanced Target Selection via a Variable-Friction Shoe

SESSION:Targets and Paths

While several foot-controlled pointing devices have been explored as alternatives to conventional interfaces, we are interested in whether such devices can achieve higher performance with the addition of variable friction. Users wore our variable-friction prototype shoe on their right foot, which they slid on a low-friction surface to control a mouse cursor. Two interface modes were evaluated: constant (CF) and variable friction (VF), under the ISO 9241-9 standard for pointing device evaluation. For the variable-friction modality, target regions were high friction to provide sliding resistance cues. Our findings confirmed that variable-friction foot-controlled pointing can achieve throughput competitive with a range of hand-controlled devices. This suggests the potential for taking advantage of foot input for simple pointing tasks, in particular when the hands are overloaded. With

respect to other foot-controlled pointing systems, our implementation offered improved performance and comparable error rates. In addition, the analysis provided further insight into the design of foot-controlled input devices.

> 虽然我们已经探索了几个脚控指针装置作为传统接口的替代品，但我们感兴趣的是，这种设备是否可以通过增加可变摩擦力来实现更高的性能。用户穿着我们的可变摩擦原型鞋在他们的右脚，他们滑动在低摩擦表面，以控制鼠标光标。两种接口模式进行了评估：常数（CF）和可变摩擦（VF），在ISO 9241-9标准瞄准装置的评价。对于可变摩擦形式，目标区域是高摩擦以提供滑动阻力线索。我们的研究结果证实，可变摩擦脚控制指向可以实现吞吐量的竞争力与一系列的手控设备。这表明利用足部输入进行简单的指向任务的潜力，特别是当手过载时。对于其他的脚控瞄准系统，我们的实现提供了更好的性能和可比的错误率。此外，分析还进一步介绍了脚踏控制输入装置的设计。 article link

23. To Miss is Human: Information-Theoretic Rationale for Target Misses in Fitts' Law

SESSION:Targets and Paths

In usual Fitts' law experiments the outcome of a pointing act can be either measured as an error, i.e., a distance from endpoint to target center, or categorized in an all-or-none way as a hit versus a miss. Information theory offers a useful distinction between transmission errors (the received symbol is wrong) and erasures (the received symbol is empty). Although Fitts' law research has been very much inspired by the information theoretic rationale, the error/erasure distinction has escaped attention so far: Target misses have always been treated as normally-distributed errors, through the effective index of difficultyIDe. The paper introduces a new index of difficulty based on the simple observation that a target miss conveys zero bit of information, i.e., it is an erasure. Not only is the new index more consistent with the fundamentals of information theory, it is much simpler to derive than the ISO-recommendedIDe.

> 在通常的Fitts定律实验指向行为的结果可以作为衡量一个错误，即距离终点目标中心，或以全或无的方式打击与小姐。信息理论提供了有益的区分之间的传动误差（接收符号是错误的）和擦除（接收符号是空的）。虽然Fitts定律的研究已经非常鼓舞的信息理论基础，错误/擦除的区别没有注意到目前为止：目标失误始终被视为正态分布的误差，通过difficultyide有效指数。本文介绍了一种新的困难指数，它是基于一个简单的观察，即脱靶量传递信息的零位，即擦除。不仅是新指标与信息理论基础比较一致，这是获得比ISO recommendedide简单多了。 article link

24. Implications for Adoption

SESSION:Technology & Adoption

In this paper we explore the motivations for, and practicalities of, incorporating "implications for adoption" into HCI research practice. Implications for adoption are speculations which may be used in research projects to scrutinize and explore the implications and requirements associated with a technology's potential adoption in the future. There is a rich tradition within the HCI community of implementing, demonstrating, and testing new interactions or technologies by building prototypes. User-centered design methods help us to develop prototypes to and move toward designs that are validated, efficient, and rewarding to use. However, these studies rarely shift their temporal focus to consider, in any significant detail, what it would mean for a technology to exist beyond its prototypical implementation, in other words how these prototypes might ultimately be adopted. Given the CHI community's increasing interest in technology-related human and social effects, the lack of attention paid to adoption represents a significant and relevant gap in current practices. It is this gap that the paper addresses and in doing so offers three contributions: (1) exploring and unpacking different notions of adoption from varying disciplinary perspectives; (2) discussing why considering adoption is relevant and useful, specifically in HCI research; (3) discussing methods for addressing this need, specifically design fiction, and understanding how utilizing these methods may provide researchers with means to better understand the myriad of nuanced, situated, and technologically-mediated relationships that innovative designs facilitate.

> 在本文中，我们探索的动机，和实用性，将“影响到采用“人机交互研究的实践。采纳的含义是推测，可用于研究项目，以审查和探索的影响和要求与技术的潜在采用在未来。在HCI社区中，通过构建原型实现、演示和测试新的交互或技术有着丰富的传统。以用户为中心的设计方法有助于我们开发原型，并朝着有效、高效、有价值的设计方向发展。然而，这些研究很少将他们的时间焦点转移到任何重要的细节上，即对于一个技术超越原型的实现意味着什么，换句话说，这些原型最终如何被采纳。考虑到CHI社区对与技术有关的人类和社会影响越来越感兴趣，缺乏对收养的重视代表了当前做法中的一个重大和相关的差距。正是这种差距，本文为此提供了三个贡献：（1）探索不同的概念，采用拆从不同学科视角；（2）讨论为什么考虑采用相关和有用的，特别是在人机交互的研究；（3）讨论解决这一需求的方法，专门设计的小说，和理解如何利用这些方法可以为研究人员提供的手段来更好的了解细致入微，无数的情境，和技术介导的关系，创新的设计方便。 article link

25. UX Design Innovation: Challenges for Working with Machine Learning as a Design Material

SESSION:Technology & Adoption

Machine learning (ML) is now a fairly established technology, and user experience (UX) designers appear regularly to integrate ML services in new apps, devices, and systems. Interestingly, this technology has not experienced a wealth of design innovation that other technologies have, and this might be because it is a new and difficult design material. To better understand why we have witnessed little design innovation, we conducted a survey of current UX practitioners with regards to how new ML services are envisioned and developed in UX practice. Our survey probed on how ML may or may not have been a part of their UX design education, on how they work to create new things with developers, and on the challenges they have faced working with this material. We use the findings from this survey and our review of related literature to present a series of challenges for UX and interaction design research and education. Finally, we discuss areas where new research and new curriculum might help our community unlock the power of design thinking to re-imagine what ML might be and might do.

> 机器学习（ML）现在是一个相当成熟的技术，和用户体验（UX）的设计师经常出现在新的应用程序，服务和系统设备集成毫升。有趣的是，这项技术没有经历过其他技术所拥有的丰富的设计创新，这可能是因为它是一种新的和困难的设计材料。为了更好地理解为什么我们目睹了小小的设计创新，我们进行了一项调查目前的UX从业人员对于如何与新的ML服务的设想和实践开发UX。我们的调查，探讨如何ML可能会或可能不会被他们的UX设计教育的一部分，他们如何创造与开发商的新事物，在他们面对这种材料工作的挑战。我们使用的调查结果，从这个调查，我们回顾相关文献，提出了一系列的用户体验和交互设计的研究和教育的挑战。最后，我们将讨论新研究和新课程可能帮助我们的社区解锁设计思维的能力，重新想象ML可能是什么，可能做什么。 article link

26. Technology Maintenance: A New Frame for Studying Poverty and Marginalization

SESSION:Technology & Adoption

This paper offers a new theoretical frame for those interested in poverty and design. As digital access rates peak, technology maintenance argues that the digital divide will increasingly manifest in the (in)ability to stay connected. As a novel and conservative test, open-ended data from a 748-person university student survey of technology

maintenance were analyzed. Use and ownership were ubiquitous, but students demonstrated variability in coping with the inevitable; disconnection was more burdensome for low-resourced students. Findings extend technology maintenance and are leveraged as a starting point for three calls for action in HCI: 1) the CHI community should research the burdens of poverty in poor and wealthy contexts; 2) new HCI projects should accommodate inconsistent access; and, 3) new design choices should minimize disruption and optimize stability. This requires action at the individual and organizational level as designers create products that consider marginalization but also use expertise to influence policy.

> 本文为那些对贫困和设计感兴趣的人提供了一个新的理论框架。随着数字接入率的峰值，技术维护认为数字鸿沟将越来越体现在保持联系的能力上。作为一种新颖保守的测试，对748名大学生进行技术维护的开放式数据进行了分析。使用权和所有权是司空见惯的，但是学生表现出变异的应对不可避免的；断开更繁重的低资源的学生。结果延长技术维护和利用为出发点，为行动电话：1）人机交互三卡社区应该研究在穷人和富人中贫困的负担；2）新的HCI项目应该容纳不一致的访问；和3），新设计的选择应尽量减少破坏和优化稳定性。这需要在个人和组织层面采取行动，因为设计师创造的产品考虑边际化，但也使用专业知识来影响政策。 article link

27. Someone to Read with: Design of and Experiences with an In-Home Learning Companion Robot for Reading

SESSION:Telepresence and Robots

The development of literacy and reading proficiency is a building block of lifelong learning that must be supported both in the classroom and at home. While the promise of interactive learning technologies has widely been demonstrated, little is known about how an interactive robot might play a role in this development. We used eight design features based on recommendations from interest-development and human-robot-interaction literatures to design an in-home learning companion robot for children aged 11--12. The robot was used as a technology probe to explore families' (N=8) habits and views about reading, how a reading technology might be used, and how children perceived reading with the robot. Our results indicate reading with the learning companion to be a way to socially engage with reading, which may promote the development of reading interest and ability. We discuss design and research implications based on our findings.

> 识字和阅读能力的发展是终身学习的基石，无论是在课堂上还是在家庭中都必须得到支持。虽然交互式学习技术的前景得到了广泛的展示，但是很少有人知道交互机器人如何在这一发展中发挥作用。我们使用了八个设计特征，基于兴趣发展和人机交互文献的建议，设计了一个11岁至12岁儿童的家庭学习伴侣机器人。该机器人被用来作为一种技术探索，探索家庭（n = 8）的习惯和观点的阅读，如何使用阅读技术，以及儿童如何看待与机器人阅读。我们的研究结果表明，学习同伴阅读是社会参与阅读的一种方式，可以促进阅读兴趣和能力的发展。我们根据我们的研究结果讨论设计和研究的意义。 article link

28. Robotic Telepresence at Scale

SESSION:Telepresence and Robots

Telepresence robots offer a relatively new way for people to project their presence remotely. However, these experiences have only been studied in controlled or small scale installations. To broaden our understanding of the successes and limitations of telepresence robots in large-scale venues, we conducted a study at CHI 2016 where five factors increased over past research: (1) number of local attendees; (2) ratio of remote users to systems; (3) variety of activities; (4) time zone differences; and, (5) environment size. Our results reveal that unlike small-scale venues and situations, remote users take a more socially isolated and functional approach to remote attendance while combating challenges around scheduling and large navigational spaces. Our results reveal new opportunities for thinking about the design of robot personalization, availability, and navigation for systems targeted at large-scale public contexts.

> 遥视机器人提供了一种相对较新的方式，使人们远程投射他们的存在。然而，这些经验只在受控或小型装置中进行过研究。为了扩大我们的成功和大型场馆的远程呈现机器人的局限性的认识，我们进行了在卡2016五因素增加在过去的研究：（1）当地人数；（2）远程用户系统比；（3）各种活动；（4）时区差异；及（5）环境的大小。我们的研究结果显示，不同于小规模的场地和情况，远程用户在远程出勤方面采取了一种更为社会孤立和实用的方法，同时克服了围绕调度和大型导航空间的挑战。我们的研究结果揭示了在面向大规模公共环境的系统中考虑机器人个性化、可用性和导航设计的新机会。 article link

29. Movement Matters: Effects of Motion and Mimicry on Perception of Similarity and Closeness in Robot-Mediated Communication

SESSION:Telepresence and Robots

In face-to-face interaction, moving with and mimicking the body movements of communication partners has been widely demonstrated to affect interpersonal processes, including feel- ings of affiliation and closeness. In this paper, we examine effects of movement and mimicry in robot-mediated communication. Participants were instructed to get to know their partner, a confederate, who interacted with them via a telepresence robot. The robot either (a) mimicked the participant's body orientation (mimicry condition), (b) mimicked pre-recorded movements of another participant (random movement condition), or (c) did not move during the interaction (static condition). Results showed that mimicry and random movement had similar effects on participants' perceptions of similarity and closeness to their partners and that these effects depend on the participant's gender and level of self-monitoring. The findings suggest that the social movements of a telepresence robot affect interpersonal processes and that these effects are shaped by individual differences.

> 在面对面互动，移动通信合作伙伴，模仿身体动作已被广泛证明影响人际交往的过程，包括感觉的联系和亲密。在本文中，我们研究了运动和模仿在机器人介导的通信中的作用。参与者被指示去了解他们的伙伴，一个同盟，他们通过一个临场感机器人与他们互动。机器人（a）模仿参与者的身体方向（模仿条件），（b）模仿另一参与者的预先记录的运动（随机运动状态），或（c）在交互过程中没有移动（静态条件）。结果表明，模仿和随意运动对参与者对同伴的相似性和亲密度有相似的影响，这些影响取决于参与者的性别和自我监控水平。研究结果表明，临场感机器人的社会运动影响人际过程，这些影响是由个体差异决定的。 article link

30. A Simple Nod of the Head: The Effect of Minimal Robot Movements on Children's Perception of a Low-Anthropomorphic Robot

SESSION:Telepresence and Robots

In this note, we present minimal robot movements for robotic technology for children. Two types of minimal gaze movements were designed: social-gaze movements to communicate social engagement and deictic-gaze movements to communicate task-related referential information. In a two (social-gaze movements vs. none) by two (deictic-gaze movements vs. none) video-based study (n=72), we found that social-gaze movements significantly increased children's perception of animacy and likeability of the robot. Deictic-gaze and social-gaze movements significantly increased children's perception of helpfulness. Our findings show the compelling communicative power of social-gaze movements, and to a lesser extent deictic-gaze movements, and have implications for designers who want to achieve animacy, likeability and helpfulness with simple and easily implementable

minimal robot movements. Our work contributes to human-robot interaction research and design by providing a first indication of the potential of minimal robot movements to communicate social engagement and helpful referential information to children.

> 在这篇文章中，我们提出了机器人机器人技术的最小机器人运动。两类最小的目光凝视运动动作设计：社会沟通社会参与和指示注视动作传达任务相关的参考信息。在一个两（社会凝视运动与无）2（指示凝视运动与无）基于视频的研究（n = 72），我们发现社会的凝视运动显著增加儿童的生命性和受欢迎程度感知机器人。指示的目光和社会的凝视运动显著增加儿童的感知有用性。我们的研究结果表明，社会的目光动作引人注目的交际能力，以及在较小程度上指示着动作，和设计师谁想要实现生命的意义，能用简单和容易实现的最小的机器人动作乐于助人。我们的工作有助于人类机器人互动的研究和设计，提供了第一个迹象表明，最小的机器人运动的潜力，沟通社会参与和有益的参考信息给儿童。 article link

31. My Student is a Robot: How Schools Manage Telepresence Experiences for Students

SESSION:Telepresence and Robots

Homebound students, those who can learn but have a serious health issue (e.g. cancer, heart disease, immune deficiency) that prevents physical attendance at school, are now able to go to school using telepresence robots. Telepresence robots are generally video conferencing units on remote-controlled robots. Previous research has shown that using these robots allows homebound students to interact with classmates and teachers as if they are physically present. But, what does this mean for teachers and administrators? We present a qualitative study of 22 teachers and school administrators who worked with telepresent students and 4 who decided against adopting the robot. Our goal was to learn how decisions are made to adopt the robot, what issues arise in its use, and what would make adoption easier. This study contributes new insights on teacher and administrator perspectives on what is needed for effective use of this technology in educational settings.

> 闲居在家的学生，那些可以学习但有一个严重的健康问题（如癌症、心脏病、免疫缺陷），防止物理上学，现在可以去学校用远程监控机器人。远程呈现机器人通常是遥控机器人上的视频会议单元。先前的研究已经表明，使用这些机器人让闲居学生与同学和老师互动，如果他们都是实际存在的。但是，这对教师和管理者意味着什么呢？我们目前22的教师和学校管理人员曾与临场感的学生和4的人决定不采用机器人的定性研究。我们的目标是学习如何决定采用机器人，在使用过程中产生什么问题，以及如何使采用更容易。这项研究提供了新的见解，教师和管理员的角度来看，需要什么，有效地利用这项技术在教育环境中。 article link

32. How Do System Administrators Resolve Access-Denied Issues in the Real World?

SESSION:Authentication and Access Control

The efficacy of access control largely depends on how system administrators (sysadmins) resolve access-denied issues. A correct resolution should only permit the expected access, while maintaining the protection against illegal access. However, anecdotal evidence suggests that correct resolutions are occasional---sysadmins often grant too much access (known as security misconfigurations) to allow the denied access, posing severe security risks. This paper presents a quantitative study on real-world practices of resolving access-denied issues, with a particular focus on how and why security misconfigurations are introduced during problem solving. We characterize the real-world security misconfigurations introduced in the field, and show that many of these misconfigurations were the results of trial-and-error practices commonly adopted by sysadmins to work around access denials. We argue that the lack of adequate feedback information is one fundamental reason that prevents sysadmins from developing precise understanding and thus induces trial and error. Our study on access-denied messages shows that many of today's software systems miss the opportunities for providing adequate feedback information, imposing unnecessary obstacles to correct resolutions.

> 访问控制的效果很大程度上取决于系统管理员（系统管理员）拒绝访问问题的解决。正确的解决方案只允许预期的访问，同时保持对非法访问的保护。然而，有证据表明，正确的决议是偶尔---系统管理员经常给予太多的访问（称为安全配置错误）允许拒绝访问，构成严重的安全隐患。本文提出了在解决拒绝访问问题实际的定量研究，与特定的重点放在如何和为什么安全配置错误的解决问题的过程中引入了。我们描述了现实世界的安全配置错误的领域，表明试验和错误的做法，通常采用系统管理员工作访问拒绝的结果这些错误。我们认为，适当的反馈信息的缺乏是一个根本原因，防止系统管理员从开发精确的理解从而诱导试验和错误。我们对访问拒绝消息的研究表明，许多今天的软件系统错过了提供足够反馈信息的机会，给正确的决议强加了不必要的障碍。 article link

33. User Interactions and Permission Use on Android

SESSION:Authentication and Access Control

Android and other mobile operating systems ask users for authorization before allowing apps to access sensitive resources such as contacts and location. We hypothesize that such authorization systems could be improved by becoming more integrated with the app's user interface. In this paper, we conduct two studies to test our hypothesis. First, we use apptracer{}, a dynamic analysis tool we developed, to measure to what extent user interactions and sensitive resource use are related in existing apps. Second, we conduct an online survey to examine how different interactions with the UI affect users' expectations about whether an app accesses sensitive resources. Our results suggest that user interactions such as button clicks can be interpreted as authorization, reducing the need for separate requests; but that accesses not directly tied to user interactions should be separately authorized, possibly when apps are first launched.

> Android和其他移动操作系统在允许应用程序访问敏感资源（如联系人和位置）之前向用户请求授权。我们假设可以通过与应用程序的用户界面更加集成来改进这种授权系统。在本文中，我们进行了两项研究来检验我们的假设。首先，我们使用apptracer{}，我们开发了一个动态的分析工具，来测量到什么程度的用户交互和敏感资源的使用在现有的应用程序相关的。第二，我们进行了一项在线调查，以考察不同的UI交互如何影响用户对应用程序是否访问敏感资源的期望。我们的研究结果表明，用户交互，如按钮点击可以被解释为授权，减少了对单独请求的需求；但是，不直接绑定到用户交互的访问应该单独授权，可能在应用程序首次启动时。 article link

34. Where Usability and Security Go Hand-in-Hand: Robust Gesture-Based Authentication for Mobile Systems

SESSION:Authentication and Access Control

Gestures have recently gained interest as a secure and usable authentication method for mobile devices. Gesture authentication relies on recognition, wherein raw data is collected from user input and preprocessed into a more manageable form before applying recognition algorithms. Preprocessing is done to improve recognition accuracy, but little work has been done in justifying its effects on authentication. We examined the effects of three variables: location, rotation, and scale, on authentication accuracy. We found that an authentication-optimal combination (location invariant, scale variant, and rotation variant) can reduce the error rate by 45.3% on average compared to the recognition-optimal combination (all invariant). We analyzed 13 gesture recognizers and evaluated them with three criteria: authentication accuracy, and resistance against both brute-force and imitation attacks. Our novel multi-expert method (Garda) achieved the lowest error rate (0.015) in authentication accuracy, the lowest error rate (0.040) under imitation attacks, and

resisted all brute-force attacks.

> 手势作为移动设备的安全和可用的认证方法最近引起了人们的兴趣。手势认证依赖于识别，其中原始数据从用户输入中收集，并在应用识别算法之前被预处理成更易于管理的形式。预处理是为了提高识别精度，但在证明其对认证的影响方面做的工作很少。我们研究了三个变量：位置、旋转和刻度对认证准确性的影响。我们发现，一个认证最佳组合（位置不变、尺度变化和旋转变体）与识别最佳组合（所有不变）相比，平均可以减少45.3%的错误率。我们分析了13的手势识别和评估他们的三个标准：认证的准确性，并抵抗蛮力攻击和模仿。我们的新的多专家法（Garda）达到最低的错误率（0.015）在认证准确，误差率最低（0.040）在模仿攻击，并拒绝所有的蛮力攻击。 article link

35. I'm too Busy to Reset my LinkedIn Password: On the Effectiveness of Password Reset Emails

SESSION:Authentication and Access Control

A common security practice used to deal with a password breach is locking user accounts and sending out an email to tell users that they need to reset their password to unlock their account. This paper evaluates the effectiveness of this security practice based on the password reset email that LinkedIn sent out around May 2016, and through an online survey conducted on 249 LinkedIn users who received that email. Our evaluation shows that only about 46% of the participants reset their passwords. The mean time taken to reset password was 26.3 days, revealing that a significant proportion of the participants reset their password a few weeks, or even months after first receiving the email. Our findings suggest that more effective persuasive measures need to be added to convince users to reset their password in a timely manner, and further reduce the risks associated with delaying password resets.

> 一个常见的安全做法用来处理密码违约，是锁定用户帐户，并发送电子邮件告诉用户，他们需要重置他们的密码来解锁他们的帐户。本文评估了基于LinkedIn 2016年5月发布的密码重置电子邮件的安全实践的有效性，并通过对收到电子邮件的249名LinkedIn用户进行了在线调查。我们的评估显示，只有大约46%的参与者重新设置了密码。重新设置密码的平均时间为26.3天，显示有相当一部分参与者在收到电子邮件后的几周甚至几个月内重新设置密码。我们的研究结果表明，需要增加更有效的说服措施，以说服用户及时重新设置密码，并进一步减少与延迟密码重置相关的风险。 article link

36. Priming Drivers before Handover in Semi-Autonomous Cars

SESSION:Cars and Automation

Semi-autonomous vehicles occasionally require control to be handed over to the driver in situations where the vehicle is unable to operate safely. Currently, such handover requests require the driver to take control almost instantaneously. We investigate how auditory pre-alerts that occur well before the handover request impact the success of the handover in a dual task scenario. In a study with a driving simulator, drivers perform tasks on their phone while the car is in an autonomous mode. They receive a repeated burst audio pre-alert or an increasing pulse audio pre-alert preceding the standard warning for immediate handover. Results show that pre-alerts caused people to look more at the road before the handover occurred, and to disengage from the secondary task earlier, compared to when there was no pre-alert. This resulted in safer handover situations. Increasing pulse pre-alerts show particular promise due to their communication of urgency. Our detailed analysis informs the design and evaluation of alerts in safety-critical systems with automation.

> 半自动车辆偶尔需要在车辆无法安全运行的情况下将控制权交给司机。目前，这种切换请求要求驾驶员几乎立即控制。我们研究了在切换请求之前发生的听觉预警报如何影响双任务场景中切换的成功。在驾驶模拟器的研究中，驾驶员在汽车处于自主模式时在手机上执行任务。在标准立即发出警告之前，他们会收到重复的突发音频警报或增加的脉冲音频预警报。结果表明，预先警报使人们在交接前发生更多的事故，并比没有预警时更早地从次要任务中解脱出来。这导致了更安全的交接情况。增加脉冲预警报显示了特殊的承诺，由于他们的沟通紧迫性。我们的详细分析通知了安全关键系统中警报的自动化设计和评估。 article link

37. Toward Measurement of Situation Awareness in Autonomous Vehicles

SESSION:Cars and Automation

Until vehicles are fully autonomous, safety, legal and ethical obligations require that drivers remain aware of the driving situation. Key decisions about whether a driver can take over when the vehicle is confused, or its capabilities are degraded, depend on understanding whether he or she is responsive and aware of external conditions. The leading techniques for measuring situation awareness in simulated environments are ill-suited to autonomous driving scenarios, and particularly to on-road testing. We have developed a technique, named Daze, to measure situation awareness through real-time, in-situ event alerts. The technique is ecologically valid: it resembles applications people use in actual driving. It is also flexible: it can be used in both simulator and on-road research settings. We performed simulator-based and on-road test deployments to (a) check that Daze could characterize drivers' awareness of their immediate environment and (b) understand practical aspects of the technique's use. Our contributions include the Daze technique, examples of collected data, and ways to analyze such data.

> 在车辆完全自主之前，安全、法律和道德义务要求司机仍然注意驾驶情况。当车辆混淆或性能下降时，驾驶员是否能接管关键决定取决于是否了解外界情况。在模拟环境中测量态势感知的领先技术不适合于自主驾驶场景，特别是在道路测试中。我们已经开发出一种技术，名为Daze，通过实时的现场警报来测量态势感知。这种技术在生态学上是有效的：它类似于人们在实际驾驶中使用的应用。它也很灵活：它可以在模拟器和道路研究设置中使用。我们执行模拟器和道路测试部署（A）检查Daze可以表征司机对他们的直接环境的认识和（b）理解技术使用的实际方面。我们的贡献包括眩晕技术，收集数据的例子，以及分析这些数据的方法。 article link

38. The Trouble with Autopilots: Assisted and Autonomous Driving on the Social Road

SESSION:Cars and Automation

As self-driving cars have grown in sophistication and ability, they have been deployed on the road in both localised tests and as regular private vehicles. In this paper we draw upon publicly available videos of autonomous and assisted driving (specifically the Tesla autopilot and Google self-driving car) to explore how their drivers and the drivers of other cars interact with, and make sense of, the actions of these cars. Our findings provide an early perspective on human interaction with new forms of driving involving assisted-car drivers, autonomous vehicles and other road users. The focus is on social interaction on the road, and how drivers communicate through, and interpret, the movement of cars. We provide suggestions toward increasing the transparency of autopilots' actions for both their driver and other drivers.

> 由于自动驾驶汽车的精密度和性能都有了提高，它们已在道路上进行了局部试验和常规私家车。在本文中，我们利用公开的自主和辅助驾驶的视频（特别是特斯拉自动驾驶仪和谷歌自驾车）来探索他们的驱动程序和其他汽车的驱动程序如何相互作用，并了解这些汽车的动作。我们的发现提供了一个早期的视角，可以看到人类与新的驾驶方式有关，包括辅助汽车驾驶员、自主车辆和其他道路使用者。重点是在道路上的社会互动，以及司机如何沟通，并解释汽车的运动。我们提供的建议对提高航行的行动为他们的司机和其他

> 司机的透明度。 article link

39. Understanding the Cost of Driving Trips

SESSION:Cars and Automation

Driving is the second highest expense for the average American household. Yet few people know the total cost of owning and operating their vehicles, and most cannot estimate accurately how much a common driving trip (like a daily commute) costs. There are an increasing number of viable alternatives for personal transportation, such as car services (e.g. Uber, Lyft), in addition to ridesharing, transit, biking, and walking. Cost is one factor in transportation mode choice, and awareness of the cost of driving is useful in making better informed decisions. To bridge this awareness gap, we built and deployed a system that makes the total cost of each driving trip (including depreciation, maintenance, insurance, and fuel) visible to the user. After this intervention, participants were able to more accurately and confidently estimate costs of their driving commutes, and transfer this knowledge to other trips for which they had not seen a cost.

> 开车是美国普通家庭的第二大开支。然而，很少有人知道拥有和运营车辆的总成本，大多数人无法准确估计一个普通的驾车旅行（像每天通勤）花费多少钱。有越来越多的个人运输的可行的替代品，如汽车服务（如Uber、Lyft），除了搭车，交通，骑自行车和步行。成本是运输方式选择的一个因素，而驾驶成本的认识有助于做出更明智的决策。为了缩小这一认识差距，我们构建并部署了一个系统，该系统使每个驾驶旅行的总成本（包括折旧、维护、保险和燃料）对用户可见。在这种干预，参与者能够更准确地估计自己的驾驶的通勤成本，并传递这方面的知识，其他的旅行，他们没有看到一个成本。 article link

40. Making Ritual Machines: The Mobile Phone as a Networked Material for Research Products

SESSION:Design Theory

Viewing the mobile telephone as a networked material, we demonstrate the ways in which we have used it to make Research Products for the "Family Rituals 2.0" inquiry of families separated by work. Drawing from a diversity of sources we survey and deconstruct the phone as a material that can be worked to a vast range of technical effects, extended by hardware and configured by software. We demonstrate the transformations of hacking and prototyping practices necessary to construct complex Research Products through the case study of our machines. We offer the Interaction Design community seven specific and actionable techniques for using mobile telephones in Research Products. Finally, we open up a broader discussion for researchers and practitioners using mobile phones as a design material in their work.

> 以移动电话为网络材料，我们演示了如何使用它来为“家庭礼仪2”调查工作的家庭进行研究产品。从不同的来源中，我们调查和解构手机作为一种材料，可以工作到广泛的技术效果，由硬件扩展和软件配置。我们通过我们机器的案例研究演示了构建复杂研究产品所需的黑客和原型实践的转换。我们提供互动设计社区七个特定的和可操作的技术在研究产品中使用移动电话。最后，我们利用手机作为设计材料在他们的工作中为研究人员和从业者开辟了一个更广泛的讨论。 article link

41. Products as Agents: Metaphors for Designing the Products of the IoT Age

SESSION:Design Theory

Design-based inquiries into the networked products of the Internet of Things (IoT) lack a coherent understanding of the effect of such products on society. This paper proposes a new taxonomy for networked products, which would allow articulation on their current state and future, and provide insights to designers for creating meaningful and aesthetic products of IoT. Central to this framework is the proposition that our current product-scape should be understood as a distribution of material agencies and best analyzed through the metaphor of "agency". We identify three types of agencies, i.e., the Collector, the Actor, and the Creator, and discuss how this approach could create new design methodologies to create more meaningful networked products that would empower people in their everyday lives.

> 基于物联网的网络产品的基于设计的查询缺乏对这些产品对社会的影响的一致理解。本文提出了一种新的网络产品分类方法，使其能够对当前的状态和未来进行分析，并为设计者提供见解，以创造物联网的有意义和美感的产品。这个框架的核心是我们当前的产品外观应该被理解为一个物质机构的分布，并且最好通过“代理”的隐喻来分析。我们确定了三种类型的代理，即收集器、参与者和创建者，并讨论了这种方法如何创建新的设计方法，以创建更有意义的网络产品，使人们在日常生活中获得权力。 article link

42. Pause: A Multi-lifespan Design Mechanism

SESSION:Design Theory

At times, inaction may be a wise course of action. This insight lies at the heart of the design mechanism of pause. In this note, we explore the construct of pause, its rhythms, and nuances of enacting pause. Throughout, we draw on our experience engaging with pause in the multi-lifespan design of information systems for transitional justice. Five rhythms are identified: periodic hiatus, pending future event, responding to the socio-political climate, (temporary) closure, and laying fallow. In addition, we provide heuristics for managing pause and then restarting the design process. We then explore the scalability of pause from longer (e.g., multi-lifespan design) to shorter timeframes. We conclude with reflections on the potential benefits and open questions about pause as a design mechanism.

> 有时，无所作为可能是明智之举。这种洞察力是暂停设计机制的核心所在。在这篇文章中，我们探讨了停顿的结构、节奏和停顿的细微差别。在整个过程中，我们利用我们的经验，参与了过渡时期司法系统信息系统的多寿命设计。确定了五种节奏：周期性中断、未决事件、应对社会政治气候、临时关闭和休耕。此外，我们还提供了管理暂停和重新启动设计过程的启发式方法。然后我们探讨暂停的可扩展性（例如，从长到短时间多寿命设计）。最后，我们对关于暂停作为设计机制的潜在好处和开放问题进行了反思。 article link

43. Interdependent Wearables (for Play): A Strong Concept for Design

SESSION:Design Theory

Typically wearable devices are conceived of and constructed as stand-alone, individually based technologies. However, in practice wearables become part of the social context and ecology of overall device use. We present a strong concept for design: Interdependent Wearables (for play): wearables designed to require shared attention and mutual awareness, with interdependent functionality that encourages and rewards collocated interaction. The concept arose through design, development, and public exhibition of Hotaru, a collocated social game that uses wearables as game controllers. Hotaru has been shown in festivals and also formally playtested with 62 individuals. To more fully articulate the Interdependent Wearables strong concept, we compared this system's design with wearable and embodied systems for play and other purposes, and drew upon relevant HCI

theory. The work is of benefit to those in the HCI/UX community focused on the design and development of social wearable technologies, especially those interested in supporting collocated interaction.

> 通常，可穿戴设备被设想为独立的、基于独立的技术。然而，在实践中服饰成为社会语境和整体设备的使用生态的一部分。我们提出的设计一个强大的概念：相互依存的服饰（玩）：设计需要共同关注和共同意识的服饰，与相互依存的功能，鼓励和奖励搭配的互动。概念是通过设计、开发、和公共展览的萤，并置社会游戏使用可穿戴设备作为游戏控制器。萤已被证明在节日和正式测试的62个人。为了更充分地表达相互依存的服饰观念强，我们这个系统的设计与游戏和其他用途的可穿戴体现系统相比，并对相关交互设计理论。工作在交互/ UX社区专注于社会的可穿戴技术的设计和开发是有益的，尤其是那些支持搭配的互动感兴趣。 article link

44. How Methods Make Designers

SESSION:Design Theory

Through their combination of lifestyle and method, Silicon Valley models for tech production such as design thinking, startup incubators, lean management, etc. are spreading across the globe. These paradigms are positioned by product designers, politicians, investors and corporations alike as replicable routes to individual and national empowerment. They are portrayed as universal templates, portable across national borders and applicable to local needs. We draw from our ethnographic engagements with tech entrepreneurial efforts in Ghana, China, and Jamaica to unpack the stakes involved in their uptake, showing that while local actors produce situated alternatives, their work nevertheless often results in a continued valorization of these seemingly universal methods. We argue that design methods shape not only use practices, but have consequences for the life worlds of professional designers. This includes how they impact personal and national identities, confer legitimacy in transnational innovation circles, and secure access to social and economic resources. Ultimately, we call for an inclusion of these factors in ongoing conversations about design and design methods.

> 通过他们的生活方式和方法的结合，硅谷的技术生产模式，如设计思维，启动孵化器，精益管理等正在全球范围内推广。这些模式是由产品设计师，定位的政客、投资者和企业都是可复制的路线，个人和国家的权力。它们被描绘成通用模板，可跨国界携带，适用于当地需求。从我们的科技创业在加纳的努力，中国的民族志的约会，我们得出，牙买加要参与吸收股份，显示当地演员产生情境的替代品，他们的工作，但结果往往是在继续利用这些看似普遍的方法。我们认为，设计方法不仅使用实践，而且对专业设计师的生活世界产生影响。这包括它们如何影响个人和国家的身份，赋予跨国创新界的合法性，并确保获得社会和经济资源。最后，我们呼吁将这些因素包含在正在进行的关于设计和设计方法的对话中。 article link

45. Consumer to Creator: How Households Buy Furniture to Inform Design and Fabrication Interfaces

SESSION:Fabrication via 3D Printing

Emerging technologies for digital design and fabrication let people participate in the making of objects that were previously dominated by professional designers. A growing body of work in HCI provides understanding in the activities of designing and making by novices and in maker communities. However, we know little about how casual users might employ these technologies with the goal of having an object in their home that satisfies a need. We present a long-term qualitative study in which we followed 16 households during a purchasing process of furniture items for their homes. We looked into how families discover what they need, find solutions, realize a solution in their house and put it to use. The results provide insights into their design activities and workflow and we identify two distinct stages: understanding needs and prototyping a solution. Based on the findings, we discuss the social practice of acquiring and appropriating furniture in the home and within families, and identify design opportunities for digital design and fabrication to support people as they create the objects they need, want and desire.

> 数字设计和制造的新兴技术让人们参与了以前由专业设计师主导的对象的制作。HCI中越来越多的工作为新手和制造商社区的设计和制作活动提供了理解。然而，我们不太了解休闲用户如何使用这些技术，其目标是在家中有一个满足需求的对象。我们提出了一个长期的定性研究，我们跟踪了16个家庭在购买家具物品的过程中，为他们的家。我们研究了家庭如何发现他们所需要的，找到解决办法，在他们的房子里实现一个解决方案并加以利用。这些结果提供了对其设计活动和工作流的深入了解，我们确定了两个不同的阶段：理解需求和原型化解决方案。在此基础上，我们讨论了获取和占有的家具和家庭内的社会实践活动，并确定数字设计和制造支持人们为他们创造他们所需要的对象设计的机会，希望和愿望。 article link

46. Stretching the Bounds of 3D Printing with Embedded Textiles

SESSION:Fabrication via 3D Printing

Textiles are an old and well developed technology that have many desirable characteristics. They can be easily folded, twisted, deformed, or cut; some can be stretched; many are soft. Textiles can maintain their shape when placed under tension and can even be engineered with variable stretching ability. Conversely, 3D printing is a relatively new technology that can precisely produce functional, rigid objects with custom geometry. Combining 3D printing and textiles opens up new opportunities for rapidly creating rigid objects with embedded flexibility as well as soft materials imbued with additional functionality. In this paper, we introduce a suite of techniques for integrating 3D printing with textiles during the printing process, opening up a new design space that takes inspiration from both fields. We demonstrate how the malleability, stretchability and aesthetic qualities of textiles can enhance rigid printed objects, and how textiles can be augmented with functional properties enabled by 3D printing.

> 纺织品是一种古老而发达的技术，有许多可取之处。他们可以很容易地折叠，扭曲，变形，或削减；一些可以伸展，许多是软的。纺织品在张力下可以保持形状，甚至可以设计成可变拉伸能力。相反，三维打印是一种相对较新的技术，它可以精确地生成具有自定义几何形状的功能性、刚性对象。结合3D打印和纺织品开辟了新的机会，快速创建具有嵌入式灵活性的刚性对象，以及充满额外功能的软材料。在本文中，我们介绍了一套技术，在印刷过程中集成三维打印与纺织品，开辟了一个新的设计空间，从两个领域的灵感。我们展示的延展性、拉伸性和审美品质的纺织品可以提高刚性印刷物，以及纺织品可以增强功能特性的3D打印功能。 article link

47. WeaveMesh: A Low-Fidelity and Low-Cost Prototyping Approach for 3D Models Created by Flexible Assembly

SESSION:Fabrication via 3D Printing

To meet the increasing requirements of HCI researchers who are prototyping a variety of forms to create novel interfaces under a ubiquitous situation, we present WeaveMesh, a low-fidelity and low-cost rapid prototyping system that produces 3D objects in a mesh structure. Inspired by hand-weaving craft, WeaveMesh supports a highly customizable software platform, which is applicable for simulating and facilitating freeform surface constructions composed of woven lines arranged in a regular grid, which can serve as a guide for easy assembly. In addition, mobilizable connectors are suggested to support flexible assembly, which can be revised, recycled, and reused to facilitate short iterations. Furthermore, compared to common additive and subtractive techniques, WeaveMesh has a better balance between time and material saving. In this paper, we will introduce the system in detail and demonstrate the feasibility of the technique through various 3D models in the area of interactive media, products and architecture.

> 为了满足人机交互研究谁是原型的多种形式普遍存在的情况下创建新的接口要求的不断提高，我们现在的WeaveMesh，一个低精度、低成本的快速成型系统的网状结构，产生的3D对象。灵感的手工编织工艺，WeaveMesh支持高度可定制的软件平台，适用于模拟和促进自由曲面结构由编织线安排在一个规则的网格，它可以作为一个简单的装配指南。此外，建议支持灵活的组件是可移动连接器，可以修改、再生，重复使用方便短迭代。此外，相比普通加法和减法技术，WeaveMesh有时间和节省材料之间更好的平衡。在本文中，我们将详细介绍该系统，并通过交互式媒体、产品和体系结构中的各种3D模型演示该技术的可行性。 article link

48. A Framework for Speechreading Acquisition Tools

SESSION:Learning and Reading

At least 360 million people worldwide have disabling hearing loss that frequently causes difficulties in day-to-day conversations. Traditional technology (e.g., hearing aids) often fails to offer enough value, has low adoption rates, and can result in social stigma. Speechreading can dramatically improve conversational understanding, but speechreading is a skill that can be challenging to learn. To address this, we developed a novel speechreading acquisition framework that can be used to design Speechreading Acquisition Tools (SATs) - a new type of technology to improve speechreading acquisition. We interviewed seven speechreading tutors and used thematic analysis to identify and organise the key elements of our framework. We then evaluated our framework by using it to: 1) categorise every tutor-identified speechreading teaching technique, 2) critically evaluate existing conversational aids, and 3) design three new SATs. Through the use of SATs designed using our framework, the speechreading abilities of people with hearing loss around the world should be enhanced, thereby improving the conversational foundation of their day-to-day lives.

> 全世界至少有3亿6000万人丧失了听力损失，这常常在日常对话中造成困难。传统的技术（如助听器）往往不能提供足够的价值，采用率低，并可能导致社会耻辱。朗读可以大大提高对话的理解，而朗读是一种可以是具有挑战性的学习技能。为了解决这个问题，我们开发了一种新型的唇读采集框架，可以用来设计唇读采集工具（SAT）-一种新的技术来提高唇读采集。我们采访了七位聋哑人导师和专题分析识别和组织框架的关键要素。然后我们评价的框架，用它来：1）确定每个导师视话教学技术分类2）认真评估现有的会话艾滋病，3）设计了三种新的SAT。通过使用我们的框架设计的SAT的使用，语言朗读能力与听力损失的世界各地的人们应该增强，从而提高了他们的日常生活会话的基础。 article link

49. FLight: A Low-Cost Reading and Writing System for Economically Less-Privileged Visually-Impaired People Exploiting Ink-based Braille System

SESSION:Learning and Reading

Reading printed documents and writing on a paper pose a great challenge for visually-impaired people. Existing studies that attempt to solve these challenges are expensive and not feasible in low-income context. Moreover, these studies solve reading and writing problems separately. On the contrary, in this study, we proposeFLight, a low-cost reading and writing system for economically less-privileged people.FLightuses ink-based Braille characters as the medium of textual representation. This helps in keeping a compact spatial representation of texts, yet achieving a low-cost status. Additionally,FLightutilizes a low-cost wearable device to enhance ease of reading by visually-impaired people. We conduct a participatory design and iterative evaluation involving five visually-impaired children in Bangladesh for more than 18 months. Our user evaluation reveals thatFLightis easy-to-use, and exhibits a potential low-cost solution for economically less-privileged visually-impaired people.

> 阅读纸质文件和在纸上写作对视障人士来说是一个巨大的挑战。现有的研究试图解决这些挑战是昂贵的，在低收入的情况下是不可行的。此外，这些研究分别解决阅读和写作问题。相反，在这项研究中，我们proposeflight，低成本的阅读和写作的经济弱势people.flightuses油墨的盲文字符作为文本表示的介质系统。这有助于保持文本的紧凑空间表示，但实现低成本状态。此外，FLightutilizes一个低成本的可穿戴设备提高由视障人士阅读方便。我们参与了一项参与设计和迭代评估，涉及孟加拉五名视力受损儿童超过18个月。我们的用户评价显示thatflightis易于使用，并具有潜在的低成本解决方案经济弱势视障人士。 article link

50. Teaching Language and Culture with a Virtual Reality Game

SESSION:Learning and Reading

Many people want to learn a language but find it difficult to stay engaged. Ideally, we would have language learning tools that can make language learning more enjoyable by simulating immersion in a foreign language environment. Therefore, we adaptedCrystallize, a 3D video game for learning Japanese, so that it can be played in virtual reality with the Oculus Rift. Specifically, we explored whether we could leverage virtual reality technology to teach embodied cultural interaction, such as bowing in Japanese greetings. To evaluate the impact of our virtual reality game designs, we conducted a formative user study with 68 participants. We present results showing that the virtual reality design trained players how and when to bow, and that it increased participants' sense of involvement in Japanese culture. Our results suggest that virtual reality technology provides an opportunity to leverage culturally-relevant physical interaction, which can enhance the design of language learning technology and virtual reality games.

> 许多人想学一门语言，却发现很难继续工作。理想情况下，我们将有语言学习工具，通过模拟沉浸在外语环境中，可以使语言学习更愉快。因此，我们adaptedcrystallize，一个学习日本的3D视频游戏，可与Oculus Rift虚拟现实了。具体来说，我们探讨了我们是否可以利用虚拟现实技术来教授具体的文化交流，比如鞠躬问候。为了评估我们的虚拟现实游戏设计的影响，我们进行了68人参与的形成性用户研究。我们的结果表明，虚拟现实设计训练了玩家如何和何时鞠躬，并增加了参与者对日本文化的参与感。我们的研究结果表明，虚拟现实技术提供了一个利用文化相关的物理交互的机会，可以加强语言学习技术和虚拟现实游戏的设计。 article link

51. Identifying how Visually Impaired People Explore Raised-line Diagrams to Improve the Design of Touch Interfaces

SESSION:Learning and Reading

Raised-line diagrams are widely used by visually impaired (VI) people to read maps, drawings or graphs. While previous work has identified general exploration strategies for raised-line drawings, we have limited knowledge on how this exploration is performed in detail and how it extends to other types of diagrams such as maps or graphs, frequently used in specialized schools. Such information can be crucial for the design of accessible interfaces on touchscreens. We conducted a study in which participants were asked to explore five types of raised-line diagrams (common drawings, perspective drawings, mathematical graphs, neighborhood maps, and geographical maps) while tracking both hands fingers. Relying on a first set of results, we proposed a set of design guidelines for touch interfaces.

> 凸起的线图被视障人士广泛使用，用来阅读地图、图画或图表。虽然以前的工作已经确定了一般的勘探策略，提出了线画，我们有有限的知识，这是如何进行详细的探索，以及如何延伸到其他类型的图表，如地图或图表，经常使用的专业学校。这些信息可以对触摸屏的访问接口的设计是至关重要的。我们进行了一项研究，要求参与者在追踪双手手指时，探索五种凸起的线条图（普通图画、透视图、数学图、邻里地图和地理地图）。基于第一组结果，我们提出了一套触摸接口的设计准则。 article link

52. Sensing and Handling Engagement Dynamics in Human-Robot Interaction Involving Peripheral Computing Devices

SESSION:Robots at Work & Home

When human partners attend to peripheral computing devices while interacting with conversational robots, the inability of the robots to determine the actual engagement level of the human partners after gaze shift may cause communication breakdown. In this paper, we propose a real-time perception model for robots to estimate human partners' engagement dynamics, and investigate different robot behavior strategies to handle ambiguities in humans' status and ensure the flow of the conversation. In particular, we define four novel types of engagement status and propose a real-time engagement inference model that weighs humans' social signals dynamically according to the involvement of the computing devices. We further design two robot behavior strategies (explicitandimplicit) to help resolve uncertainties in engagement inference and mitigate the impact of uncoupling, based on an annotated human-human interaction video corpus. We conducted a within-subject experiment to assess the efficacy and usefulness of the proposed engagement inference model and behavior strategies. Results show that robots with our engagement model can deliver better service and smoother conversations as an assistant, and people find the implicit strategy more polite and appropriate.

> 当人类伙伴在与对话机器人交互时关注周边计算设备时，机器人在注视转移后无法确定人类伙伴的实际参与水平可能导致通信故障。本文提出了一种机器人实时感知模型来估计人类伙伴的参与动态，并研究了不同的机器人行为策略来处理人类状态中的模糊性，确保会话的流畅。特别是，我们定义了四种新型的参与状态，并提出了一种实时参与推理模型，该模型根据计算设备的参与动态地衡量人类的社会信号。我们还设计了两个机器人的行为策略（explicitandimplicit）帮助解决参与推理不确定性和减轻解偶联的影响，基于注释的人-人交互视频语料库。我们进行了一个内部实验，以评估所提出的参与推理模型和行为策略的有效性和实用性。结果表明，我们的参与模式的机器人可以提供更好的服务和更顺畅的交谈作为助理，人们发现隐含的策略更礼貌和适当的。 article link

53. Managing Uncertainty in Time Expressions for Virtual Assistants

SESSION:Robots at Work & Home

"Remind me to get milklater this afternoon." In communications and planning, people often express uncertainty about time using imprecise temporal expressions (ITEs). Unfortunately, modern virtual assistants often lack system support to capture the intents behind these expressions. This can result in unnatural interactions and undesirable interruptions (e.g., having a work reminder delivered at 12pm when out at lunch, because the user said "this afternoon"). In this paper we explore existing practices, expectations, and preferences surrounding the use of ITEs. Our mixed methods approach employs surveys, interviews, and an analysis of a large corpus of written communications. We find that people frequently use a diverse set of ITEs in both communication and planning. These uses reflect a variety of motivations, such as conveying uncertainty or task priority. In addition, we find that people have a variety of expectations about time input and management when interacting with virtual assistants. We conclude with design implications for future virtual assistants.

> “提醒我去milklater下午。”交通规划，人们经常表达对使用不精确的时间表达时间的不确定性（ITES）。不幸的是，现代虚拟助理常常缺乏系统支持来捕捉这些表达式背后的意图。这会导致不自然的相互作用和不良的干扰（例如，有一个工作提醒交付时当午餐，因为用户说“下午”）。在本文中我们探讨现有的做法，期望，和周围的网站的使用偏好。我们的混合方法使用调查，访谈，和一个庞大的书面通信语料库分析。我们发现人们在沟通和计划经常使用一组不同的网站。这些用途反映了各种动机，如传递不确定性或任务优先级。此外，我们发现，当与虚拟助理交互时，人们对时间输入和管理有各种各样的期望。我们的结论与未来的虚拟助理设计的影响。 article link

54. Comparing Social Robot, Screen and Voice Interfaces for Smart-Home Control

SESSION:Robots at Work & Home

With domestic technology on the rise, the quantity and complexity of smart-home devices are becoming an important interaction design challenge. We present a novel design for a home control interface in the form of a social robot, commanded via tangible icons and giving feedback through expressive gestures. We experimentally compare the robot to three common smart-home interfaces: a voice-control loudspeaker; a wall-mounted touch-screen; and a mobile application. Our findings suggest that interfaces that rate higher on flow rate lower on usability, and vice versa. Participants' sense of control is highest using familiar interfaces, and lowest using voice control. Situation awareness is highest using the robot, and also lowest using voice control. These findings raise questions about voice control as a smart-home interface, and suggest that embodied social robots could provide for an engaging interface with high situation awareness, but also that their usability remains a considerable design challenge.

> 随着国内技术的不断发展，智能家居设备的数量和复杂度日益成为重要的交互设计挑战。我们提出了一种新的设计，家庭控制界面的形式，社会机器人，命令通过有形的图标，并给予反馈，通过表现性手势。我们实验比较了机器人与三种常见的智能家居接口：声控扬声器、壁挂式触摸屏和移动应用程序。我们的研究结果表明，流速较高的接口对可用性的影响较小，反之亦然。使用熟悉的界面，参与者的控制感最高，使用语音控制的最低。使用机器人的态势感知最高，使用语音控制的最低。这些发现提出了语音控制作为一个智能家居界面的问题，并建议体现社会机器人可以提供一个有吸引力的界面与高态势意识，但他们的可用性仍然是一个相当大的设计挑战。 article link

55. Self-tracking for Mental Wellness: Understanding Expert Perspectives and Student Experiences

SESSION:Self-tracking Mental Health

Previous research suggests an important role for self-tracking in promoting mental wellness. Recent studies with college student populations have examined the feasibility of collecting everyday mood, activity, and social data. However, these studies do not account for students' experiences and challenges adopting self-tracking technologies to support mental wellness goals. We present two studies conducted to better understand self-tracking for stress management and mental wellness in student populations. First, focus groups and card sorting activities with 14 student health professionals reveal expert perspectives on the usefulness of tracking for three scenarios. Second, an online survey of 297 students examines personal experiences with self-tracking and attitudes toward sharing self-tracked data with others. We draw on findings from these studies to characterize students' motivations, challenges and preferences in collecting and viewing self-tracked data related to mental wellness, and we compare findings between students with diagnosed mental illnesses and those without. We conclude with a discussion of challenges and opportunities in leveraging self-tracking for mental wellness, highlighting several design considerations.

> 以前的研究表明自我跟踪在促进心理健康方面的重要作用。最近对大学生群体的调查研究了收集日常情绪、活动和社会数据的可行性。然而，这些研究并没有说明学生采用自我跟踪技术来支持心理健康目标的经验和挑战。我们提出了两项研究，以更好地了解自我跟踪的压力管理和心理健康的学生群体。首先，焦点小组和卡片分类活动与14名学生卫生专业人员揭示了三种情况下跟踪有用性的专家观点。第二，对297名学生进行的一项在线调查，考察了自我跟踪和与他人分享自我跟踪数据的态度。我们利用这些研究的结果来描述学生在收集和观察与心理健康相关的自我追踪数据方面的动机、挑战和偏好，并比较诊断出的精神疾病和那些没有精神疾病的学生之间的结果。最后，我们讨论了利用自我跟踪心理健康的挑战和机会，强调了几个设计考虑因素。 article link

56. "It's Definitely Been a Journey": A Qualitative Study on How Women with Eating Disorders Use Weight Loss Apps

SESSION:Self-tracking Mental Health

Technology is often viewed as either positive or negative. On one hand, in HCI, weight loss apps are usually seen as a positive influence on users. From the sociocultural perspective, on the other hand, media and technology negatively impact body satisfaction and contribute to eating disorders; however, these studies fail to include weight loss apps. While these apps can be beneficial to users, they can also have negative effects on users with eating disorder behaviors. Yet few research studies have looked at weight loss apps in relation to eating disorders. In order to fill this gap, we conducted interviews with 16 women with a history of eating disorders who use(d) weight loss apps. While our findings suggest these apps can contribute to and exacerbate eating disorder behaviors, they also reveal a more complex picture of app usage. Women's use and perceptions of weight loss apps shift as they experience life and move to and from stages of change. This research troubles the binary view of technology and emphasizes the importance of looking at technology use as a dynamic process. Our study contributes to our understanding of weight loss app design.

> 技术通常被视为正面或负面的。一方面，在HCI中，减肥应用程序通常被视为对用户的积极影响。从社会文化的角度来看，另一方面，媒体和技术对身体满意度产生负面影响，并有助于饮食失调；然而，这些研究未能包括减肥应用程序。虽然这些应用程序对用户有益，但也会对进食障碍行为的用户产生负面影响。然而，很少有研究对减肥应用程序与饮食失调有关。为了填补这一空白，我们对16位有饮食障碍病史的妇女进行了访谈。虽然我们的研究结果表明，这些应用程序可能导致和加剧进食障碍的行为，他们还揭示了一个更复杂的应用程序使用图片。女性对减肥应用的使用和感知随着她们体验生活和改变阶段而改变。这项研究对技术的二元观点提出了异议，并强调将技术应用看作一个动态过程的重要性。我们的研究有助于我们了解减肥应用程序设计。 article link

57. Conflict in Comments: Learning but Lowering Perceptions, with Limits

SESSION:Self-tracking Mental Health

Prior work and perception theory suggests that when exposed to discussion related to a particular piece of crowdsourced text content, readers generally perceive that content to be of lower quality than readers who do not see those comments, and that the effect is stronger if the comments display conflict. This paper presents a controlled experiment with over 1000 participants testing to see if this effect carries over to other documents from the same platform, including those with similar content or by the same author. Although we do generally find that perceived quality of the commented-on document is affected, effects do not carry over to the second item and readers are able to judge the second in isolation from the comment on the first. We confirm a prior finding about the negative effects conflict can have on perceived quality but note that readers report learning more from constructive conflict comments.

> 以前的工作和认知理论表明，当暴露于一个特定的大众文本内容相关的讨论，读者普遍认为内容是低质量的读者谁不看那些评论，而且效果更强如果评论显示冲突。本文提出了一个控制实验，有1000多个参与者进行测试，以检验这种效果是否会从同一个平台上传递给其他文档，包括那些内容相同或同一作者的文档。虽然我们一般认为，评论的质量受到影响的文件，效果不带到第二个项目，读者能够判断第二个孤立的评论第一。我们确认先前关于负面影响冲突对感知质量的发现，但注意到读者报告更多地从建设性冲突评论中学习。 article link

58. Identification and Classification of Usage Patterns in Long-Term Activity Tracking

SESSION:Self-tracking Mental Health

Activity trackers are frequently used in health and well-being, but their application in effective interventions is challenging. While research for reasons of use and non-use is ongoing, little is known about the way activity trackers are used in everyday life and over longer periods. We analyzed data of 104 individuals over 14,413 use days, and in total over 2.5 years. We describe general tracker use, periodic changes and overall changes over time, and identify characteristic patterns. While the use of trackers shows large individual heterogeneity, from our findings we could identify and classify general patterns for activity tracker use such as try-and-drop, slow-starter, experimenter, hop-on hop-off, intermittent and power user. Our findings contribute to the body of knowledge towards the successful design of effective health technologies, health interventions, and long-term health applications.

> 活动跟踪经常用于健康和福利，但它们在有效干预中的应用具有挑战性。虽然对使用和不使用的原因的研究正在进行，但对活动追踪器在日常生活中使用的时间和周期较长的情况知之甚少。我们分析了104个人超过14413天使用的数据，总共超过2.5年。我们描述了一般跟踪器的使用、周期性变化和随时间的总体变化，并识别特征模式。虽然跟踪器的使用显示了巨大的个体异质性，但根据我们的发现，我们可以识别和分类活动跟踪器使用的一般模式，如尝试和拖放、慢启动、实验者、跳上跳下、间歇性和电力用户。我们的发现有助于成功地设计有效的卫生技术、健康干预和长期健康应用的知识体系。 article link

59. AirPanes: Two-Handed Around-Device Interaction for Pane Switching on Smartphones

SESSION:Smartwatch Interactions and Displays

In recent years, around device input has emerged as a complement to standard touch input, albeit in limited tasks and contexts, such as for item selection or map navigation. We push the boundaries for around device interactions to facilitate an entire smartphone application: browsing through large information lists to make a decision. To this end, we present AirPanes, a novel technique that allows two-handed in-air interactions, conjointly with touch input to perform analytic tasks, such as making a purchase decision. AirPanes resolves the inefficiencies of having to switch between multiple views or panes in common smartphone applications. We explore the design factors that make AirPanes efficient. In a controlled study, we find that AirPanes is on average 50% more efficient that standard touch input for an analytic task. We offer recommendations for implementing AirPanes in a broad range of applications.

> 近年来，尽管在有限的任务和上下文中，如项目选择或地图导航，设备输入已经成为标准触摸输入的补充。我们推动围绕设备交互的边界，以方便整个智能手机应用程序：浏览大型信息列表做出决定。为此，我们提出了airpanes，一种新的技术，让双手在空气中相互作用，共同触摸输入执行分析任务，如购买决策。airpanes解决了在普通的智能手机应用程序的多个视图或窗格之间切换的效率。我们探索，使airpanes高效的设计因素。在对照研究中，我们发现，airpanes是平均50%更有效的解析任务标准触摸输入。我们提供了广泛的应用airpanes实施建议。 article link

60. Float: One-Handed and Touch-Free Target Selection on Smartwatches

SESSION:Smartwatch Interactions and Displays

Touch interaction on smartwatches suffers from the awkwardness of having to use two hands and the "fat finger" problem. We present Float, a wrist-to-finger input approach that enables one-handed and touch-free target selection on smartwatches with high efficiency and precision using only commercially-available built-in sensors. With Float, a user tilts the wrist to point and performs an in-air finger tap to click. To realize Float, we first explore the appropriate motion space for wrist tilt and determine the clicking action (finger tap) through a user-elicitation study. We combine the photoplethysmogram (PPG) signal with accelerometer and gyroscope to detect finger taps with a recall of 97.9% and a false discovery rate of 0.4%. Experiments show that using just one hand, Float allows users to acquire targets with size ranging from 2mm to 10mm in less than 2s to 1s, meanwhile achieve much higher accuracy than direct touch in both stationary (>98.9%) and walking (>71.5%) contexts.

> 触摸交互在smartwatches患有必须用两只手和“胖手指”问题的尴尬。我们目前的浮动，手腕手指输入的方法，使单手触摸在高效使用市面上唯一内置传感器精度smartwatches自由选择目标。使用浮动，用户倾斜手腕到点并执行空气手指点击点击。为了实现浮动，我们首先探索适当的运动空间，手腕倾斜和确定点击动作（手指轻拍）通过用户启发研究。我们结合光电血管容积图（PPG）与加速度计和陀螺仪信号与召回97.9%和0.4%的错误发现率检测手指的水龙头。实验结果表明，仅使用一只手，浮点允许用户获得小于2mm到1秒的大小为2mm到10mm的目标，同时在静止（> 98.9%）和行走（> 71.5%）上下文中比直接触摸获得更高的精度。 article link

61. COMPASS: Rotational Keyboard on Non-Touch Smartwatches

SESSION:Smartwatch Interactions and Displays

Entering text is very challenging on smartwatches, especially on non-touch smartwatches where virtual keyboards are unavailable. In this paper, we designed and implemented COMPASS, a non-touch bezel-based text entry technique. COMPASS positions multiple cursors on a circular keyboard, with the location of each cursor dynamically optimized during typing to minimize rotational distance. To enter text, a user rotates the bezel to select keys with any nearby cursors. The design of COMPASS was justified by an iterative design process and user studies. Our evaluation showed that participants achieved a pick-up speed around 10 WPM and reached 12.5 WPM after 90-minute practice. COMPASS allows users to enter text on non-touch smartwatches, and also serves as an alternative for entering text on touch smartwatches when touch is unavailable (e.g., wearing gloves).

> 进入文本是非常具有挑战性的smartwatches，尤其在非接触智能手表虚拟键盘不可用。在本文中，我们设计并实现了指南针，一种非触摸式的基于表格的文本输入技术。罗盘在一个圆形键盘上放置多个光标，在输入时动态优化每个光标的位置，以最小化旋转距离。要输入文本，用户旋转边框以选择任何附近光标的键。通过迭代设计过程和用户研究，指南针的设计是合理的。我们的评估显示，参与者实现了回升速度在每分钟10字和90分钟的练习后，达到每分钟12.5个字。指南针可以让用户在非接触智能手表输入文本，也可以作为一种替代输入文本时无法触摸的smartwatches联系（如戴手套）。 article link

62. WatchThru: Expanding Smartwatch Displays with Mid-air Visuals and Wrist-worn Augmented Reality

SESSION:Smartwatch Interactions and Displays

We introduce WatchThru, an interactive method for extended wrist-worn display on commercially-available smartwatches. To address the limited visual and interaction space, WatchThru expands the device into 3D through a transparent display. This enables novel interactions that leverage and extend smartwatch glanceability. We describe three novel interaction techniques,Pop-up Visuals,Second PerspectiveandPeek-through, and discuss how they can complement interaction on current devices. We also describe two types of prototypes that helped us to explore standalone interactions, as well as, proof-of-concept AR interfaces using our platform.

> 我们介绍watchthru，交互式方法扩展腕戴式显示在市售的智能手表。为解决有限的视觉和互动的空间，watchthru扩展到三维通过透明显示装置。这使得新的相互作用，利用和扩展的SmartWatch glanceability。我们描述了三个新的互动技术，流行的视觉效果，二perspectiveandpeek通过，并讨论如何可以补充现有设备的交互。我们还描述了两种类型的原型，它们帮助我们探索独立的交互，以及使用我们的平台验证概念AR接口。 article link

63. Evaluation of Korean Text Entry Methods for Smartwatches

SESSION:Smartwatch Interactions and Displays

This paper presents results from a user study designed to evaluate the effectiveness of Korean text entry methods for smartwatches. Specifically, the study compares the four popular text entry methods for smartphones in the context of smartwatch use (three multi-tap 3x4 keypad methods and a QWERTY-like method). A distinctive feature of text entry in Korea is that traditionally different manufacturers have developed their own text entry methods starting with particular physical layouts on feature phones that are now available as soft keypads on smartphones. This research considers the next step in this progression by studying the viability of adopting these text entry methods on smartwatches. The results from the user study indicate that existing methods can be effective for text entry on smartwatches; analysis of the data offers suggestions for improving the effectiveness of the methods.

> 本文从设计评估对于smartwatches朝鲜文字输入方法效果的用户研究的结果。具体来说，该研究比较了四种流行的文本输入方法在SmartWatch使用上下文智能手机（三多抽头3x4键盘的方法和一个QWERTY的方法）。韩国的文本输入的一个显著特征是，传统上不同的厂商都开发了自己的文本输入方法从特定的物理布局，现在可以作为软键盘的智能手机功能手机。这项研究认为，在下一步的研究，采用这些文本输入方法上smartwatches的可行性。从用户研究的结果表明，现有的方法可以对手表的文本输入是有效的；对数据的分析提供了改进方法的有效性的建议。 article link

64. "WhatsApp is for family; Messenger is for friends": Communication Places in App Ecosystems

SESSION:Social & Collaborative Technologies

Today's users communicate via multiple apps, even when they offer almost identical functionality. We studied how and why users distribute their contacts within their app ecosystem. We found that the contacts in an app affect a user's conversations with other contacts, their communication patterns in the app, and the quality of their social relationships. Users appropriate the features and technical constraints of their apps to create idiosyncraticcommunication places, each with its own recursively defined membership rules, perceived purposes, and emotional connotations. Users also shift the boundaries of their communication places to accommodate changes in their contacts' behaviour, the dynamics of their relationships, and the restrictions of the technology. We argue that communication apps should support creating multiple communication places within the same app, relocating conversations across apps, and accessing functionality from other apps.

> 今天的用户通过多个应用程序进行通信，即使它们提供几乎相同的功能。我们研究了用户如何在应用程序生态系统中分发联系人。我们发现应用程序中的联系人影响用户与其他联系人的会话、应用程序中的通信模式以及社交关系的质量。用户创建idiosyncraticcommunication适当地方特点和应用技术的限制，每个都有其自己的递归定义的成员规则，感知的目的，和情感内涵。用户也改变了他们的交流场所的边界，以适应他们交往行为的变化、人际关系的动态以及技术的限制。我们认为，通信应用程序应该支持在同一个应

> 用程序中创建多个通信位置，在应用程序之间进行对话，并从其他应用程序访问功能。 article link

65. I Need Your Encouragement!: Requesting Supportive Comments on Social Media Reduces Test Anxiety

SESSION:Social & Collaborative Technologies

Many students underperform on exams due to experiencing high test anxiety. We report on a study comparing a novel intervention of seeking support from one's social network to the more common approaches of expressive writing and studying task-relevant materials for simulated open-ended test questions. We measured in-the-moment (state) anxiety before and after each intervention, and correctness of the solutions. We also surveyed students to learn about their perceptions of the interventions. Our results showed that social support decreased the anxiety of high test-anxious students by 21% with the reduction in anxiety correlating with the number of messages received. Social support also allowed high test-anxious students to score at the level of low test-anxious students. Expressive writing showed a similar effect, but increased the anxiety of low test-anxious students by 61%. Studying task materials had no effect on anxiety and high test-anxious students performed worse than low test-anxious students. Despite benefiting from social support, we found that students were uncomfortable soliciting support from their online social network. Realizing the benefits of this approach may therefore require different formulations of social support in practice.

> 许多学生在考试中表现不佳，由于经历高考试焦虑。我们报告了一项研究，比较了一种新的干预方法，从一个人的社交网络寻求支持，到表达写作的更普遍的方法，以及学习模拟开放式测试问题的任务相关材料。我们测量了每次干预前后的状态（状态）焦虑，以及解决方案的正确性。我们还对学生进行了调查，了解他们对干预措施的看法。我们的研究结果表明，社会支持降低了高焦虑学生的焦虑感，减少了21%的焦虑，与接收到的信息数量相关。社会支持也允许高焦虑学生在低考试焦虑学生的水平上得分。表现性写作表现出相似的效果，但增加了低考试焦虑学生的焦虑61%。研究任务材料对焦虑没有影响，高焦虑学生表现不如低焦虑学生。尽管受益于社会支持，我们发现学生们很不愿意从他们的在线社交网络上获得支持。因此，实现这种方法的好处可能需要在实践中采用不同的社会支持。 article link

66. Goodbye Text, Hello Emoji: Mobile Communication on WeChat in China

SESSION:Social & Collaborative Technologies

We present a qualitative study of mobile communication via WeChat in Southern China, focusing on the rapid proliferation of emoji and stickers and the lessening dependence on text. We use interview and observation data from 30 participants to investigate how rural, small town, and urban Chinese adults creatively and innovatively balance the use of emoji, stickers, and text in their mobile communication practices. We also discuss design implications of our research for the field of HCI, offering ways of leveraging the non-textual communication practices that we uncover, in scenarios where purely text-based communication may not suffice.

> 我们目前的移动通信的定性研究通过微信在华南，重点对表情符号和标签快速增殖和减少依赖文字。我们采用访谈和观察的数据从30名参加者探讨农村、小城镇，城市人创造性地平衡表情贴纸的使用，并在他们的移动通信实践文本。我们还讨论了我们对HCI领域的研究的设计意义，提供了利用我们发现的非文本交流实践的方法，在纯粹基于文本的交流可能不够的情况下。 article link

67. A Kaleidoscope of Languages: When and How Non-Native English Speakers Shift between English and Their Native Language during Multilingual Teamwork

SESSION:Social & Collaborative Technologies

Multilingual teams often include subgroups of members who share a native language different from the team's common language. Linguistic choices by members of these subgroups can have implications for information exchange at the team level. We reported a field study of language use in 3 multilingual teams, each of which consisted of some native English speakers (NS) and some non-native English speakers (NNS) who shared a native language with at least one other team member. We found that NNS often shifted between English and their native language. The way language shift happened differed for formal meetings, informal conversations, and instant messaging. Language variation was often associated with shifts in content, participants, and communication medium. Further analysis indicated that language shift had both benefits and costs for team communication, depending on the context in which it happened. Based on these findings, we outline suggestions for designing multilingual collaboration systems.

> 多语言团队通常包括与母语共享不同于本地语言的成员组。这些小组成员的语言选择对团队层面的信息交流有影响。我们报道了3多语种的语言使用领域的研究团队，其中包括一些以英语为母语的人（NS）和一些非英语为母语的人（NNS）谁共享母语与至少一个其他团队成员。我们发现，网络经常转移英语和母语之间。正式会议、非正式对话和即时消息传递的方式发生了差异。语言变异通常与内容、参与者和交流媒介的变化有关。进一步的分析表明，语言转换对团队沟通有好处，也有成本，这取决于它发生的上下文。基于这些发现，我们概述了设计多语言协作系统的建议。 article link

68. The (Un)sustainability of Imagined Future Information Societies

SESSION:Sustainability and Public Service

The pathway to a sustainable society is not clear, and we need to consider different developmental possibilities. This paper describes the results of a research project in the intersection of HCI and Futures Studies as well as in the intersection between "the future information society" and sustainability. We here present parts of the body of materials that were developed in a multi-year research project with the aim of describing and evaluating the sustainability impact of possible future information societies. We also discuss some of the lessons learned and what HCI and design fiction can learn from Futures Studies in general and from this project in particular. The main stakeholders in this project have been city administrators and corporate partners, and the overarching goal has primarily been to influence planning processes at the regional (Stockholm, Sweden) level.

> 通往可持续社会的道路还不清楚，我们需要考虑不同的发展可能性。本文描述了人机交互和期货研究交叉的一个研究项目的结果，以及“未来信息社会”与可持续性之间的交叉点。我们在这里展示了多年研究项目中开发的部分材料，目的是描述和评估未来可能的信息社会的可持续性影响。我们还讨论了一些经验教训，以及HCI和设计小说可以从一般的未来研究中学习，特别是从这个项目中学习的内容。这个项目的主要利益相关者是城市管理者和企业合作伙伴，总体目标主要是影响区域（斯德哥尔摩、瑞典）的规划进程。 article link

69. Means and Ends in Human-Computer Interaction: Sustainability through Disintermediation

SESSION:Sustainability and Public Service

There has been an increased interest in broader contexts from ecology and economics within the HCI community in recent years. These developments suggest that the HCI community should engage with and respond to concerns that are external to computing yet profoundly impact human society. In this paper we observe that taking these broader contexts into account yields a fundamentally different way to think about sustainable interaction design, one in which the designer's focus must be on a) ecological limits, b) creating designs and artifacts that do not further a cornucopian paradigm, and c) fundamental human needs.It can be hard to be responsive to these contexts in practical HCI work. To address this, we propose that the design rubric of disintermediation can serve as a unifying approach for work that aims to meet the ecological and economic challenges outlined in the literature. After discussing the potential use and impact of disintermedation, we perform an analysis using this design rubric to several key application areas.

> 近年来，在HCI社区中，从生态和经济角度对更广泛的环境产生了浓厚兴趣。这些事态发展表明，HCI社区应该参与并应对那些对人类社会产生深远影响的计算之外的关注点。在本文中，我们观察到，这些更广泛的背景下考虑收益率的一个根本不同的方式来思考可持续交互设计，一个设计师的焦点必须在）生态极限，B）的创意和文物，不要再丰饶的范式，和c）人类的基本需求，它可以很难在实际工作中应根据这些交互。为了解决这个问题，我们建议去设计规则可以作为一个统一的方法，旨在满足文献概述了生态和经济的挑战。在讨论了潜在的使用和影响disintermedation，我们进行分析利用该设计法的几个关键的应用领域。 article link

70. Crowdfunding Platforms and the Design of Paying Publics

SESSION:Sustainability and Public Service

Crowdfunding enables groups to self-fund the changes they want to make in the world. In other words, digital financial platforms are proving capable of supporting new relations between groups of people as well as offering new ways to organize money. Taking an HCI lens, we look at how some crowdfunding platform owners are approaching social innovation, not only at the level of supporting individual community initiatives, but at the broader level of using their platform to change societal behavior. Through four case studies, we show how crowdfunding has been chosen as a tool to redesign society by promoting environmental or social sustainability. We argue that the groups constituted through these interactions are not merely "crowds", but deliberate constellations built round a thing of interest (or "paying publics"). Our interviews with managers and owners explore how interactions with and around platforms work to achieve these ends and we conclude with design considerations.

> 众筹使团体自基金他们想让全世界的变化。换句话说，数字金融平台已经证明能够支持群体之间的新关系，也提供了组织资金的新方法。以人机交互的镜头，我们来看看一些众筹平台所有者接近社会创新，不仅在支持社区活动的水平，但在使用他们的平台，改变社会行为的整体水平。通过四个案例研究中，我们展示了如何融资已被选定作为一种工具来重新设计社会环境和社会可持续发展的推动。我们认为，通过这些相互作用而形成的群体不仅仅是“人群”，而是围绕着一件感兴趣的事物（或“付钱给公众”）建造的深思熟虑的星座。我们与经理和业主的访谈探讨了如何与周围的平台进行交互，以达到这些目的，并得出设计考虑。 article link

71. Reappropriating Hackathons: The Production Work of the CHI4Good Day of Service

SESSION:Sustainability and Public Service

The popularity of hackathons has increased as technology pervades more facets of our lives. Originally designed for programmers, hackathons are now being appropriated by new stakeholders across diverse sectors. Yet with this evolution in hackathons, we no longer adequately understand what is produced and, thereby, the value of these events. We conducted an interview study with 22 stakeholders - participants, representatives of nonprofit organizations, and organizers - of the CHI4Good Day of Service to understand what is produced through philanthropic hackathons. Whereas traditional hackathons are oriented around the production of code or prototypes, our analysis of interview data suggests that the production work of philanthropic hackathons also includes technical capacity and expertise, expanded social networks, an exposure to design process, affective experiences, and an opportunity for participants to shape their identities against a cross-sectoral, interdisciplinary backdrop. We conclude by reflecting on implications for the CHI community in carrying out philanthropic events styled after hackathons.

> 黑客马拉松的普及科技正在我们的生活更方面增加。原先设计的程序员，编程马拉松活动正在被不同行业的新的利益相关者。然而，这种发展在这种形式的比赛，我们没有充分理解什么是生产，因此，这些事件的价值。我们进行了一次访谈研究22利益相关者参与，非营利组织的代表，以及服务chi4good天明白什么是黑客马拉松组织者通过慈善机构的产生。而传统的黑客马拉松是面向代码或原型的生产，我们的访谈资料的分析表明，慈善的黑客马拉松的生产工作还包括技术能力和专业知识，扩大社会网络，一接触到设计的过程中，情感的体验，以及学员塑造自己的身份对一个跨部门、跨学科的背景。我们的结论反映了在开展慈善活动为黑客马拉松卡界的影响后。 article link

72. Understanding Concept Maps: A Closer Look at How People Organise Ideas

SESSION:Understanding Data Visualization

Research into creating visualisations that organise ideas into concise concept maps often focuses on implicit mathematical and statistical theories which are built around algorithmic efficacy or visual complexity. Although there are multiple techniques which attempt to mathematically optimise this multi-dimensional problem, it is still unknown how to create concept maps that are immediately understandable to people. In this paper, we present an in-depth qualitative study observing the behaviour and discussing the strategy used by non-expert participants to create, interact, update and communicate a concept map that represents a collection of research ideas. Our results show non-expert individuals create concept maps differently to visualisation algorithms. We found that our participants prioritised narrative, landmarks, abstraction, clarity, and simplicity. Finally, we derive design recommendations from our results which we hope will inspire future algorithms that automatically create more usable and compelling concept maps better suited to the natural behaviours and needs of users.

> 研究显示，组织观念创造成简明的概念图往往侧重于内隐数学和统计理论，是建立在算法的效果或视觉的复杂性。尽管有多种技术试图在数学上优化这种多维问题，但如何创建概念图却能立即被人们理解仍然是未知的。在本文中，我们提出了一个深入的定性研究观察行为，并讨论非专家参与者使用的策略，创建，互动，更新和沟通的概念图，代表了一个研究思路的集合。我们的研究结果表明非专家个人创建概念图不同的可视化算法。我们发现，我们的参与者优先叙事、地标、抽象、清晰和简单。最后，我们从我们的结果中得出设计建议，我们希望这将激励未来的算法，自动创建更适合和更令人信服的概念图，更适合用户的自然行为和需求。 article link

73. Increasing Users' Confidence in Uncertain Data by Aggregating Data from Multiple Sources

SESSION:Understanding Data Visualization

We often base our decisions on uncertain data - for instance, when consulting the weather forecast before deciding what to wear. Due to their uncertainty, such forecasts can differ by provider. To make an informed decision, many people compare several forecasts, which is a time-consuming and cumbersome task. To facilitate comparison, we identified three aggregation mechanisms for forecasts: manual comparison and two mechanisms of computational aggregation. In a survey, we compared the mechanisms using different representations. We then developed a weather application to evaluate the most promising candidates in a real-world study. Our results show that aggregation increases users'

confidence in uncertain data, independent of the type of representation. Further, we find that for daily events, users prefer to use computationally aggregated forecasts. However, for high-stakes events, they prefer manual comparison. We discuss how our findings inform the design of improved interfaces for comparison of uncertain data, including non-weather purposes.

> 我们常常把决策建立在不确定的数据上，例如，在决定天气预报之前，在决定穿什么衣服之前。由于其不确定性，这种预测可能因提供者不同而有所不同。为了做出明智的决定，许多人比较几种预测，这是一项费时费力的任务。为了便于比较，我们确定了三种预测聚集机制：手动比较和两种计算聚合机制。在一项调查中，我们比较了使用不同表示的机制。然后，我们开发了一个天气应用程序，以评估最有前途的候选人在现实世界中的研究。我们的研究结果表明，聚合增加了用户对不确定数据的信心，独立于表示的类型。此外，我们发现，对于日常事件，用户更喜欢使用计算汇总的预测。然而，对于高风险事件，他们更喜欢手动比较。我们将讨论我们的发现如何通知改进接口的设计，以比较不确定数据，包括非天气目的。 article link

74. Bottom-up vs. Top-down: Trade-offs in Efficiency, Understanding, Freedom and Creativity with InfoVis Tools

SESSION:Understanding Data Visualization

The emergence of tools that support fast-and-easy visualization creation by non-experts has made the benefits of InfoVis widely accessible. Key features of these tools include attribute-level operations, automated mappings, and visualization templates. However, these features shield people from lower-level visualization design steps, such as the specific mapping of data points to visuals. In contrast, recent research promotes constructive visualization where individual data units and visuals are directly manipulated. We present a qualitative study comparing people's visualization processes using two visualization tools: one promoting a top-down approach to visualization construction (Tableau Desktop) and one implementing a bottom-up constructive visualization approach (iVoLVER). Our results show how the two approaches influence: 1) the visualization process, 2) decisions on the visualization design, 3) the feeling of control and authorship, and 4) the willingness to explore alternative designs. We discuss the complex trade-offs between the two approaches and outline considerations for designing better visualization tools.

> 那些支持快速和容易的非专家的可视化创造了广泛的好处，可视化工具的出现。这些工具的主要特性包括属性级别操作、自动映射和可视化模板。然而，这些特性保护人们不受低级可视化设计步骤的影响，如数据点到视觉的具体映射。与此相反，最近的研究促进了建设性的可视化，其中单个数据单元和视觉被直接操纵。我们发明的方法定性研究比较人们的可视化使用可视化工具：一个促进自上而下的方法来可视化建设（Tableau桌面）和一个自底向上的建设性的可视化方法实现（ivolver）。我们的结果显示了这两种方法是如何影响的：（1）可视化过程，2）关于可视化设计的决定，3）控制感和作者感，以及4）探索替代设计的意愿。我们将讨论这两种方法之间的复杂权衡和设计更好的可视化工具的概要考虑。 article link

75. What Happened in my Home?: An End-User Development Approach for Smart Home Data Visualization

SESSION:Understanding Data Visualization

Smart home systems change the way we experience the home. While there are established research fields within HCI for visualizing specific use cases of a smart home, studies targeting user demands on visualizations spanning across multiple use cases are rare. Especially, individual data-related demands pose a challenge for usable visualizations. To investigate potentials of an end-user development (EUD) approach for flexibly supporting such demands, we developed a smart home system featuring both pre-defined visualizations and a visualization creation tool. To evaluate our concept, we installed our prototype in 12 households as part of a Living Lab study. Results are based on three interview studies, a design workshop and system log data. We identified eight overarching interests in home data and show how participants used pre-defined visualizations to get an overview and the creation tool to not only address specific use cases but also to answer questions by creating temporary visualizations.

> 智能家居系统改变了我们体验家庭的方式。虽然在HCI中已经建立了可视化智能家居特定用例的研究领域，但针对多个用例的可视化的用户需求的研究很少。特别是，个人数据相关的需求对可用的可视化提出了挑战。了解最终用户的发展潜力（EUD）灵活支持这种需求的方法，我们开发了一个智能家居系统具有预定义的可视化和可视化创作工具。为了评估我们的概念，我们在12个家庭安装了我们的原型，作为活体实验室研究的一部分。结果是基于三个访谈研究，一个设计研讨会和系统日志数据。我们确定了家庭数据中的八个主要兴趣，并展示了参与者如何使用预定义的可视化来获得概览和创建工具，不仅可以解决特定的用例，还可以通过创建临时可视化来回答问题。 article link

76. Opportunities and Design Considerations for Peer Support in a Hospital Setting

SESSION:Clinical Settings

Although research has demonstrated improved outcomes for outpatients who receive peer support-such as through online health communities, support groups, and mentoring systems-hospitalized patients have few mechanisms to receive such valuable support. To explore the opportunities for a hospital-based peer support system, we administered a survey to 146 pediatric patients and caregivers, and conducted semi-structured interviews with twelve patients and three caregivers in a children's hospital. Our analysis revealed that hospitalized individuals need peer support for five key purposes: (1) to ask about medical details-such as procedures, treatments, and medications; (2) to learn about healthcare providers; (3) to report and prevent medical errors; (4) to exchange emotional support; and (5) to manage their time in the hospital. In this paper, we examine these themes and describe potential barriers to using a hospital-based peer support system. We then discuss the unique opportunities and challenges that the hospital environment presents when designing for peer support in this setting.

> 尽管研究表明，通过在线健康社区、支持团体和辅导系统获得住院治疗的门诊病人的治疗结果有所改善，但住院病人几乎没有得到这些宝贵支持的机制。探讨医院同伴支持系统的机会，我们146个儿科患者和照顾者进行调查，并进行了半结构化面试十二例和三照顾者在一家儿童医院。我们的分析显示，住院个人需要的五个关键目的同行的支持：（1）询问医疗细节等程序，治疗，和药物治疗；（2）了解医疗服务提供者；（3）报告和预防医疗差错；（4）交流情感上的支持；和（5）中医院的管理自己的时间。在本文中，我们研究这些主题描述使用医院的同事支持系统的潜在障碍。然后，我们讨论了在这个环境中设计同行支持时，医院环境所带来的独特的机遇和挑战。 article link

77. Patient Strategies as Active Adaptation: Understanding Patient Behaviors During an Emergency Visit

SESSION:Clinical Settings

Although the ability of patients to access their health information during ongoing care is considered crucial for better health outcomes and increased satisfaction, the current care model places patients in a passive role. To investigate the patient experience in the hospital environment where information is lacking and in accessible, we conducted an ethnographic study with patients, caregivers, and healthcare providers in the emergency care setting. We report the three types of information breakdowns ED patients encountered during their emergency visits and the strategies they developed to cope. Our findings reveal a rich picture of the coping mechanisms ED patients use to proactively adapt to the nature of the ED care context. This work expands upon our understanding of the unique information challenges ED patients face, as well as the important adapting

behaviors they engage in; it also uncovers design opportunities for supporting crucial, yet unmet, patient information needs.

> 虽然病人在持续的护理中获得健康信息的能力被认为是改善健康状况和提高满意度的关键，但目前的护理模式却使患者处于被动的角色。为了调查医院环境中缺乏信息和可获得的病人经验，我们在急诊室进行了与患者、护理人员和医疗保健提供者的人种学研究。我们报告急诊病人在急诊期间遇到的三种类型的信息故障及其应对策略。我们的发现揭示了ED患者主动适应ED护理环境本质的应对机制。这项工作扩展了我们对ED患者所面临的独特信息挑战的理解，以及他们所从事的重要适应行为；它也揭示了支持关键但尚未得到满足的病人信息需求的设计机会。 article link

78. Itchtector: A Wearable-based Mobile System for Managing Itching Conditions

SESSION:Clinical Settings

Severe itching conditions such as eczema or atopic dermatitis can have a significant impact on one's quality of life. Unfortunately, many of these conditions cannot be cured, and the focus is often on properly controlling or managing the condition. Thus, it is important to understand or objectively monitor how one's scratching behavior changes, based on medication or treatment or environmental conditions. In this work, we explore how wearable devices can support people with itching conditions to better manage their conditions. We carried out a three-phase study with 40 participants and 2 dermatologists to understand the implications of various system features and designs. Based on interviews with patients and doctors, we incorporated medical guidelines for treatment and patients' needs in the proposed Itchtector - a smartwatch-based mobile system to monitor itching behaviors and provide objective information about the user's scratching behaviors. Using the Itchtector prototype, we evaluated performance and possible acceptance with subjects.

> 严重的瘙痒状态，如湿疹或异位性皮炎，会对人的生活质量产生重大影响。不幸的是，许多这些条件不能治愈，重点往往是适当控制或管理的条件。因此，重要的是要了解或客观地监测一个人的抓挠行为如何改变，根据药物或治疗或环境条件。在这项工作中，我们将探讨如何穿戴设备可以支持有瘙痒条件的人，以更好地管理他们的条件。我们进行了40名参与者和2名皮肤科医生的三相研究，以了解各种系统特征和设计的含义。基于患者和医生的采访，我们将在该itchtector -治疗和病人需要医疗指南的SmartWatch移动系统监控瘙痒行为和提供用户的抓挠行为的客观信息。使用itchtector原型，我们评估的性能和可能的接受主体。 article link

79. Privacy, Security, and Surveillance in the Global South: A Study of Biometric Mobile SIM Registration in Bangladesh

SESSION:Digital Privacy & Security

With the rapid growth of ICT adoption in the Global South, crimes over and through digital technologies have also increased. Consequently, governments have begun to undertake a variety of different surveillance programs, which in turn provoke questions regarding citizens' privacy rights. However, both the concepts of privacy and of citizens' corresponding political rights have not been well-developed in HCI for non-Western contexts. This paper presents findings from a three-month long ethnography and online survey (n=606) conducted in Bangladesh, where the government recently imposed mandatory biometric registration for every mobile phone user. Our analysis surfaces important privacy and safety concerns regarding identity, ownership, and trust, and reveals the cultural and political challenges of imposing biometric registration program in Bangladesh. We also discuss how alternative designs of infrastructure, technology, and policy may better meet stakeholders' competing needs in the Global South.

> 随着信息和通信技术在全球南部的迅速发展，通过数字技术的犯罪也增加了。因此，各国政府开始实施各种不同的监视计划，这反过来又引发公民隐私权问题。然而，在非西方语境下，关于隐私权和公民相应的政治权利的概念都没有得到充分的发展。本文介绍了一个为期三个月的人种学和在线调查（N = 606）在孟加拉进行的调查结果，其中政府最近对每个手机用户强制实施生物注册。我们的分析揭示了有关身份、所有权和信任的重要隐私和安全问题，并揭示了在孟加拉实施生物特征登记方案所面临的文化和政治挑战。我们还讨论了基础设施、技术和政策的替代设计如何更好地满足全球南部利益相关者的竞争需求。 article link

80. Youth Perspectives on Critical Data Literacies

SESSION:Digital Privacy & Security

As contemporary youth learn, play, and socialize online, their activities are often being recorded and analyzed. What should young people know about these data collection and analysis efforts? Although critiques of these new forms of data collection and analysis have grown increasingly loud, the voices of users, and particularly youth, have largely been absent. This paper explores the critical perspectives of youth who are programming with public data about their own learning and social interaction in the Scratch online community. Using a bottom-up approach based on ethnographic observation of discussions among these young users, we identify a series of themes in how these youth critique, question, and debate the implications of data analytics. We connect these themes-framed in terms of critical data literacies-to expert critiques and discuss the implications of these findings for education and design.

> 当代青年在网上学习、玩耍、社交，他们的活动经常被记录和分析。年轻人应该如何了解这些数据收集和分析工作？虽然对这些新形式的数据收集和分析的批评声越来越大，但用户的声音，尤其是青年人的声音，基本上已经消失了。本文探讨了青少年的关键观点，他们在自己的学习社区和社会互动的公共数据编程。使用自下而上的方法，基于这些年轻用户之间的人种学观察讨论，我们确定了一系列的主题，这些年轻人如何批评，质疑，并讨论数据分析的含义。我们将这些主题框架中关键数据的能力方面的专家评论和讨论这些研究结果的教育和设计的影响。 article link

81. Where is the Digital Divide?: A Survey of Security, Privacy, and Socioeconomics

SESSION:Digital Privacy & Security

The behavior of the least-secure user can influence security and privacy outcomes for everyone else. Thus, it is important to understand the factors that influence the security and privacy of a broad variety of people. Prior work has suggested that users with differing socioeconomic status (SES) may behave differently; however, no research has examined how SES, advice sources, and resources relate to the security and privacy incidents users report. To address this question, we analyze a 3,000 respondent, census-representative telephone survey. We find that, contrary to prior assumptions, people with lower educational attainment report equal or fewer incidents as more educated people, and that users' experiences are significantly correlated with their advice sources, regardless of SES or resources.

> 最不安全的用户的行为会影响其他人的安全和隐私结果。因此，了解影响各种人的安全和隐私的因素是很重要的。此前的研究表明，不同社会经济地位（SES）的用户可能表现不同；然而，没有研究调查SES、咨询来源和资源如何与用户报告的安全和隐私事件有关。为了解决这个问题，我们分析了3000名被调查者，即人口普查代表电话调查。我们发现，与先前的假设相反，受教育程度较低的人报告的事件与受过教育的人的事件相同或更少，用户的经验与他们的咨询来源有显著的相关性，而不管SES或资源。 article link

82. A Unified Framework for Knowledge Assessment and Progression Analysis and Design

SESSION:Educational Assessment

Designing engaging learning content is important but difficult, and typically involves a lot of manual specification. We present a unified framework that utilizes automatic problem decomposition and partial ordering graph construction to facilitate multiple workflows: knowledge assessment and progression analysis and design. We present results from a study with 847 participants in an online Japanese-language assessment tool demonstrating that our framework can efficiently measure student ability and predict student performance on specific problems. We also present results from analysis of curricula showing that the progressions of two different textbooks are surprisingly similar, and that our framework can lead to the discovery of general principles of expert progression design. Finally, we demonstrate automatic progression generation with desired sequencing and pacing, allowing for tailoring of progressions and mapping of parameters extracted from one curriculum onto another.

> 设计有吸引力的学习内容很重要，但很难，通常涉及大量的手动说明。我们提出了一个统一的框架，它利用自动问题分解和偏序图构造来促进多个工作流：知识评估和进度分析和设计。我们提出了一个在线日语评估工具的847名参与者的研究结果表明，我们的框架可以有效地衡量学生的能力和预测学生的具体问题的表现。我们还提出了从课程说明两不同教材的过程是非常相似的结果，和我们的框架可以导致专家发展设计的一般原则的发现。最后，我们展示了自动生成所需的进展顺序和进度，使过程和参数的提取从一个到另一个映射剪裁课程。 article link

83. HOBIT: Hybrid Optical Bench for Innovative Teaching

SESSION:Educational Assessment

Practical work in optics allows supporting the construction of knowledge, in particular when the concept to be learned remains diffuse. To overcome the limitations of the current experimental setups, we have designed a hybrid system that combines physical interaction and numerical simulation. This system relies on 3D-printed replicas of optical elements, which are augmented with pedagogical information. In this paper, we focus on the well-known Michelson interferometer experiment, widely studied in undergraduate programs of Science. A 3-months user study with 101 students and 6 teachers showed that, beyond the practical aspects offered by this system, such an approach enhances the technical and scientific learning compared to a standard Michelson interferometer experiment.

> 在光学方面的实际工作可以支持知识的建构，特别是当学习的概念仍然分散时。为了克服现有实验装置的局限性，我们设计了一个物理交互和数值模拟相结合的混合系统。该系统依赖于光学元件的3D打印复制品，并增加了教学信息。在本文中，我们专注于著名的迈克尔逊干涉仪实验，广泛研究的本科课程的科学。有101名学生和6名教师表明，3个月的用户研究，超越这个系统所提供的实践方面，这种方法提高了技术与科学的学习相比，标准的迈克尔逊干涉仪实验。 article link

84. PathViewer: Visualizing Pathways through Student Data

SESSION:Educational Assessment

Analysis of student data is critical for improving education. In particular, educators need to understand what approaches their students are taking to solve a problem. However, identifying student strategies and discovering areas of confusion is difficult because an educator may not know what queries to ask or what patterns to look for in the data. In this paper, we present a visualization tool, PathViewer, to model the paths that students follow when solving a problem. PathViewer leverages ideas from flow diagrams and natural language processing to visualize the sequences of intermediate steps that students take. Using PathViewer, we analyzed how several students solved a Python assignment, discovering interesting and unexpected patterns. Our results suggest that PathViewer can allow educators to quickly identify areas of interest, drill down into specific areas, and identify student approaches to the problem as well as misconceptions they may have.

> 对学生数据的分析对于改进教育至关重要。特别是，教育工作者需要了解他们的学生采取什么方法来解决问题。然而，识别学生的策略和发现混乱的区域是困难的，因为一个教育工作者可能不知道要问什么样的问题或者在数据中寻找什么样的模式。在本文中，我们提出了一个可视化工具，PathViewer，模型，学生遵循解决问题的路径。PathViewer利用思想从流程图和自然语言处理的可视化的中间步骤，学生以序列。使用PathViewer，我们分析了几个学生解决了一个Python赋值，发现有趣的图案。我们的研究结果表明，PathViewer可以让教育工作者快速识别感兴趣的领域，深入到具体的领域，并确定学生问题的方法以及可能有误解。 article link

85. WireFab: Mix-Dimensional Modeling and Fabrication for 3D Mesh Models

SESSION:Fabricating New Materials

Many rapid fabrication technologies are directed towards layer wise printing or laser based prototyping. We propose WireFab, a rapid modeling and prototyping system that uses bent metal wires as the structure framework. WireFab approximates both the skeletal articulation and the skin appearance of the corresponding virtual skin meshes, and it allows users to personalize the designs by (1) specifying joint positions and part segmentations, (2) defining joint types and motion ranges to build a wire-based skeletal model, and (3) abstracting the segmented meshes into mixed-dimensional appearance patterns or attachments.The WireFab is designed to allow the user to choose how to best preserve the fidelity of the topological structure and articulation motion while selectively maintaining the fidelity of the geometric appearance. Compared to 3D-printing based high-fidelity fabrication systems, WireFab increases prototyping speed by ignoring unnecessary geometric details while preserving structural integrity and articulation motion. In addition, other rapid or low-fidelity fabrication systems produce only static models, while WireFab produces posable articulated models and has the potential to enable personalized functional products larger than the machines that produce them.

> 许多快速制造技术针对分层印刷或基于激光的原型制造。我们提出了wirefab，用弯曲的金属丝作为框架结构快速建模和原型系统。wirefab近似的骨骼关节和相应的虚拟皮肤网格的皮肤外观，它允许用户以个性化的设计（1）指定节点位置和部分分割，（2）确定关节的类型和运动范围的建立一个基于有线的骨骼模型，和（3）提取分割的网格到混合维外观模式或附件，wirefab的设计允许用户选择如何最好地保存的拓扑结构和关节运动的忠实而有选择地保留几何外形的逼真度。相比于基于3D高保真印刷制造系统，提高成型速度wirefab忽略不必要的几何细节的同时保持结构的完整性和关节运动。此外，其他快速或低精度的制造系统产生的静态模型，而wirefab产生阐明posable模型，使个性化功能的产品比生产机器的潜力。 article link

86. Digital Mechanical Metamaterials

SESSION:Fabricating New Materials

In this paper, we explore how to embodymechanicalcomputation into 3D printed objects, i.e., without electronic sensors, actuators, or controllers typically used for this purpose. A

key benefit of our approach is that the resulting objects can be 3D printed in one piece and thus do not require assembly. We are building on 3D printed cell structures, also known asmetamaterials. We introduce a new type of cell that propagates a digital mechanical signal using an embedded bistable spring. When triggered, the embedded spring discharges and the resulting impulse triggers one or more neighboring cells, resulting in signal propagation. We extend this basic mechanism to implement simple logic functions. We demonstrate interactive objects based on this concept, such as a combination lock. We present a custom editor that allows users to model 3D objects, route signals, simulate signal flow, and synthesize cell patterns.

> 在本文中，我们探讨如何embodymechanicalcomputation为3D打印对象，即没有电子传感器，执行器，或通常用于此目的的控制器。我们的方法的一个主要好处是，生成的对象可以是三维打印在一块，因此不需要装配。我们正在建设3D打印的细胞结构，也被称asmetamaterials。介绍了一种利用嵌入式双稳态弹簧实现数字机械信号传输的新型单元。当触发时，嵌入的弹簧放电和由此产生的脉冲触发一个或多个相邻的细胞，从而导致信号传播。我们扩展了这个基本机制来实现简单的逻辑函数。我们演示了基于这个概念的交互式对象，比如组合锁。我们提供了一个自定义编辑器，允许用户建模3D对象，路由信号，模拟信号流，并合成细胞模式。 article link

87. Organic Primitives: Synthesis and Design of pH-Reactive Materials using Molecular I/O for Sensing, Actuation, and Interaction

SESSION:Fabricating New Materials

In this paper we present Organic Primitives, an enabling toolbox that expands upon the library of input-output devices in HCI and facilitates the design of interactions with organic, fluid-based systems. We formulated color, odor and shape changing material primitives which act as sensor-actuators that convert pH signals into human-readable outputs. Food-grade organic molecules anthocyanin, vanillin, and chitosan were employed as dopants to synthesize materials which output a spectrum of colors, degrees of shape deformation, and switch between odorous and non-odorous states. We evaluated the individual output properties of our sensor-actuators to assess the rate, range, and reversibility of the changes as a function of pH 2-10. We present a design space with techniques for enhancing the functionality of the material primitives, and offer passive and computational methods for controlling the material interfaces. Finally, we explore applications enabled by Organic Primitives under four contexts: environmental, cosmetic, edible, and interspecies.

> 在本文中，我们提出了有机基元，一个有利的工具箱，扩展了在HCI的输入输出设备库，并促进与有机，流体为基础的系统的交互设计。我们制定了颜色，气味和形状变化的材料原语作为传感器执行器，将pH值信号转换成人类可读的输出。以食品级有机分子花青素、香草醛和壳聚糖作为掺杂剂，合成了具有不同颜色、不同形状、不同气味和非气味状态的交换材料。我们评估我们的传感器执行器的各个输出性能评估的速度，范围和变化作为pH 2-10功能的可逆性。我们提出了一个设计空间，用于增强材料基元的功能，并提供控制材料界面的被动和计算方法。最后，我们探讨了有机原语在四种环境下启用的应用程序：环境、化妆品、食用和种间。 article link

88. Flexibles: Deformation-Aware 3D-Printed Tangibles for Capacitive Touchscreens

SESSION:Fabricating New Materials

We introduceFlexibles: 3D-printed flexible tangibles that are deformation-aware and operate on capacitive touchscreens. Flexibles add expressive deformation input to interaction with on-screen tangibles. Based on different types of deformation mapping, we contribute a set of 3D-printable mechanisms that capture pressing, squeezing, and bending input with multiple levels of intensities. They can be integrated into 3D printed objects with custom geometries and on different locations. A Flexible is printed in a single pass on a consumer-level 3D printer without requiring further assembly. Through a series of interactive prototypes, example applications and a technical evaluation, we show the technical feasibility and the wide applicability of Flexibles.

> 我们introduceflexibles：3D打印灵活的有形资产，是变形的感知和对电容式触摸屏操作。柔性加表现变形输入与屏幕上的有形互动。基于不同类型的变形映射，我们提供了一套3D打印机制，捕捉按压，挤压和弯曲输入与多个级别的强度。它们可以被集成到具有定制几何形状和不同位置的3D打印对象中。在消费者级的3D打印机上，只需在一次传递中打印一个柔性，而无需进一步组装。通过一系列的交互原型，应用实例和技术评估，我们展示的技术可行性和软包装的广泛适用性。 article link

89. Towards Personality-driven Persuasive Health Games and Gamified Systems

SESSION:Motivation in Games

Persuasive games and gamified systems are effective tools for motivating behavior change using various persuasive strategies. Research has shown that tailoring these systems can increase their efficacy. However, there is little knowledge on how game-based persuasive systems can be tailored to individuals of various personality traits. To advance research in this area, we conducted a large-scale study of 660 participants to investigate how different personalities respond to various persuasive strategies that are used in persuasive health games and gamified systems. Our results reveal that people's personality traits play a significant role in the perceived persuasiveness of different strategies. Conscientious people tend to be motivated bygoal setting, simulation, self-monitoring and feedback; people who are more open to experience are more likely to be demotivated byrewards, competition, comparison, andcooperation. We contribute to the CHI community by offering design guidelines for tailoring persuasive games and gamified designs to a particular group of personalities.

> 有说服力的游戏和游戏化系统是激励行为的变化采用不同的说服策略的有效工具。研究表明，剪裁这些系统可以提高它们的功效。然而，关于基于游戏的说服系统如何适应不同个性特征的个体，却知之甚少。在这一领域的研究进展，我们进行了一次大规模的660名参与者研究探讨不同性格的人应对各种有说服力的策略，进行有说服力的健康游戏和游戏化系统。我们的研究结果表明，人的人格特质在不同策略的说服力起着重要的作用。有责任心的人往往是出于bygoal设置、仿真、监控与反馈；人更开放的经验更可能是消极的byrewards、竞争、比较、合作。我们有助于池社区通过提供有说服力的游戏和游戏化的剪裁设计一组特定的个性设计指南。 article link

90. Is Difficulty Overrated?: The Effects of Choice, Novelty and Suspense on Intrinsic Motivation in Educational Games

SESSION:Motivation in Games

Many game designers aim to optimize difficulty to make games that are "not too hard, not too easy." However, recent experiments have shown that even moderate difficulty can reduce player engagement. The present work investigates other design factors that may account for the purported benefits of difficulty, such as choice, novelty and suspense. These factors were manipulated in three design experiments involving over 20,000 play sessions of an online educational game.The first experiment (n=10,472) randomly assigned some players to a particular level of difficulty but allowed other players to freely choose their difficulty. Moderately difficult levels were most motivating when self-selected; yet, when difficulty was blindly assigned, the easiest games were most motivating. The second experiment (n=5,065) randomly assigned players to differing degrees of novelty. Moderate novelty was optimal, while too much or too little novelty reduced intrinsic motivation. A final experiment (n=6,511) investigated the role of suspense in "close games", where it was found to be beneficial. If difficulty decreases motivation while novelty and suspense increase it, then an implication for educational game designers is to make easy, interesting

games that are "not too hard, not too boring."

> 许多游戏设计者致力于优化难度，使游戏“不太难，也不太容易”。然而，最近的实验表明，即使是中等难度也可以减少玩家的参与。目前的工作调查其他设计因素，可能占的好处，如选择的困难，新奇和悬念。这些因素在三个设计实验中被操纵，涉及在线教育游戏的超过20000个播放阶段。第一个实验（N＝10472）随机分配一些玩家到特定的难度级别，但允许其他玩家自由选择他们的困难。中等难度的水平在自我选择时最能激励人；然而，当困难被盲目分配时，最简单的游戏最能激发人的积极性。第二个实验（N = 5065）随机分配玩家不同程度的新奇。适度新奇是最佳的，而过多或过少则会降低内在动机。最后一个实验（N = 6511）调查了悬念在“亲密游戏”中的作用，在那里它被认为是有益的。如果困难减少了积极性，而新奇和悬念增加了它，那么教育游戏设计者的一个暗示就是制作简单、有趣的游戏，“不太难，也不太无聊”。 article link

91. Why is This Happening to Me?: How Player Attribution can Broaden our Understanding of Player Experience

SESSION:Motivation in Games

Games user research (GUR) measures the performance and preference of digital game players, and interprets these measurements in the context of theories that explain human behavior. There are many validated approaches for measuring player experience that are grounded in psychological theories on motivation and emotion. Attribution theory explains how people assign causes to events and how these attributions affect peoples' emotional reactions and motivations. In this paper we argue that attribution theory can provide additional value to the existing suite of GUR tools; however, there are currently no validated tools to assess player attribution in the context of games. This paper describes the conceptualization of player attribution based on literature, presents the development and validation of a scale to assess player attribution in games, and discusses the implications of adding player attribution to the toolbox of methods for the design and evaluation of digital games.

> 游戏用户研究（GUR）措施和数字游戏玩家偏好的表现，并解释这些测量在理论解释人类行为的语境。基于动机和情绪的心理学理论，有许多行之有效的测量运动员经验的方法。归因理论解释了人们如何将事件归因于事件，以及这些归因是如何影响人们的情绪反应和动机的。在本文中，我们认为，归因理论可以对古尔工具现有套房提供额外的价值；然而，目前没有有效的工具来评估球员属性在游戏中。本文介绍了基于球员归属文学的概念，给出了一个量表的发展与验证评估球员属性在游戏中，并讨论了添加播放器归因方法的工具箱和数字游戏设计评价的意义。 article link

92. Keeping Users Engaged through Feature Updates: A Long-Term Study of Using Wearable-Based Exergames

SESSION:Motivation in Games

Gamification and exergames in particular have been broadly employed in health and fitness as an attempt to promote exercise and more active life styles. Motivated by popularity and availability of wearable activity trackers, we present the design and findings of a study on the motivational effects of using activity tracker-based games to promote daily exercise. Furthermore, we have investigated user behaviors, usage patterns, engagement, and parameters that affect them. An exergame was developed with an accompanying wearable device, for which different variations of application updates were pushed out periodically over a 70-day period. The results of this long-term study show that the usage of wearable activity trackers during exercise, even when gamified for increased entertainment, sees a consistent decline over time. This decline, however, is observed to be reversible with periodic updates to the game. This work, we believe, can make a significant contribution to solving the user retention problem of wearable-based exergames.

> 特别是游戏化和exergames已广泛应用于医疗和健康促进运动的尝试和更积极的生活方式。基于可穿戴活动追踪器的普及性和可用性，我们提出了使用基于活动跟踪器的游戏促进日常锻炼的动机效果的设计和研究结果。此外，我们调查了用户行为、使用模式、参与和影响它们的参数。一是伴随exergame可穿戴设备开发的，而应用程序更新的不同变化，定期推出超过70天的期限。这项长期研究的结果表明，在运动过程中的可穿戴活动追踪器的使用，即使游戏化增加娱乐，看到一个一致的下降时间。然而，这种下降被认为是可逆的，定期更新的游戏。这项工作，我们相信，可以解决可穿戴型exergames用户保留问题的重要贡献。 article link

93. Supporting the Self-Management of Chronic Pain Conditions with Tailored Momentary Self-Assessments

SESSION:Self-Monitored Healthcare

To better support the self-management of chronic pain, this paper investigates how those living with the condition prefer to self-assess their pain levels using smartphones. Our work consists of three stages: design ideation and review, an in-lab user study with 10 participants resulting in nine candidate interfaces, and a 3 week field trial of two further honed measures with 12 participants. This research firstly yields a better understanding of participants' strong and sometimes contrasting preferences regarding their self-assessment of pain intensity. We additionally contribute two novel interfaces that support accurate, quick, and repeated use along with other participant-valued interactions (e.g., familiar, relatable, and highly usable). In particular, we focus on designing tailored measures that both enhance respondent motivation as well as minimize the difficulty of meaningful self-assessment by supporting the cognitive effort in translating a subjective experience into a single numerical value.

> 为了更好地支持慢性疼痛的自我管理，本文研究了如何使用智能手机进行自我评估。我们的工作包括三个阶段：设计构思和复习，一个实验室用户研究，10个参与者产生九个候选界面，3个为期两周的现场试验，两个进一步的训练措施，有12个参与者。这项研究首先能更好地了解参与者对疼痛强度自我评估的强烈和有时相反的偏好。我们还贡献了两个新的接口，支持快速、准确、重复使用以及其他参与者的价值的相互作用（例如，熟悉的，可靠的，高度可用的）。特别是，我们专注于设计量身定制的措施，既提高了答辩动机，并尽量减少困难的有意义的自我评估，支持认知努力在一个单一的数值转化成一个单一的数值。 article link

94. Supporting Self-Care of Adolescents with Nut Allergy Through Video and Mobile Educational Tools

SESSION:Self-Monitored Healthcare

Anaphylaxis is a life-threatening allergic reaction which is rapid in onset. Adolescents living with anaphylaxis risk often lack the knowledge and skills required to safely manage their condition or talk to friends about it. We designed an educational intervention comprising group discussion around videos of simulated anaphylaxis scenarios and a mobile application containing video-based branching anaphylaxis narratives. We trialed the intervention with 36 nut allergic adolescents. At 1-year follow-up participants had improved adrenaline auto-injector skills and carriage, disease- and age-specific Quality of Life and confidence in anaphylaxis management. At 3-year follow-up adrenaline carriage improved further and confidence remained higher. Participants expressed how the education session was a turning point in taking control of their allergy and how the app facilitated sharing about anaphylaxis with others. We contribute insights regarding design of mobile self-care and peer-support applications for health in adolescence, and discuss strengths and limitations of video-based mobile health interventions.

> 过敏反应是一种危及生命的过敏反应，发病迅速。患有过敏性疾病的青少年往往缺乏安全管理病情或与朋友交谈的知识和技能。我们设计了一个教育干预，包括围绕模拟过敏反应场景的视频进行分组讨论，以及一个包含基于视频的分支过敏性叙述的移动应用程序。我们进行干预36坚果过敏的青少年。在一年的随访参与者提高肾上腺素自动注射器，

> 技能和马车，疾病和生活质量管理信心年龄过敏。在3年随访中，肾上腺素转运进一步改善，信心保持较高。与会者表示，教育会议是控制过敏的一个转折点，以及应用程序如何促进与他人分享过敏反应。我们提供了关于移动自我保健和同行支持应用在青春期健康的见解，并讨论了基于视频的移动健康干预的优势和局限性。 article link

95. AVUI: Designing a Toolkit for Audiovisual Interfaces

SESSION:Toolkits and UIs

The combined use of sound and image has a rich history, from audiovisual artworks to research exploring the potential of data visualization and sonification. However, we lack standard tools or guidelines for audiovisual (AV) interaction design, particularly for live performance. We propose the AVUI (AudioVisual User Interface), where sound and image are used together in a cohesive way in the interface; and an enabling technology, the ofxAVUI toolkit. AVUI guidelines and ofxAVUI were developed in a three-stage process, together with AV producers: 1) participatory design activities; 2) prototype development; 3) encapsulation of prototype as a plug-in, evaluation, and roll out. Best practices identified include: reconfigurable interfaces and mappings; object-oriented packaging of AV and UI; diverse sound visualization; flexible media manipulation and management. The toolkit and a mobile app developed using it have been released as open-source. Guidelines and toolkit demonstrate the potential of AVUI and offer designers a convenient framework for AV interaction design.

> 声音和图像的结合使用有丰富的历史，从视听艺术，研究探索数据可视化、可听化的潜力。然而，我们缺乏视听交互设计的标准工具或指导方针，尤其是现场表演。我们提出的avui（视听用户界面），在声音和图像一起使用的一种衔接方式的接口；和一个有利的技术，这ofxavui工具包。avui指南和ofxavui过程分为三个阶段进行开发，结合AV生产：1）参与设计活动；2）原型系统的开发；3）封装的原型作为一个插件，评价，并推出。确定的最佳实践包括：可重构接口和映射；面向对象的AV和UI打包；不同的声音可视化；灵活的媒体操作和管理。使用它开发的工具包和移动应用程序已经作为开源发布了。指南和工具展示avui潜力，为设计人员提供一个方便的框架设计影音互动。 article link

96. Suggesting API Usage to Novice Programmers with the Example Guru

SESSION:Toolkits and UIs

Programmers, especially novices, often have difficulty learning new APIs (Application Programming Interfaces). Existing research has not fully addressed novice programmers' unawareness of all available API methods. To help novices discover new and appropriate uses for API methods, we designed a system called the Example Guru. The Example Guru suggests context-relevant API methods based on each programmer's code. The suggestions provide contrasting examples to demonstrate how to use the API methods. To evaluate the effectiveness of the Example Guru, we ran a study comparing novice programmers' use of the Example Guru and documentation-inspired API information. We found that twice as many participants accessed the Example Guru suggestions compared to documentation and that participants used more than twice as many new API methods after accessing suggestions than documentation.

> 程序员，尤其是新手，常常很难学习新的API（应用程序编程接口）。现有的研究尚未完全解决新手程序员没有所有可用的API方法。为了帮助新手发现API方法的新的和适当的用途，我们设计了一个称为范例大师的系统。示例大师根据每个程序员的代码建议与上下文相关的API方法。这些建议提供了对比的例子来演示如何使用API方法。为了评估示例大师的有效性，我们进行了一项研究，比较新手程序员使用范例大师和文档启发的API信息。我们发现，与文档相比，有两倍的参与者访问了范例大师的建议，参与者在获得建议后使用了超过两倍的新API方法，而不是文档。 article link

97. Toward Everyday Gaze Input: Accuracy and Precision of Eye Tracking and Implications for Design

SESSION:Toolkits and UIs

For eye tracking to become a ubiquitous part of our everyday interaction with computers, we first need to understand its limitations outside rigorously controlled labs, and develop robust applications that can be used by a broad range of users and in various environments. Toward this end, we collected eye tracking data from 80 people in a calibration-style task, using two different trackers in two lighting conditions. We found that accuracy and precision can vary between users and targets more than six-fold, and report on differences between lighting, trackers, and screen regions. We show how such data can be used to determine appropriate target sizes and to optimize the parameters of commonly used filters. We conclude with design recommendations and examples how our findings and methodology can inform the design of error-aware adaptive applications.

> 为了使眼球跟踪成为我们日常与计算机交互的一个普遍部分，我们首先需要了解严格控制的实验室之外的局限性，并开发健壮的应用程序，以便广泛的用户和各种环境中使用。为此，我们收集了80人在校准样式任务中的眼动跟踪数据，在两种照明条件下使用两种不同的跟踪器。我们发现，用户和目标之间的精度和精确度可以相差六倍以上，并报告照明、跟踪器和屏幕区域之间的差异。我们展示了如何利用这些数据来确定合适的目标尺寸和优化常用滤波器的参数。我们的结论与设计建议和例子，我们的研究结果和方法可以告知设计的错误感知的自适应应用程序。 article link

98. Heat-Nav: Using Temperature Changes as Navigation Cues

SESSION:Toolkits and UIs

HCI is increasingly exploring how temperature can be used as an interaction modality. One challenge is that temperature changes are perceived over the course of seconds. This can be attributed to both the slow response time of skin thermoreceptors and the latency of the technology used to heat and cool the skin. For this reason, thermal cues are typically used to communicate single states, such as an emotion, and then there is a pause of tens of seconds to allow the skin to re-adapt to a neutral temperature before sending another signal. In contrast, this paper presents the first experimental demonstration that continuous temperature changes can guide behaviour: significantly improving performance in a 2D maze navigation task, without having to return to a neutral state before a new signal is sent. We discuss how continuous thermal feedback may be used for real world navigational tasks.

> HCI正在越来越多地探索温度如何作为交互方式使用。一个挑战是温度变化在几秒钟内被感知。这可以归因于缓慢的响应时间和皮肤温度感受器的技术延迟用于加热和冷却的皮肤。由于这个原因，热信号通常被用来传达单个状态，例如情感，然后暂停几十秒，让皮肤在发出另一个信号之前重新适应中性温度。与此相反，本文提出了第一个实验证明，连续的温度变化可以指导行为：在2D迷宫导航任务中显著提高性能，而不需要在发送新信号之前返回中立状态。我们将讨论如何连续热反馈可用于现实世界的导航任务。 article link

99. CodePilot: Scaffolding End-to-End Collaborative Software Development for Novice Programmers

SESSION:Toolkits and UIs

Novice programmers often have trouble installing, configuring, and managing disparate tools (e.g., version control systems, testing infrastructure, bug trackers) that are required to become productive in a modern collaborative software development environment. To lower the barriers to entry into software development, we created a prototype IDE for novices called CodePilot, which is, to our knowledge, the first attempt to integrate coding, testing, bug reporting, and version control management into a real-time collaborative system. CodePilot enables multiple users to connect to a web-based programming session and work together on several major phases of software development. An eight-subject exploratory user study found that first-time users of CodePilot spontaneously used it to assume roles such as developer/tester and developer/assistant when creating a web application together in pairs. Users felt that CodePilot could aid in scaffolding for novices, situational awareness, and lowering barriers to impromptu collaboration.

> 新手程序员在安装、配置和管理不同的工具（例如，版本控制系统、测试基础结构、bug跟踪程序）时，往往难以在现代协作软件开发环境中变得高效。较低的进入到软件开发的障碍，我们创建了一个叫做codepilot新手，原型IDE是，据我们所知，第一次尝试统一编码，测试，报告bug，和版本控制管理成为一个实时协同系统。codepilot允许多个用户连接到一个网络编程会话和工作在软件开发中的几个主要阶段。八主体的探索性的用户研究发现，codepilot自发地用它来承担的角色，如开发/测试人员和开发人员/助理当创建一个Web应用结合在一起，对初次使用的用户。用户认为codepilot可以帮助脚手架的新手，态势感知，并降低即兴合作的障碍。 article link

100. Crowdsourcing GO: Effect of Worker Situation on Mobile Crowdsourcing Performance

SESSION:Uniqueness of Geographic Information

The increasing popularity of mobile crowdsourcing platforms has enabled crowd workers to accept jobs wherever/whenever they are, and also provides opportunity for task requesters to order time/location specific tasks to workers. Since workers on mobile platforms are working on the go, the situation of the workers is expected to influence their performance. However, the effects of mobile worker situations to task performance is an uninvestigated area. In this paper, our research question is, "do worker situations affect task completion, price and quality on mobile crowdsourcing platforms?" We draw on economics and psychology research to examine whether worker situations such as busyness, fatigue and presence of companions affect their performance. Our three-week between-subjects field experiment revealed that worker busyness caused 30.1% relative decrease of task completion rate. Mean accepted task price increased by 7.6% when workers are with companions. Worker fatigue caused 37.4% relative decrease of task quality.

> 移动众包平台的日益普及，使得人群工人接受工作的地方/时，还提供了对任务请求订购时间/地点的具体任务的工人的机会。由于移动平台上的工人正在进行工作，预计工人的情况会影响他们的工作。然而，移动工作者的情况下，任务绩效的影响是一个未经调查的地区。在本文中，我们的研究问题是，“工人的情况是否影响任务完成，价格和质量在移动众包平台？”我们从经济学和心理学的研究探讨工作情况如忙碌，同伴的疲劳和存在影响其性能。我们三周的学科领域之间透露，工人忙碌实验造成了30.1%的任务完成率相对降低。平均接受任务价格增加7.6%时，工人与同伴。工人疲劳导致任务质量下降37.4%。 article link

101. Understanding "Death by GPS": A Systematic Study of Catastrophic Incidents Associated with Personal Navigation Technologies

SESSION:Uniqueness of Geographic Information

Catastrophic incidents associated with GPS devices and other personal navigation technologies are sufficiently common that these incidents have been given a colloquial nickname: "Death by GPS". While there is a significant body of work on the use of personal navigation technologies in everyday scenarios, no research has examined these technologies' roles in catastrophic incidents. In this paper, we seek to address this gap in the literature. Borrowing techniques from public health research and communication studies, we construct a corpus of 158 detailed news reports of unique catastrophic incidents associated with personal navigation technologies. We then identify key themes in these incidents and the roles that navigation technologies played in them, e.g. missing road characteristics data contributed to over 25% of these incidents. With the goal of reducing casualties associated with personal navigation technologies, we outline implications for design and research that emerge from our results, e.g. advancing "space usage rule" mapping, incorporating weather information in routing, and improving visual and audio instructions in complex situations.

> 与GPS设备和其他个人导航技术相关的灾难性事件是相当普遍的，这些事件被赋予了一个口语化的绰号：“GPS死亡”。虽然在日常场景中使用个人导航技术的工作非常重要，但没有研究探讨这些技术在灾难性事件中的作用。在本文中，我们试图解决文献中的这一空白。借用公共卫生研究和传播学的研究方法，构建了158个与个人导航技术相关的独特灾难事件的详细新闻报道。然后，我们确定了这些事件中的关键主题，以及导航技术在其中发挥的作用，例如丢失了25%以上这些事件的道路特征数据。以减少人员伤亡和个人导航技术相关的目标，我们的大纲设计和研究结果出现的影响，如推进“空间使用规则”的映射，在路由将天气信息，提高在复杂情况下的视觉和音频指令。 article link

102. The Effect of Population and "Structural" Biases on Social Media-based Algorithms: A Case Study in Geolocation Inference Across the Urban-Rural Spectrum

SESSION:Uniqueness of Geographic Information

Much research has shown that social media platforms have substantial population biases. However, very little is known about how these population biases affect the many algorithms that rely on social media data. Focusing on the case study of geolocation inference algorithms and their performance across the urban-rural spectrum, we establish that these algorithms exhibit significantly worse performance for underrepresented populations (i.e. rural users). We further establish that this finding is robust across both text- and network-based algorithm designs. However, we also show that some of this bias can be attributed to the design of algorithms themselves rather than population biases in the underlying data sources. For instance, in some cases, algorithms perform badly for rural users even when we substantially overcorrect for population biases by training exclusively on rural data. We discuss the implications of our findings for the design and study of social media-based algorithms.

> 许多研究表明，社交媒体平台存在大量的人口偏见。然而，对于这些人口偏见如何影响依赖于社会媒体数据的许多算法，人们知之甚少。针对地理推理算法及其性能在城乡谱的案例研究，我们建立了这些算法表现出显着恶化表现为弱势族群（即农村用户）。我们进一步证实，这一发现在基于文本和基于网络的算法设计中都是健壮的。然而，我们还表明，这种偏差可能归因于算法本身的设计，而不是底层数据源中的人口偏差。例如，在某些情况下，算法执行好农村用户即使我们基本上矫枉过正的人口通过培训专门对农村数据偏差。我们讨论了我们的发现对社会媒体算法的设计和研究的影响。 article link

103. The Geography of Pokémon GO: Beneficial and Problematic Effects on Places and Movement

SESSION:Uniqueness of Geographic Information

The widespread popularity of Pokémon GO presents the first opportunity to observe the geographic effects of location-based gaming at scale. This paper reports the results of a mixed methods study of the geography of Pokémon GO that includes a five-country field survey of 375 Pokémon GO players and a large scale geostatistical analysis of game

elements. Focusing on the key geographic themes of places and movement, we find that the design of Pokémon GO reinforces existing geographically-linked biases (e.g. the game advantages urban areas and neighborhoods with smaller minority populations), that Pokémon GO may have instigated a relatively rare large-scale shift in global human mobility patterns, and that Pokémon GO has geographically-linked safety risks, but not those typically emphasized by the media. Our results point to geographic design implications for future systems in this space such as a means through which the geographic biases present in Pokémon GO may be counteracted.

> 博爱éMon的广泛普及去了大规模的观察位置游戏的地理效应的第一个机会。本文报道了一种混合方法研究é博爱周一去地理，包括375个博爱éMon五国实地调查去玩家和游戏元素的大型统计分析结果。重点场所和运动的关键地理主题，我们发现博爱éMon去设计加强了现有的地理上的偏见（例如游戏的优势和城市地区与少数群体的社区），é，博爱周一去可能煽动全球人类移动模式相对罕见的大规模转移，而博爱é我去了地理上的安全风险，而不是由媒体通常会强调。我们的结果指出地理设计对未来的系统在这个空间如通过é孟目前在巴控克什米尔地域偏见去可能会抵消。 article link

104. Empirical Analysis of the Subjective Impressions and Objective Measures of Domain Scientists' Visual Analytic Judgments

SESSION:Visual Perception based Decisions

Scientists often use specific data analysis and presentation methods familiar within their domain. But does high familiarity drive better analytical judgment? This question is especially relevant when familiar methods themselves can have shortcomings: many visualizations used conventionally for scientific data analysis and presentation do not follow established best practices. This necessitates new methods that might be unfamiliar yet prove to be more effective. But there is little empirical understanding of the relationships between scientists' subjective impressions about familiar and unfamiliar visualizations and objective measures of their visual analytic judgments. To address this gap and to study these factors, we focus on visualizations used for comparison of climate model performance. We report on a comprehensive survey-based user study with 47 climate scientists and present an analysis of: i) relationships among scientists' familiarity, their perceived levels of comfort, confidence, accuracy, and objective measures of accuracy, and ii) relationships among domain experience, visualization familiarity, and post-study preference.

> 科学家们经常使用他们领域内熟悉的数据分析和表示方法。但是高度的熟悉是否会导致更好的分析判断？当熟悉的方法本身也有缺点时，这个问题尤其相关：传统上用于科学数据分析和演示的许多可视化并不遵循既定的最佳实践。这就需要新的方法，可能是陌生的，但被证明是更有效的。但是对于科学家对熟悉的和不熟悉的形象的主观印象和他们的视觉分析判断的客观度量之间的关系的经验了解很少。为了解决这一差距，并研究这些因素，我们着重于用于比较气候模型性能的可视化。我们报告一个47气候科学家基于用户研究的综合调查和现状分析：我）科学家的熟悉度之间的关系，他们的认知水平的安慰，信心，准确性和精度的客观的措施，和II）之间关系的可视化领域的经验，熟悉和学习后的偏好。 article link

105. A Cognitive Model of How People Make Decisions Through Interaction with Visual Displays

SESSION:Visual Perception based Decisions

In this paper we report a cognitive model of how people make decisions through interaction. The model is based on the assumption that interaction for decision making is an example of a Partially Observable Markov Decision Process (POMDP) in which observations are made by limited perceptual systems that model human foveated vision and decisions are made by strategies that are adapted to the task. We illustrate the model by applying it to the task of determining whether to block a credit card given a number of variables including the location of a transaction, its amount, and the customer history. Each of these variables have a different validity and users may weight them accordingly. The model solves the POMDP by learning patterns of eye movements (strategies) adapted to different presentations of the data. We compare the model behavior to human performance on the credit card transaction task.

> 在本文中，我们报告了人们如何通过交互决策的认知模型。该模型是基于假设的决策互动是一部分Observable Markov的决策过程的一个例子（POMDP）在观测是由有限的感知系统模仿人类视网膜中央凹视觉和决策是由适应任务策略作出。我们通过将它应用于确定是否阻止信用卡的任务，给出了一系列的变量，包括交易的地点、金额和客户历史。这些变量各有一个不同的有效性，用户可以相应地对它们进行加权。该模型通过学习眼动模式解决POMDP（策略）适应不同的数据报告。在信用卡交易任务中，我们将模型行为与人的表现进行了比较。 article link

106. Building with Data: Architectural Models as Inspiration for Data Physicalization

SESSION:Visual Perception based Decisions

In this paper we analyze the role of physical scale models in the architectural design process and apply insights from architecture for the creation and use of data physicalizations. Based on a survey of the architecture literature on model making and ten interviews with practicing architects, we describe the role of physical models as a tool for exploration and communication. From these observations, we identify trends in the use of physical models in architecture, which have the potential to inform the design of data physicalizations. We identify four functions of architectural modeling that can be directly adapted for use in the process of building rich data models. Finally, we discuss how the visualization community can apply observations from architecture to the design of new data physicalizations.

> 本文分析了物理模型在建筑设计过程中的作用和应用的见解从架构创建和使用数据physicalizations。通过对建筑模型文献的调查和对建筑师的十次访谈，我们描述了物理模型作为探索和交流工具的作用。从这些观察中，我们发现在建筑物理模型的使用趋势，已通知数据physicalizations设计潜力。我们确定了建筑建模的四个功能，这些功能可以直接用于构建丰富数据模型的过程中。最后，我们将讨论如何可视化社区可以观察从建筑到新的数据physicalizations设计。 article link

107. Variolite: Supporting Exploratory Programming by Data Scientists

SESSION:All about Data

How do people ideate through code? Using semi-structured interviews and a survey, we studied data scientists who program, often with small scripts, to experiment with data. These studies show that data scientists frequently code new analysis ideas by building off of their code from a previous idea. They often rely on informal versioning interactions like copying code, keeping unused code, and commenting out code to repurpose older analysis code while attempting to keep those older analyses intact. Unlike conventional version control, these informal practices allow for fast versioning of any size code snippet, and quick comparisons by interchanging which versions are run. However, data scientists must maintain a strong mental map of their code in order to distinguish versions, leading to errors and confusion. We explore the needs for improving version control tools for exploratory tasks, and demonstrate a tool for lightweight local versioning, called Variolite, which programmers found usable and desirable in a preliminary usability study.

> 人们是如何想到通过代码？通过半结构化访谈和一项调查，我们研究了数据科学家，他们经常用小脚本来实验数据。这些研究表明，数据科学家经常通过从先前的想法中提取代

> 码来编码新的分析思想。他们往往依赖于非正式版本的互动就像复制代码，保持未使用的代码，在代码重新利用旧分析代码在试图保持较完整的分析。不同于传统的版本控制，这些非正式的做法，允许快速的版本的任何大小的代码片段，并通过互换，快速比较版本运行。然而，数据科学家必须保持他们的代码的强大的心理图谱，以区分版本，导致错误和混乱。我们探索的需要版本控制工具改进的探索任务，并展示了一个工具，轻量级的本地版本，称为球粒玄武岩，程序员发现了初步的可用性研究可用可取。 article link

108. The Trials and Tribulations of Working with Structured Data: -a Study on Information Seeking Behaviour

SESSION:All about Data

Structured data such as databases, spreadsheets and web tables is becoming critical in every domain and professional role. Yet we still do not know much about how people interact with it. Our research focuses on the information seeking behaviour of people looking for new sources of structured data online, including the task context in which the data will be used, data search, and the identification of relevant datasets from a set of possible candidates. We present a mixed-methods study covering in-depth interviews with 20 participants with various professional backgrounds, supported by the analysis of search logs of a large data portal. Based on this study, we propose a framework for human structured-data interaction and discuss challenges people encounter when trying to find and assess data that helps their daily work. We provide design recommendations for data publishers and developers of online data platforms such as data catalogs and marketplaces. These recommendations highlight important questions for HCI research to improve how people engage and make use of this incredibly useful online resource.

> 结构化数据（如数据库、电子表格和Web表）在每一个领域和专业角色中都变得至关重要。然而，我们仍然不太了解人们是如何与之互动的。我们的研究主要集中在寻找新的结构化数据来源的人的信息查寻行为，包括使用数据的任务上下文，数据搜索，以及从一组可能的候选者中识别相关的数据集。我们提出了一个混合方法研究，涵盖了深入访谈20名不同专业背景的参与者，支持的搜索日志的大型数据门户的分析。基于这项研究，我们提出了一个人类结构化数据交互的框架，并讨论了人们在寻找和评估帮助日常工作的数据时遇到的挑战。我们为在线数据平台（如数据目录和市场）的数据发布者和开发人员提供设计建议。这些建议强调HCI研究的重要问题，以改进人们如何使用和使用这种非常有用的在线资源。 article link

109. Same Stats, Different Graphs: Generating Datasets with Varied Appearance and Identical Statistics through Simulated Annealing

SESSION:All about Data

Datasets which are identical over a number of statistical properties, yet produce dissimilar graphs, are frequently used to illustrate the importance of graphical representations when exploring data. This paper presents a novel method for generating such datasets, along with several examples. Our technique varies from previous approaches in that new datasets are iteratively generated from a seed dataset through random perturbations of individual data points, and can be directed towards a desired outcome through a simulated annealing optimization strategy. Our method has the benefit of being agnostic to the particular statistical properties that are to remain constant between the datasets, and allows for control over the graphical appearance of resulting output.

> 数据集与许多统计属性相同，但却产生不同的图形，经常用来说明图形表示在探索数据时的重要性。本文提出了一种产生这种数据集的新方法，并给出了几个例子。我们的技术不同于以往的方法，新的数据集是迭代产生的种子数据集，通过随机扰动的单个数据点，并可以通过模拟退火优化策略，以达到预期的结果。我们的方法有一个好处，就是不依赖于数据集之间保持不变的特定统计属性，并允许对结果输出的图形外观进行控制。 article link

110. Inferring Cognitive Models from Data using Approximate Bayesian Computation

SESSION:All about Data

An important problem for HCI researchers is to estimate the parameter values of a cognitive model from behavioral data. This is a difficult problem, because of the substantial complexity and variety in human behavioral strategies. We report an investigation into a new approach using approximate Bayesian computation (ABC) to condition model parameters to data and prior knowledge. As the case study we examine menu interaction, where we have click time data only to infer a cognitive model that implements a search behaviour with parameters such as fixation duration and recall probability. Our results demonstrate that ABC (i) improves estimates of model parameter values, (ii) enables meaningful comparisons between model variants, and (iii) supports fitting models to individual users. ABC provides ample opportunities for theoretical HCI research by allowing principled inference of model parameter values and their uncertainty.

> HCI研究人员的一个重要问题是从行为数据中估计认知模型的参数值。这是一个困难的问题，因为人类行为策略的复杂性和多样性。我们报告一个新的方法，使用近似贝叶斯计算（ABC）的条件模型参数的数据和先验知识的调查。作为案例研究，我们研究菜单交互，在这里我们点击时间数据只推断一个认知模型，实现搜索行为的参数，如固定时间和召回概率。我们的研究结果表明，abc（I）改进模型参数值的估计，（ii）使模型变量之间有意义的比较，和（iii）支持个别用户拟合模型。ABC允许模型参数值的原则推断及其不确定性，为理论HCI研究提供了充足的机会。 article link

111. Effects of Frequency Distribution on Linear Menu Performance

SESSION:All about Data

While it is well known that menu usage follows a Zipfian distribution, there has been little interest in the impact of menu item frequency distribution on user's behavior. In this note, we explore the effects of frequency distribution on average menu performance as well as individual item performance. We compare three frequency distributions of menu item usage: Uniform; Zipfian with s=1 and Zipfian with s=2. The results show that (1) user's behavior is sensitive to different frequency distributions at both menu and item level; (2) individual item selection time depends on, not only its frequency, but also the frequency of other items in the menu. Finally, we discuss how these findings might have impacts on menu design, empirical studies and menu modeling.

> 而众所周知，菜单使用如下一个Zipfian分布，有菜单项的频率分布对用户行为的影响已经不感兴趣。在这篇文章中，我们探讨了频率分布对平均菜单性能和单项性能的影响。我们比较了菜单项的使用频率分布均匀；三：Zipfian与S = 1，S = 2 Zipfian。结果表明：（1）用户的行为对菜单和项目层次上的不同频率分布是敏感的；（2）单项选择时间不仅取决于它的频率，而且取决于菜单中其他项的频率。最后，我们将讨论这些研究结果对菜单设计、实证研究和菜单建模的影响。 article link

112. DemYouth: Co-Designing and Enacting Tools to Support Young People's Engagement with People with Dementia

SESSION:Design and Cognitive Impairment

There is a growing body of research examining the role of technology in supporting the care of--and relationships surrounding--people with dementia, yet little attention has been given to how this relates to younger family members. We conducted a qualitative study based on a series of 6 co-design workshops conducted with 14 young people who had personal experience with dementia. Initially, our workshops focused on understanding the difficulties that young people face when engaging, interacting and being with people with dementia. Initial analysis of workshop data informed the design of three digital tool concepts that were used as the basis for user enactment workshops. Our findings highlight the young people's desire to be more involved in their family discussions around dementia and a need for them to find new ways to connect with their loved ones with dementia. We offer a set of design considerations for future systems that support these needs and reflect on some of the complexities we faced around engaging young people in this difficult topic of discussion.

> 越来越多的研究探讨了技术在支持痴呆症患者的照顾和关系方面的作用，但很少注意到这与年轻的家庭成员有何关系。我们进行了一系列定性研究，其中有6个与14名有痴呆经历的年轻人进行的合作设计研讨会。最初，我们的工作重点是了解年轻人在与老年痴呆症患者接触、交往和相处时所面临的困难。对车间数据的初步分析通知了三个数字工具概念的设计，这些概念被用作用户设定车间的基础。我们的发现强调了年轻人希望更多地参与痴呆症的家庭讨论，并希望他们找到新的方法来与他们的亲人进行痴呆症的联系。我们为未来支持这些需求的系统提供了一套设计考虑，并反映了我们围绕年轻人参与这一艰难讨论议题所面临的一些复杂性。 article link

113. The Value of Experience-Centred Design Approaches in Dementia Research Contexts

SESSION:Design and Cognitive Impairment

Experience-Centred Design (ECD) has been applied in numerous HCI projects to call attention to the particular and dialogical nature of people's experiences with technology. In this paper, we report on ECD within the context of publicly-funded, long-stay residential dementia care, where the approach helped to highlight aspects of participants' felt experience, and informed sensitive and meaningful design responses. This study contributes an extended understanding of the quality of experience and the means of making sense in dementia, as well as unpicking the potential of ECD to support enriched experience and contextual meaning-making for people with dementia. Finally, we delineate what it is about Experience-Centred Design that differentiates the approach from other often-used approaches in designing in dementia contexts: 1) explorative thinking, 2) working within 'cuttings-out of time and space', 3) careful yet expressive methodology and documentation, and 4) working together to imagine futures. We end with considerations of how the contributions of this research may extend to other experience-centred projects in challenging settings.

> 体验为中心的设计（ECD）已被应用于众多HCI项目呼吁关注特定的对话与技术的人的经验性质。在本文中，我们报告了在公共资助的长期住宿痴呆症护理环境下的ECD，该方法有助于突出参与者感受到的方面，并告知敏感和有意义的设计反应。这项研究有助于扩展的理解经验的质量和手段在痴呆的意义，以及将ECD潜在支持的丰富经验和语境意义与老年痴呆症的人。最后，我们描绘出什么是体验为中心的设计方法，区分从其他痴呆症的情境设计经常使用的方法：1）探索性思维，2）工作在扦插的时间和空间，3）仔细而有表现力的方法和文档，和4）一起畅想未来。最后，我们考虑如何将这项研究的贡献扩展到以挑战为中心的其他以经验为中心的项目。 article link

114. Connecting Those That Care: Designing for Transitioning, Talking, Belonging and Escaping

SESSION:Design and Cognitive Impairment

Care provision in many nations increasingly relies on the work of informal, or non-professional, carers. Often these carers experience substantial disruptions and reductions to their own sociality, weakened social support networks and, ultimately, a heightened risk of social isolation. We describe a qualitative study, comprised of interviews, design workshops and probes, that investigated the social and community support practices of carers. Our findings highlight issues related to becoming and recognising being a carer, and feelings of being ignored by, and isolated from, others. We also note the benefits that sharing between carers can bring, and routes to coping and relaxing from the burdens of care. We conclude with design considerations for facilitating new forms of digitally mediated support that connect those that care, emphasising design qualities related to transitioning, talking, belonging and escaping.

> 许多国家的护理服务越来越多地依赖于非正式或非专业护理人员的工作。这些照顾者通常会经历重大的破坏和减少自己的社会性，削弱社会支持网络，并最终增加社会隔离的风险。我们描述了一个定性研究，包括访谈、设计讲习班和调查，调查了照顾者的社会和社区支持做法。我们的研究结果强调成为承认被照顾者相关的问题，和被忽略的感觉，和孤立的，别人。我们还注意到照顾者之间可以分享的好处，以及应付和减轻护理负担的途径。我们的结论是设计考虑促进新形式的数字介导的支持，连接那些关心，强调设计质量有关过渡，谈话，归属和逃避。 article link

115. Designing Game-Based Myoelectric Prosthesis Training

SESSION:Design and Cognitive Impairment

A myoelectric prosthesis (myo) is a dexterous artificial limb controlled by muscle contractions. Learning to use a myo can be challenging, so extensive training is often required to use a myo prosthesis effectively. Signal visualizations and simple muscle-controlled games are currently used to help patients train their muscles, but are boring and frustrating. Furthermore, current training systems require expensive medical equipment and clinician oversight, restricting training to infrequent clinical visits. To address these limitations, we developed a new game that promotes fun and success, and shows the viability of a low-cost myoelectric input device. We adapted a user-centered design (UCD) process to receive feedback from patients, clinicians, and family members as we iteratively addressed challenges to improve our game. Through this work, we introduce a free and open myo training game, provide new information about the design of myo training games, and reflect on an adapted UCD process for the practical iterative development of therapeutic games.

> 肌电假肢是一种由肌肉收缩控制的灵巧假肢。学习使用肌肉可能是具有挑战性的，因此需要有效地使用肌肉假体进行广泛的训练。信号可视化和简单的肌肉控制游戏目前被用来帮助病人训练肌肉，但很无聊和令人沮丧。此外，目前的培训系统需要昂贵的医疗设备和临床医生监督，限制培训，以罕见的临床访问。为了解决这些限制，我们开发了一种新游戏，以促进乐趣和成功，并显示了低成本的肌电输入装置的可行性。我们采用了一个以用户为中心的设计（UCD）过程中接受反馈的患者，临床医生和家庭成员为我们解决的挑战，提高我们的游戏。通过这项工作，我们引入一个自由和开放的肌训练游戏，提供有关肌训练游戏设计新的信息，并反映在改编的UCD过程治疗游戏实际迭代开发。 article link

116. Affective Color in Visualization

SESSION:Evaluating Visual Perceptions

Communicating the right affect, a feeling, experience or emotion, is critical in creating engaging visual communication. We carried out three studies examining how different color properties (lightness, chroma and hue) and different palette properties (combinations and distribution of colors) contribute to different affective interpretations in information

visualization where the numbers of colors is typically smaller than the rich palettes used in design. Our results show how color and palette properties can be manipulated to achieve affective expressiveness even in the small sets of colors used for data encoding in information visualization.

> 传达正确的情感、感觉、经历或情感，是创造吸引人的视觉交流的关键。我们进行了三项研究研究不同的颜色属性（明度、彩度和色调）和不同的调色板（颜色的组合和分布）在信息可视化在颜色的数量比设计中采用的丰富的调色板通常不同的情感诠释的贡献较小。我们的结果表明，颜色和调色板属性如何被操纵，以实现情感表达，即使在小规模的颜色用于信息可视化的数据编码。 article link

117. Explaining the Gap: Visualizing One's Predictions Improves Recall and Comprehension of Data

SESSION:Evaluating Visual Perceptions

Information visualizations use interactivity to enable user-driven querying of visualized data. However, users' interactions with their internal representations, including their expectations about data, are also critical for a visualization to support learning. We present multiple graphically-based techniques for eliciting and incorporating a user's prior knowledge about data into visualization interaction. We use controlled experiments to evaluate how graphically eliciting forms of prior knowledge and presenting feedback on the gap between prior knowledge and the observed data impacts a user's ability to recall and understand the data. We find that participants who are prompted to reflect on their prior knowledge by predicting and self-explaining data outperform a control group in recall and comprehension. These effects persist when participants have moderate or little prior knowledge on the datasets. We discuss how the effects differ based on text versus visual presentations of data. We characterize the design space of graphical prediction and feedback techniques and describe design recommendations.

> 信息可视化使用交互性，使用户能够对可视化数据进行查询。然而，用户与内部表示的交互，包括对数据的期望，对于可视化支持学习也是至关重要的。我们提出了多种图形为基础的技术，引出和合并用户的先验知识，数据可视化交互。我们使用受控实验来评估如何以图形方式提取先前知识的形式，并对先前知识和观测数据之间的差距提出反馈，从而影响用户对数据的回忆和理解能力。我们发现，受试者通过预测和自我解释的数据来反思他们先前的知识，在回忆和理解上优于对照组。当参与者对数据集有中度或很少的先验知识时，这些效应仍然存在。我们将讨论基于文本和视觉呈现数据的效果如何不同。我们描述了图形预测和反馈技术的设计空间，并描述了设计建议。 article link

118. Regression by Eye: Estimating Trends in Bivariate Visualizations

SESSION:Evaluating Visual Perceptions

Observing trends and predicting future values are common tasks for viewers of bivariate data visualizations. As many charts do not explicitly include trend lines or related statistical summaries, viewers often visually estimate trends directly from a plot. How reliable are the inferences viewers draw when performing suchregression by eye? Do particular visualization designs or data features bias trend perception? We present a series of crowdsourced experiments that assess the accuracy of trends estimated using regression by eye across a variety of bivariate visualizations, and examine potential sources of bias in these estimations. We find that viewers accurately estimate trends in many standard visualizations of bivariate data, but that both visual features (e.g., "within-the-bar" bias) and data features (e.g., the presence of outliers) can result in visual estimates that systematically diverge from standard least-squares regression models.

> 观察趋势和预测未来值是二元数据可视化的常见任务。由于许多图表没有明确地包含趋势线或相关的统计摘要，观众常常直接从一个情节中直接预测趋势。如何可靠的推论得出的观众表演时suchregression眼？特定的可视化设计或数据特征偏向趋势感知吗？我们提出了一系列的实验，评估大众趋势估计回归的眼睛在各种二维可视化的准确性，并检查这些估计的偏差的潜在来源。我们发现观众准确地估算二元数据标准的可视化的发展趋势，但视觉特征（例如，“在酒吧”的偏见）和数据特征（例如，异常值的存在）会导致视觉估计系统偏离标准的最小二乘回归模型。 article link

119. Evaluating Perceptually Complementary Views for Network Exploration Tasks

SESSION:Evaluating Visual Perceptions

We explore the relative merits of matrix, node-link and combined side-by-side views for the visualisation of weighted networks with three controlled studies: (1) finding the most effective visual encoding for weighted edges in matrix representations; (2) comparing matrix, node-link and combined views for static weighted networks; and (3) comparing MatrixWave, Sankey and combined views of both for event-sequence data. Our studies underline that node-link and matrix views are suited to different analysis tasks. For the combined view, our studies show that there is a perceptually complementary effect in terms of improved accuracy for some tasks, but that there is a cost in terms of longer completion time than the faster of the two techniques alone. Eye-movement data shows that for many tasks participants strongly favour one of the two views, after trying both in the training phase.

> 我们探讨矩阵的相对优点，与三个对照研究加权网络的可视化节点连接和组合并排的观点：（1）寻找最有效的视觉编码矩阵表示的加权边缘；（2）比较矩阵，静态加权网络节点连接和组合的意见；和（3）比较matrixwave，Sankey和联合的意见的事件序列数据。我们的研究强调节点链接和矩阵视图适用于不同的分析任务。对于组合视图，我们的研究表明，在某些任务的准确性方面有一种感知互补效应，但是在完成时间方面，这两种技术的速度比单独使用两种技术的速度要快。眼动数据表明，对于许多任务，参与者在两个训练阶段都试过后，强烈赞成这两种观点之一。 article link

120. How Design-inclusive UXR Influenced the Integration of Project Activities: Three Design Cases from Industry

SESSION:HCI/UX Education and Industry

In this paper, we discuss how the implementation of design-inclusive User Experience Research (UXR) has influenced the composition of UXR and design activities in the industrial setting of Philips Design. We present three design case studies that were executed in a time span of three years: a baby sleep project; a pregnancy project; and a baby bottle-feeding project. Through a retrospective analysis we conclude that the approach adopted in these cases progressed from complete separation of UXR and design activities to design-inclusive UXR in which design forms an integral part of research. This is reflected by a rearrangement of project activities toidentify, envision, enableandevaluateuser experiences. Previously the UXR (identifyandevaluate) and design (envisionandenable) activities were executed sequentially. Now, these four project activities merge in studying design interventions in context over a prolonged time, to iteratively explore and advance UX design qualities.

> 在本文中，我们将讨论如何设计用户体验研究的实施（uxr）已经在飞利浦设计的工业环境影响uxr和设计活动的组成。我们提出了三个设计案例研究，在一个为期三年的时间内执行：一个婴儿睡眠项目，一个怀孕项目和奶瓶喂养项目。通过回顾性分析，我们认为采用这些例进展从uxr设计活动完全分离的设计，包括uxr设计形式的研究中不可或缺的方法。这是反映在重排项目活动识别，设想，enableandevaluateuser经验。以前的uxr（identifyandevaluate）和设计（envisionandenable）活动的顺序执行。现在，这四个项目

> 合并在研究设计干预的背景下在一个较长的时间，反复地探索和推动UX设计品质。 article link

121. Augmented Studio: Projection Mapping on Moving Body for Physiotherapy Education

SESSION:HCI/UX Education and Industry

Physiotherapy students often struggle to translate anatomical knowledge from textbooks into a dynamic understanding of the mechanics of body movements in real life patients. We present theAugmented Studio, an augmented reality system that uses body tracking to project anatomical structures and annotations over moving bodies for physiotherapy education. Through a user and learner centered design approach, we established an understanding that throughaugmentationandannotation, augmented reality technology can enhance physiotherapy education. Augmented Studio enables augmentation through projection mapping to display anatomical information such as muscles and skeleton in real time on the body as it moves. We created a technique forannotationto create projected hand-drawing on the moving body, to enable explicit communication of the teacher's clinical reasoning strategies to the students. Findings from our pilot usability study demonstrate a more engaging learning and teaching experience and increased communication between teacher and students when using Augmented Studio.

> 物理疗法学生常常努力把解剖学知识从课本中转化为对现实生活中病人身体运动力学的动态理解。我们提出了增广的工作室，一个增强现实系统，利用人体运动跟踪项目和注释的解剖结构在运动理疗教育机构。通过用户和学习者为中心的设计方法，建立了一种理解，throughaugmentationandannotation，增强现实技术可以提高物理教育。增强的工作室通过投影映射来增强身体在运动时实时显示骨骼和肌肉等解剖学信息。我们创建了一个技术forannotationto创建投影在移动体绘制方面，使老师的临床推理策略显式通信的学生。我们的试点可用性研究的结果表明，在使用增强工作室时，教师和学生之间更具吸引力的学习和教学经验，并增加了师生之间的交流。 article link

122. Facilitating Development of Pragmatic Competence through a Voice-driven Video Learning Interface

SESSION:HCI/UX Education and Industry

Authentic foreign language videos are effective for developing pragmatic competence, or sensitivity to meanings expressed by tone and word choice, and the ability to effectively express these meanings. However, established methods for learning from foreign language videos are primarily text-based (e.g.captioning). Using text, learners do not practice aspects of oral performance (e.g. intonation, pausing, and pitch) that are important to pragmatic competence. In this paper we present a voice-driven system where learners practice and learn a foreign language by repeating phrases out loud from any video. Utterances are transcribed and translated and, if captions are available, the system indicates the correctness of the utterance. In an evaluation with 27 participants, we show that participants more frequently used the voice-driven system than a comparison text-based system. Furthermore, ina field study of 130 independent learners, we show potential for community-driven resource collection.

> 真实的外语视频对于培养语用能力、对声调和词汇选择所表达的意义的敏感以及有效表达这些意思的能力都是有效的。然而，从外语学习方法主要是基于文本的视频（e.g.captioning）。使用文本，学习者不练习对口语能力很重要的口语表现（例如语调、停顿和音高）。在本文中，我们提出了一个语音驱动系统，学习者通过从任何视频中大声复述短语来学习和学习外语。话语被转录和翻译，如果字幕可用，系统指示话语的正确性。在27名参与者的评估中，我们表明参与者比基于文本的比较系统更频繁地使用语音驱动系统。此外，在130个独立学习者的实地研究中，我们展示了社区驱动资源收集的潜力。 article link

123. Advancing UX Education: A Model for Integrated Studio Pedagogy

SESSION:HCI/UX Education and Industry

The rapid growth of the UX profession has led to an increased need for qualified practitioners and a proliferation of UX educational programs offered in both academia and industry. In this note, we present the design and initial evaluation of a new studio-based undergraduate program in UX--the first of its kind at a large, research-intensive US university. The program includes several curricular innovations, such as an integrated studio pedagogy in which six topical strands are interwoven across two types of studios. These studios are interconnected and span five semesters of the undergraduate experience. We present the curriculum model and the foundational principles that informed its design. We describe the two types of studios and their interconnection, and present early evaluation data showing that students are building valuable skills. The program described in this note provides a trailblazing model for UX pedagogy at the undergraduate level.

> 的UX行业的快速增长导致了一个合格的从业人员和增殖的UX的教育项目，在学术界和工业界提供了需求的增加。在本文中，我们提出一种新的基于和UX工作室本科初始评价设计——首次在一个大的研究密集型大学，美国。该计划包括几项课程创新，如一个综合工作室教学法，其中六个专题股交织在两种类型的工作室。这些工作室相互联系，跨越五个学期的本科生经验。我们提出了课程模式和通知其设计的基本原则。我们描述了两种类型的工作室和他们的互连，并提供早期的评估数据显示，学生正在建立宝贵的技能。在本说明中描述的程序提供了一个开创性的模型的UX教学在本科阶段。 article link

124. Bendtroller:: An Exploration of In-Game Action Mappings with a Deformable Game Controller

SESSION:Novel Game Interfaces

We explore controller input mappings for games using a deformable prototype that combines deformation gestures with standard button input. In study one, we tested discrete gestures using three simple games. We categorized the control schemes as binary (button only), action, and navigation, the latter two named based on the game mechanics mapped to the gestures. We found that the binary scheme performed the best, but gesture-based control schemes are stimulating and appealing. Results also suggest that the deformation gestures are best mapped to simple and natural tasks. In study two, we tested continuous gestures in a 3D racing game using the same control scheme categorization. Results were mostly consistent with study one but showed an improvement in performance and preference for the action control scheme.

> 我们探索游戏的控制器输入映射使用变形原型，结合变形手势与标准按钮输入。在研究中，我们使用三个简单的游戏测试离散手势。我们把控制方案分为二进制（按钮）、动作和导航，后两种基于映射到手势的博弈机制命名。我们发现，二进制方案执行最好，但基于手势的控制方案是刺激和吸引人的。结果还表明，变形手势最好映射到简单和自然的任务。在研究二中，我们使用相同的控制方案分类对3D赛车游戏中的连续手势进行了测试。结果与研究结果基本一致，但表现出了改善和对行动控制计划的偏好。 article link

125. Inner Garden: Connecting Inner States to a Mixed Reality Sandbox for Mindfulness

SESSION:Novel Game Interfaces

Digital technology has been completely integrated into our daily lives, yet the potential of technology to improve its users' life satisfaction is still largely untapped. Mindfulness, the

act of paying a deliberate and non-judgmental attention to the present moment, has been shown to have a positive impact on a person's health and subjective well-being--commonly called "happiness". Based on an iterative process with meditation teachers and practitioners, we designed a new tool to support mindfulness practices. This tool takes the shape of an augmented sandbox, designed to inspire the user's self-motivation and curiosity. By shaping the sand, the user creates a living miniature world that is projected back onto the sand. The natural elements of the garden are connected to real-time physiological measurements, such as breathing, helping the user to stay focused on the body. Moreover, using a Virtual Reality headset, they can travel inside their garden for a dedicated meditation session. Preliminary results seem to indicate that the system is well suited for mindfulness and induces a calm and mindful state on the user. The meditation teachers envisioned the use of Inner Garden in their practice.

> 数字技术已经完全融入我们的日常生活中，但技术提高用户生活满意度的潜力仍然很大。正念是一种对当前时刻进行深思熟虑和非评判性注意的行为，它对人的健康和主观幸福感有着积极的影响，通常被称为“幸福”。基于冥想教师和实践者的迭代过程，我们设计了一种支持正念练习的新工具。该工具采用增强沙箱的形式，旨在激发用户的自我激励和好奇心。通过塑造沙子，用户创造了一个活生生的微型世界，投射到沙滩上。花园里的自然元素与实时的生理测量相联系，比如呼吸，帮助使用者集中注意力在身体上。此外，使用虚拟现实耳机，他们可以在花园里进行专门的冥想活动。初步结果似乎表明，该系统非常适合正念，并在用户身上产生一种平静和正念的状态。冥想教师设想在实践中使用内花园。 article link

126. Providing Haptics to Walls & Heavy Objects in Virtual Reality by Means of Electrical Muscle Stimulation

SESSION:Novel Game Interfaces

We explore how to add haptics to walls and other heavy objects in virtual reality. When a user tries to push such an object, our system actuates the user's shoulder, arm, and wrist muscles by means of electrical muscle stimulation, creating a counter force that pulls the user's arm backwards. Our device accomplishes this in a wearable form factor.In our first user study, participants wearing a head-mounted display interacted with objects provided with different types of EMS effects. Therepulsiondesign (visualized as an electrical field) and thesoftdesign (visualized as a magnetic field) received high scores on "prevented me from passing through" as well as "realistic".In a second study, we demonstrate the effectiveness of our approach by letting participants explore a virtual world in which all objects provide haptic EMS effects, including walls, gates, sliders, boxes, and projectiles.

> 我们将探讨如何增加触觉的墙壁和其他重的物体在虚拟现实。当一个用户试图将这样一个对象，我们的系统驱动用户的肩、臂、腕的肌肉的肌肉电刺激手段，创造了一个反作用力，把用户的手臂向后。我们的设备以可穿戴的形式完成这项工作，在我们的第一个用户研究中，佩戴头盔显示器的参与者与提供不同类型EMS效果的对象相互作用。therepulsiondesign（可视为一个电场）和thesoftdesign（可视为磁场）”获得高分，我无法通过”以及“现实的”。在另一项研究中，我们通过让参与者探索虚拟世界中的所有对象提供触觉EMS的影响，包括墙壁、门滑块，盒，证明我们的方法的有效性，和弹。 article link

127. It wasn't really about the Pokémon: Parents' Perspectives on a Location-Based Mobile Game

SESSION:Novel Game Interfaces

Though prior work shows parents worry about screen media experiences displacing physical activity and time outdoors, this research does not account for location-based mobile games likePokémon GO, which specifically facilitate outdoor activity. To fill this gap in the research, we surveyed and interviewed parents to understand (1) their values and perceptions of this type of gameplay and (2) how they co-playPokémon GOwith their children. Our findings provide empirical evidence that, in addition to appreciating the increased exercise and time outdoors, parents valued how play led to family bonding experiences. Furthermore, some traditional concerns about screen time persisted in this context, and new concerns about safety in real-world environments emerged. Parents mitigated these concerns with rules and gameplay choices, such as maintaining control of the mobile device, to ensure children were safe. This work contributes an empirical understanding of families as co-users of technology and offers a generative lens to study and design for joint media engagement among family members where gameplay differs from normative notions of screen time.

> 虽然以前的工作表明，家长担心屏幕媒体经验取代体力活动和户外活动的时间，本研究不基于位置的手机游戏likepokéMon去账户，专门方便户外活动。为了填补这一空白，在研究中，我们调查、采访了父母的理解（1）他们的价值观，这类游戏的看法，（2）如何playpoké妈妈与孩子。我们的发现提供了经验证据，除了欣赏户外运动和时间的增加外，父母还重视游戏如何导致家庭亲密体验。此外，在这种情况下，一些传统的关于屏幕时间的担忧仍然存在，并且在现实环境中出现了对安全性的新关注。父母们用规则和游戏选择减轻了这些顾虑，比如保持移动设备的控制，以确保孩子们的安全。这项工作提供了一个经验的家庭作为共同用户的技术的理解，并提供一个生成镜头研究和设计的家庭成员之间的联合媒体参与，游戏性不同于规范的屏幕时间概念。 article link

128. Placing and Recalling Virtual Items on the Skin

SESSION:Novel Interfaces

The human skin provides an ample, always-on surface for input to smart watches, mobile phones, and remote displays. Using touch on bare skin to issue commands, however, requires users to recall the location of items without direct visual feedback. We present an in-depth study in which participants placed 30 items on the hand and forearm and attempted to recall their locations. We found that participants used a variety of landmarks, personal associations, and semantic groupings in placing the items on the skin. Although participants most frequently used anatomical landmarks (e.g., fingers, joints, and nails), recall rates were higher for items placed on personal landmarks, including scars and tattoos. We further found that personal associations between items improved recall, and that participants often grouped important items in similar areas, such as family members on the nails. We conclude by discussing the implications of our findings for design of skin-based interfaces.

> 人体皮肤为智能手表、移动电话和远程显示器提供了充足的、始终在表面的输入。然而，使用裸皮肤发出命令，用户需要在没有直接视觉反馈的情况下回忆物品的位置。我们进行了一项深入的研究，参与者将30个项目放在手和前臂，试图回忆起他们的位置。我们发现参与者在皮肤上使用了各种标志、个人联想和语义分组。虽然参加者最常使用的解剖标志物（如手指，关节和指甲），召回率较高的项目放在个人地标，包括疤痕和纹身。我们进一步发现，项目之间的个人联系可以提高回忆能力，参与者通常将相似的项目归类于相似的领域，例如家庭成员的指甲。最后，我们将讨论我们的研究结果对基于皮肤的接口设计的影响。 article link

129. FLIPPIN': Exploring a Paper-based Book UI Design in a Public Space

SESSION:Novel Interfaces

Digital information systems are increasingly being used in public spaces such as museums. Such systems should be easily accessible, arouse interest and offer useful information, and be easy to use. We present FLIPPIN' user interface (UI) system, which mimics the look, feel, and usability of traditional books. We explored how the paper-based book UI is designed to improve the usability problems in a public space while creating the prototypes with the aim of introducing Japanese cultural assets and conducting a field evaluation to compare the proposed system to a touch panel UI. The results of evaluation indicated the positive effects of the system, especially in terms of the usability and user's active

appreciation derived from a physical book interaction. In addition, we present design guidelines derived from our findings. The suggested design guidelines are expected to facilitate the future development of effective interactive digital information systems in public spaces.

> 数字信息系统越来越多地被用于公共场所，如博物馆。这样的系统应该易于访问，引起兴趣和提供有用的信息，并且易于使用。我们现在做的用户界面（UI）系统，它模仿了一下，感觉，和传统书籍的可用性。我们探讨了如何基于纸质的UI设计，以改善公共空间中的可用性问题，同时创建原型，目的是介绍日本文化资产，并进行现场评估，将该系统与触摸屏UI进行比较。评价结果表明该系统的积极效果，特别是从可用性和用户的积极欣赏来自物理书籍互动方面。此外，我们提出的设计准则来自我们的调查结果。预期的设计准则将有助于公共空间中有效互动数字信息系统的未来发展。 article link

130. Designing Interactive Advertisements for Public Displays

SESSION:Novel Interfaces

Although public displays are increasingly being deployed in everyday situations, they are still mostly used as auto-active information sources. Adding interactivity can help to attract and engage users. We report on the design and in-the-wild evaluation of an interactive advert for a public display in a tourist information center. We evaluate and compare 3 different variants - non-interactive, interaction using body tracking, and interaction using personal mobile devices - with respect to attracting the attention and interaction from passersby. We further compare these variants with an iterated version of the body tracking system with an extended tracking area. Our findings include an unexpected reluctance of passersby to use their mobile device in public, and the increased interactive area for body interaction resulting in increased engagement and spontaneous multi-user interaction, while removing the so-called 'landing effect'. Based on our findings, we suggest guidelines for interactive adverts on public displays.

> 虽然公共显示器越来越多地部署在日常环境中，但它们仍然主要用作自动活动的信息源。添加交互性有助于吸引和吸引用户。我们报告的设计和在一个互动的广告在一个旅游信息中心的公开展示野生评价。我们评价和比较3个不同的变种-非交互式的，利用人体运动跟踪的互动，并使用就吸引了路人的注意和互动的个人移动设备交互。我们还将这些变体与具有扩展跟踪区域的身体跟踪系统的迭代版本进行比较。我们的研究结果包括在公众场合使用他们的移动设备的人一个意想不到的磁阻，并增加互动区体相互作用从而增加参与和自发的多用户交互，同时消除了所谓的“落地”效应。根据我们的调查结果，我们建议公共展示互动广告的指导方针。 article link

131. Don't Talk Dirty to Me: How Sexist Beliefs Affect Experience in Sexist Games

SESSION:Players, Spectators, Communities

Research on sexism in digital games has suggested that women self-select out of playing sexist games; however, assuming a homogenous gender-based response does not account for the diversity of identities within a gender group. Gender-incongruent responses to recent events like #gamergate implies that the gender of the participant is not paramount to experience, but that their beliefs about gender roles are. To explore the role of sexist beliefs on experience in sexist games, we created three versions of a game that were identical except for the presence of sexist imagery and/or dialogue. We show that enjoyment of sexist games is not predicted by player gender, but by the player's pre-existing beliefs about gender. Furthermore, avatar identification is the pathway through which enjoyment is facilitated. Finally, sexist dialogue does not improve the play experience for anyone rather it harms experience for players of all genders who do not hold sexist beliefs.

> 对数字游戏中的性别歧视的研究表明，女性在玩性别歧视游戏时会自我选择；然而，假设同质的基于性别的反应并不能解释性别群体中身份的多样性。喜欢# gamergate最近事件的性别不一致的反应意味着参与者的性别不是最重要的经验，但他们对性别角色的信念。为了探讨性别歧视观念在性别歧视游戏中的作用，我们创建了三个版本的游戏，它们都是相同的，除了性别歧视的形象和/或对话的存在。我们发现，性别歧视游戏的乐趣不是由玩家性别所预测的，而是由玩家对性别的预先观念所预测的。此外，化身识别是促进享受的途径。最后，性别歧视的对话并不能改善任何人的游戏体验，相反，它对那些没有性别歧视信仰的所有参与者都是有害的。 article link

132. Understanding Gaming Perceptions and Experiences in a Women's College Community

SESSION:Players, Spectators, Communities

Recent trends in gaming diversification have shown that women are both an increasingly significant pool of consumers and game producers, and regular victims of misogynistic harassment. Such observations stress the importance of investigating the complex relationships of women and gaming. In this paper, we draw upon perspectives from Feminist HCI to extend the current knowledge of issues in gaming that are specific to women. We present results from a mixed-methods study with 327 participants who are students and alumnae of a women's college. Our findings shed light on the complex relationships of women with games, with other gamers, and with gaming culture and industry. The results also indicate that in some cases gender-related negative experiences of gaming have lasting impact on the participation and self-confidence of young women. We conclude by discussing the implications of our findings for the design of games, game development education, and for the study of gaming.

> 在游戏多元化趋势表明，女性都是越来越重要的池消费者和游戏制作人，和女性的骚扰规则的受害者。这样的观察强调了调查妇女与赌博的复杂关系的重要性。在本文中，我们借鉴了女性主义人机交互的观点，以扩展目前对妇女特有的游戏问题的认识。我们提出了一个混合方法的研究结果与327名学生和一个女子学院的毕业生。我们的发现揭示了女性与游戏、其他玩家以及游戏文化和产业之间的复杂关系。研究结果还表明，在某些情况下，与性别有关的负面游戏经验对青年妇女的参与和自信心有着持久的影响。最后，我们将讨论我们的发现对游戏设计、游戏开发教育以及游戏研究的影响。 article link

133. Ways of Spectating: Unravelling Spectator Participation in Kinect Play

SESSION:Players, Spectators, Communities

We explore spectating on video game play as an interactional and participatory activity. Drawing on a corpus of video recordings capturing 'naturally occurring' Kinect gaming within home settings, we detail how the analytic 'work' of spectating is interactionally accomplished as a matter of collaborative action with players and engagement in the game. We examine: spectators supporting players with continuous 'scaffolding'; spectators critiquing player technique during and between moments of play; spectators recognising and complimenting competent player conduct; and spectators reflecting on prior play to build instructions for the player. From this we draw out a number of points that shift the conversation in HCI about 'the spectator' towards understanding and designing for spectating as an interactional activity; that is, sequentially ordered and temporally coordinated. We also discuss bodily conduct and the particular ways of 'seeing' involved in spectating, and conclude with remarks on conceptual and design implications for HCI.

> 我们探讨了观众对视频游戏的互动性、参与式的活动。基于语料库的录像捕捉的自然发生的Kinect游戏内设置，我们详细介绍了如何分析工作的观众是作为一个问题，在游戏玩家和参与协同作用相互作用完成的。我们研究：观众支持玩家连续“脚手架”；观众批评球员技术在时刻与玩之间；观众认可和称赞称职的球员的行为；和观众反映之前发挥的球员版本说明。由此我们得出的点数将谈话内容在HCI的观众理解和设计的观众作为一个互动的活动；即，有序和协调时间。我们还讨论了身体的行为，“看到”参与观众的特定方

> 式，最后对人机交互的概念和设计的影响的话。 article link

134. Expanding Video Game Live-Streams with Enhanced Communication Channels: A Case Study

SESSION:Players, Spectators, Communities

Live-streaming of video games is a recent phenomenon. One driving factor is the direct communication between the streamer and the audience. Currently, besides the platform-integrated options such as text chats, streamers often use external sources to let their community better articulate their opinions. In this paper we present a case study with our tool Helpstone, a live-streaming tool for the card game Hearthstone. Helpstone provides several new communication channels that allow for a better viewer-streamer interaction. We evaluated the tool within a live-streaming session with 23 viewers using Helpstone, and interviewed the streamer. The results indicate that not every implemented interactivity option is relevant. However, in general, new communication channels appear to be valuable and novel influence options are appreciated.

> 视频游戏直播是最近的一个现象。一个驱动因素是流光和观众之间的直接交流。目前，除了平台综合选项，如文本聊天，彩带往往使用外部来源，让他们的社区更好地表达他们的意见。在本文中我们提出了我们的工具helpstone为例，一个现场直播的工具，卡牌游戏的炉石。helpstone提供了一些新的沟通渠道，允许一个更好的观众流相互作用。我们评估的工具在一个生活在23的观众使用helpstone流会话，并采访了流光。结果表明并非每一个实现的交互选项都是相关的。然而，总的来说，新的沟通渠道似乎是有价值的，新的影响选择受到赞赏。 article link

135. "These are not my hands!": Effect of Gender on the Perception of Avatar Hands in Virtual Reality

SESSION:Players, Spectators, Communities

Rendering the user's body in virtual reality increases immersion and presence the illusion of "being there". Recent technology enables determining the pose and position of the hands to render them accordingly while interacting within the virtual environment. Virtual reality applications often use realistic male or female hands, mimic robotic hands, or cartoon hands. However, it is unclear how users perceive different hand styles. We conducted a study with 14 male and 14 female participants in virtual reality to investigate the effect of gender on the perception of six different hands. Quantitative and qualitative results show that women perceive lower levels of presence while using male avatar hands and male perceive lower levels of presence using non-human avatar hands. While women dislike male hands, men accept and feel presence with avatar hands of both genders. Our results highlight the importance of considering the users' diversity when designing virtual reality experiences.

> 在虚拟现实中渲染用户的身体会增加沉浸感和存在“存在”的错觉。最近的技术能够确定手的姿势和位置，以便在虚拟环境中相互作用。虚拟现实应用程序通常使用现实的男性或女性的手，模仿机器人的手，或卡通手。然而，目前还不清楚用户如何感知不同的手风格。我们对14名男性和14名女性虚拟现实参与者进行了一项调查，调查性别对六种不同手的感知的影响。定量和定性结果表明，女性感知男性男性化身时的存在水平较低，男性感知使用非人化身的存在水平较低。女人不喜欢男人的手，男人却接受并感受着男女双方的存在。我们的研究结果强调了在设计虚拟现实体验时考虑用户多样性的重要性。 article link

136. Looking Inside the Wires: Understanding Museum Visitor Learning with an Augmented Circuit Exhibit

SESSION:Smart Monitoring in Physical Spaces

Understanding electrical circuits can be difficult for novices of all ages. In this paper, we describe a science museum exhibit that enables visitors to make circuits on an interactive tabletop and observe a simulation of electrons flowing through the circuit. Our goal is to use multiple representations to help convey basic concepts of current and resistance. To study visitor interaction and learning, we tested the design at a popular science museum with 60 parent-child dyads in three conditions: a control condition with no electron simulation; a condition with the simulation displayed alongside the circuit on the same screen; and an augmented reality condition, with the simulation displayed on a tablet that acts as a lens to see into the circuit. Our findings show that children did significantly better on a post-test in both experimental conditions, with children performing best in the AR condition. However, analysis of session videos shows unexpected parent-child collaboration in the AR condition.

> 理解电路对于所有年龄段的初学者来说都是困难的。在本文中，我们描述了一个科学博物馆展览，使参观者能够在交互式桌面上进行电路和观察电子流过电路。我们的目标是使用多种表示来帮助传达电流和电阻的基本概念。研究者的交流和学习，我们测试的设计在一个科普馆60的父子二人组合中的三个条件：一个没有电子模拟控制条件；用模拟电路显示在屏幕上的状态；和一个增强现实条件，在平板电脑，作为一个镜头看到显示电路的仿真。我们的研究结果显示，在两个实验条件下，儿童的后测成绩都明显好，儿童在AR条件下表现最好。但是，会话视频的分析显示了AR条件下意外的父子协作。 article link

137. Log it While it's Hot: Designing Human Interaction with Smart Thermostats for Shared Work Environments

SESSION:Smart Monitoring in Physical Spaces

Smart thermostats offer impressive scope for adapting to users' thermal comfort preferences and saving energy in shared work environments. Yet human interactions with smart thermostats thus far amount to an assumption from designers that users are willing and able to provide unbiased data at regular intervals; which may be unrealistic. In this paper we highlight the variety of social factors which complicate users' relationships with smart thermostats in shared work environments. These include social dynamics, expectations, and contextually specific factors that influence motivations for interaction with the system. In response we outline our framework towards aSmarter Thermostat: one which better accounts for these messy social inevitabilities, is equipped for a decline in user feedback over time and one which augments rather than attempts to replaces human intelligence-thereby ensuring a smarter thermostat does not create dumber humans.

> 智能恒温器提供了令人印象深刻的范围，以适应用户的热舒适偏好和节省能源共享的工作环境。然而，迄今为止，人类与智能恒温器的相互作用相当于设计者的假设，即用户愿意并能够以固定的间隔提供无偏倚的数据，这可能是不现实的。在本文中，我们强调了各种社会因素，使用户与共享工作环境中的智能恒温器的关系复杂化。这些包括社会动态，期望，和上下文特定的因素与系统交互影响的动机。对此我们概述我们对asmarter恒温器的框架：一个更好地解释这些混乱的社会必然性，具有一个用户反馈时间和增强而不是试图取代人类的智力保证智能恒温器不创造笨人类下降。 article link

138. Community-Empowered Air Quality Monitoring System

SESSION:Smart Monitoring in Physical Spaces

Developing information technology to democratize scientific knowledge and support citizen empowerment is a challenging task. In our case, a local community suffered from air

pollution caused by industrial activity. The residents lacked the technological fluency to gather and curate diverse scientific data to advocate for regulatory change. We collaborated with the community in developing an air quality monitoring system which integrated heterogeneous data over a large spatial and temporal scale. The system afforded strong scientific evidence by using animated smoke images, air quality data, crowdsourced smell reports, and wind data. In our evaluation, we report patterns of sharing smoke images among stakeholders. Our survey study shows that the scientific knowledge provided by the system encourages agonistic discussions with regulators, empowers the community to support policy making, and rebalances the power relationship between stakeholders.

> 发展信息技术民主化的科学知识和支持公民权力是一个具有挑战性的任务。在我们的例子中，一个当地社区遭受工业活动造成的空气污染。居民缺乏收集和参考不同的科学数据支持的监管变化的科技能力。我们与社区合作，开发了一个空气质量监测系统，该系统集成了大空间和时间尺度上的异构数据。该系统提供了强有力的科学证据运用动画烟雾图像，空气质量数据，大众闻报道，和风的数据。在我们的评估中，我们报告了在利益相关者之间共享烟雾图像的模式。我们的调查研究表明，系统提供的科学知识竞赛鼓励与监管机构讨论，使社区支持政策的制定和调整，利益相关者之间的权力关系。 article link

139. The Catch(es) with Smart Home: Experiences of a Living Lab Field Study

SESSION:Smart Monitoring in Physical Spaces

Smart home systems are becoming an integral feature of the emerging home IT market. Under this general term, products mainly address issues of security, energy savings and comfort. Comprehensive systems that cover several use cases are typically operated and managed via a unified dashboard. Unfortunately, research targeting user experience (UX) design for smart home interaction that spans several use cases or covering the entire system is scarce. Furthermore, existing comprehensive and user-centered longterm studies on challenges and needs throughout phases of information collection, installation and operation of smart home systems are technologically outdated. Our 18-month Living Lab study covering 14 households equipped with smart home technology provides insights on how to design for improving smart home appropriation. This includes a stronger sensibility for household practices during setup and configuration, flexible visualizations for evolving demands and an extension of smart home beyond the location.

> 智能家居系统正在成为新兴家庭IT市场的一个整体特征。在这个通用术语下，产品主要解决安全、节能和舒适性问题。涵盖几个用例的综合系统通常通过统一的仪表板进行操作和管理。不幸的是，研究针对用户体验（UX）设计的智能家居交互跨越几个用例或覆盖整个系统缺乏。此外，现有的全面和以用户为中心的长期研究在智能家居系统的信息收集、安装和操作过程中的挑战和需求，在技术上已经过时。我们的18个月的生活实验室研究涵盖了14个家庭配备智能家居技术提供了关于如何设计，以改善智能家居拨款的见解。这包括在设置和配置过程中对家庭实践的更强烈的敏感性，对不断变化的需求的灵活的可视化，以及超出位置的智能家居的扩展。 article link

140. A Social Media Based Index of Mental Well-Being in College Campuses

SESSION:Social Computing and Health

Psychological distress in the form of depression, anxiety and other mental health challenges among college students is a growing health concern. Dearth of accurate, continuous, and multi-campus data on mental well-being presents significant challenges to intervention and mitigation efforts in college campuses. We examine the potential of social media as a new "barometer" for quantifying the mental well-being of college populations. Utilizing student-contributed data in Reddit communities of over 100 universities, we first build and evaluate a transfer learning based classification approach that can detect mental health expressions with 97% accuracy. Thereafter, we propose a robust campus-specific Mental Well-being Index: MWI. We find that MWI is able to reveal meaningful temporal patterns of mental well-being in campuses, and to assess how their expressions relate to university attributes like size, academic prestige, and student demographics. We discuss the implications of our work for improving counselor efforts, and in the design of tools that can enable better assessment of the mental health climate of college campuses.

> 大学生抑郁、焦虑等心理健康问题的心理困扰是一个日益严重的健康问题。缺乏精确、连续和多校区的精神健康数据，对大学校园的干预和缓解工作提出了重大挑战。我们考察了社会媒体作为一种新的“晴雨表”来量化大学生群体心理健康的潜力。利用学生提供的数据，在Reddit社区超过100所大学，我们首先建立和评估一个迁移学习为基础的分类方法，可以准确检测97%心理健康表现。然后，我们提出了一个强大的具体的校园心理健康指标：MWI。我们发现，分析能够揭示校园心理健康有意义的时间模式，并评估他们的表现关系到大学的属性如大小、学术声望，和学生的人口统计资料。我们讨论了我们的工作，以改善辅导员的努力，并在设计工具，可以更好地评估大学校园的心理健康气候的影响。 article link

141. When Fitness Meets Social Networks: Investigating Fitness Tracking and Social Practices on WeRun

SESSION:Social Computing and Health

The last two decades have seen growing interest in promoting physical activities by using self-tracking technologies. Previous work has identified social interactions in self-tracking as a crucial factor in motivating users to exercise. However, it is unclear how integrating fitness features into complex pre-existing social network affects users' fitness tracking practices and social interactions. In this research, we address this gap through a qualitative study of 32 users of WeRun--a fitness plugin of the widely adopted Chinese mobile social networking service WeChat. Our findings indicate that sharing fitness data with pre-existing social networks motivates users to continue self-tracking and enhances their existing social relationships. Nevertheless, users' concerns about their online personal images lead to challenges around privacy. We discuss how our study could advance understanding of the effects of fitness applications built on top of pre-existing social networks. We present implications for future social fitness applications design.

> 过去二十年来，人们越来越关注利用自我跟踪技术促进体育活动。以前的工作已经确定了自我跟踪中的社会互动是激励用户进行锻炼的一个关键因素。然而，目前还不清楚如何将健身特征融入到复杂的社会网络中，影响到用户的健身跟踪实践和社会交往。在本研究中，我们解决这个差距，通过对威琅32用户的定性研究——一种被广泛采用的移动社交服务微信健身插件。我们的研究结果表明，共享健身数据与现有的社交网络，激励用户继续自我跟踪，并加强其现有的社会关系。然而，用户对在线个人形象的关注导致了隐私方面的挑战。我们将讨论我们的研究如何促进对先前存在的社交网络上健身应用程序的影响的理解。我们提出未来的社会适应应用程序设计的影响。 article link

142. "Be Grateful You Don't Have a Real Disease": Understanding Rare Disease Relationships

SESSION:Social Computing and Health

We characterize how people with rare diseases consider their support needs as being met or neglected by different sources. After a 22-week study with 11 participants, we found that people with rare diseases identify strongly with their conditions but demonstrate a range of outlooks on their condition (positive, negative, and accepting). We found that participants think of themselves as being in a separate "Rare World" from the "normal" people in their lives and that relationships with friends and family members are strained. On the other hand, online communities were described as valuable sources of many forms of support, but do not adequately compensate for the lack oftangiblesupport in offline relationships. We propose an approach to facilitating tangible support that leverages existing research on social matching, towards facilitating support among people

withdifferentrare diseases to overcome geographic and symptomatic challenges of coordinating support between people with thesamerare disease.

> 我们描述了罕见疾病的人如何看待他们的支持需要被不同的来源所满足或忽略。在对11名参与者进行为期22周的研究后，我们发现患有罕见疾病的人对他们的病情有强烈的认同感，但他们对自己的病情表现出一系列的看法（积极的、消极的和接受的）。我们发现，参与者认为自己与生活中的“正常”人处于一个单独的“罕见的世界”，与朋友和家人的关系紧张。另一方面，在线社区被描述为许多形式的支持的重要来源，但不足以弥补线下关系缺乏oftangiblesupport。我们提出了一个促进有形的支持，充分利用现有的社会匹配的研究方法，对促进人withdifferentrare病中支持克服与thesamerare病人之间的协调支持地理和症状的挑战。 article link

143. When Personal Tracking Becomes Social: Examining the Use of Instagram for Healthy Eating

SESSION:Social Computing and Health

Many people appropriate social media and online communities in their pursuit of personal health goals, such as healthy eating or increased physical activity. However, people struggle with impression management, and with reaching the right audiences when they share health information on these platforms. Instagram, a popular photo-based social media platform, has attracted many people who post and share their food photos. We aim to inform the design of tools to support healthy behaviors by understanding how people appropriate Instagram to track and share food data, the benefits they obtain from doing so, and the challenges they encounter. We interviewed 16 women who consistently record and share what they eat on Instagram. Participants tracked to support themselves and others in their pursuit of healthy eating goals. They sought social support for their own tracking and healthy behaviors and strove to provide that support for others. People adapted their personal tracking practices to better receive and give this support. Applying these results to the design of health tracking tools has the potential to help people better access social support.

> 许多人在追求个人健康目标，如健康饮食或增加体力活动时，适当利用社交媒体和在线社区。然而，人们在印象管理上挣扎，当他们分享这些平台上的健康信息时，会遇到合适的受众。Instagram的照片，一个流行的社交媒体平台，吸引了许多人后，分享他们的食物照片。我们的目的是告知的设计工具，通过了解人们如何适当的Instagram追踪和分享食物的数据支持健康的行为，他们这样做得到的好处，他们遇到的挑战。我们采访了16名妇女持续记录和分享他们所吃的Instagram。参与者追踪他们自己和其他人追求健康饮食的目标。他们为自己的跟踪和健康行为寻求社会支持，并努力为他人提供支持。人们调整他们的个人跟踪实践，以便更好地接受和给予这种支持。将这些结果应用到健康跟踪工具的设计中，有助于人们更好地获得社会支持。 article link

144. Participatory Media: Creating Spaces for Storytelling in Neighbourhood Planning

SESSION:Supporting Local Space

Neighbourhood planning devolves power to communities to create their own planning policy but traditional forms of participation are still relied upon. And despite the ubiquitous nature of technology in society, digital participation methods are rarely used. In this paper, we outline fieldwork with two neighbourhood planning groups who used participatory media technology to improve engagement though the art of storytelling. We focus on the configuration of participatory media as a way to widen participation and enable story creation and sharing amongst citizens. We highlight that storytelling using media technology can provide a model of and a model for the way we "do" neighbourhood planning whilst emphasising the challenges of ensuring processes are linked to tangible actions and encouraging the multiplicity of stories.

> 邻里规划权力下放给社区创建自己的规划政策，但传统的参与形式仍然依赖。尽管社会中技术无处不在，但很少使用数字参与方法。在本文中，我们概述了两个邻里规划小组使用参与式媒体技术，以改善参与，虽然讲故事艺术的田野调查。我们专注于参与式媒体的配置，以此来扩大公民参与，使故事能够在公民中创造和分享。我们强调讲故事使用媒体技术可以为我们“做”邻里规划的方式和模式提供一个模式和模式，同时强调确保过程的挑战与具体行动相联系，并鼓励故事的多样性。 article link

145. Block Party: Synchronized Planning and Navigation Views for Neighbourhood Expeditions

SESSION:Supporting Local Space

Mobile wayfinding and guide apps have become indispensable tools for navigating unfamiliar urban spaces. Such applications address targeted, "just-in-time" queries, but are not optimally designed for multi-point expeditions that can quickly build route and survey-level familiarity with a neighbourhood. We first conducted an experimental simulation involving a homebuying scenario to assess the usefulness of a popular mobile wayfinding and search application (Google Maps) for exploring a neighbourhood. We then designed a prototype application called Block Party that addresses a number of limitations of Google Maps for this purpose, and evaluated it in a second replica study. The results suggested that application designs that facilitate switching among distinct but synchronized navigation views such as Block Party might support more efficient usage and the selection of task-appropriate views, leading to better overall spatial awareness.

> 移动寻路和引导应用程序已经成为在陌生的城市空间不可或缺的工具。这些应用程序针对的是“及时”查询，但并不是为多点探险而设计的，它们可以快速建立路线和调查水平，熟悉邻里。我们首先进行了实验模拟涉及购房方案评估的有效性的一个流行的移动路径和应用搜索（谷歌地图）为探索社区。然后，我们设计了一个原型应用程序称为块党，解决了一些局限性的谷歌地图为此目的，并评估它在第二个副本研究。结果表明，应用程序设计，有助于在不同的，但同步的导航视图，如块党切换可能支持更有效的使用和选择合适的任务视图，从而导致更好的整体空间意识。 article link

146. Designing for Cohabitation: Naturecultures, Hybrids, and Decentering the Human in Design

SESSION:Supporting Local Space

Recent research in urban informatics has presented the city as both a complex technological center and a diverse cultural, social, and political entity. However, there has been little research into the changing role that nature plays in urban space, particularly when it comes to understanding how animals have adapted to life in technological and networked cities. In the wake of urbanization, new kinds of cohabitation, including increased interactions between humans and animals, has resulted in new challenges for those working in urban informatics. We leverage key concepts in the Anthropocene-naturecultures, hybrids, and decentering the human in design-to unpack the entanglements of animal-human-computer interaction in two design cases: The Big Cat Behavioral Tracking Initiative and The Phenology Clock. We contribute to urban informatics and HCI research by reflecting on ways in which design can promote new forms of cohabitation and support a broader conception of the city that sees animals as an essential part of the urban landscape.

> 最近的城市信息学研究表明，城市既是一个复杂的技术中心，也是一个多元的文化、社会和政治实体。然而，很少有人研究自然在城市空间中所扮演的角色的变化，特别是在了解动物如何适应科技和网络化城市的生活方面。在城市化之后，新的同居方式，包括人与动物之间的相互作用增加，给从事城市信息学工作的人带来了新的挑战。我们利用核心概念在人类世naturecultures，杂种，和偏心的人设计把动物人机交互纠缠在两个设计案例：大猫的行为跟踪主动和物候时钟。我们对城市信息学和人机交互研究作出贡献，通过反思设计促进新形式的同居的方式，支持更广泛的城市概念，即动物是城市景观的重要组成部分。 article link

147. Stranger Searching in a Strange Land: The Impact of Familiarity on Local Search

SESSION:Supporting Local Space

Local search entails looking for places, such as restaurants or hotels, in a geographically-constrained region. Within local search, it has been observed that an individual's familiarity with their environment (i.e. how well they know the area in a query of the form "{places} in {area}") impacts which places they are most interested in visiting. Less well-understood though is how people's information preferences differ during 1) different phases of the search process and 2) based on their level of familiarity. Through a series of surveys in the domain of dining, we explore how familiarity moderates what level of information is useful to an individual about restaurant location when choosing a place to visit. We further examine how these preferences vary between regions and phases of local search (deciding on a restaurant or determining how to go). We contribute an understanding of people's information preferences during search, building on prior research of how offline context impacts online needs.

> 本地搜索需要在地理限制的地区寻找地方，如餐馆或旅馆。在本地搜索中，已经观察到一个人对环境的熟悉程度（即他们在查询"{ }区域}"）时对该区域的了解程度如何，影响到他们最感兴趣的访问地点。然而，人们不太清楚人们的信息偏好在1个不同的搜索过程中是如何变化的，2）基于他们熟悉程度的不同。通过对就餐领域的一系列调查，我们探讨了在选择一个地方时，熟悉程度如何调节一个人对餐馆地点的信息水平。我们进一步研究这些偏好如何在本地搜索的区域和阶段之间有所不同（决定一家餐馆或决定如何去）。我们在搜索过程中建立了人们对信息偏好的理解，建立在离线环境如何影响在线需求的前期研究基础之上。 article link

148. Ambiotherm: Enhancing Sense of Presence in Virtual Reality by Simulating Real-World Environmental Conditions

SESSION:Temperature Interfaces

In this paper, we present and evaluate Ambiotherm, a wearable accessory for Head Mounted Displays (HMD) that provides thermal and wind stimuli to simulate real-world environmental conditions, such as ambient temperatures and wind conditions, to enhance the sense of presence in Virtual Reality (VR). Ambiotherm consists of a Ambient Temperature Module that is attached to the user's neck, a Wind Simulation Module focused towards the user's face, and a Control Module utilizing Bluetooth communication. We demonstrate Ambiotherm with two VR environments, a hot desert, and a snowy mountain, to showcase the different types of simulated environmental conditions. We conduct several studies to 1) address design factors of the system and 2) evaluate Ambiotherm's effect on factors related to a user's sense of presence. Our findings show that the addition of wind and thermal stimuli significantly improves sensory and realism factors, contributing towards an enhanced sense of presence when compared to traditional VR experiences.

> 在本文中，我们提出并评估Ambiotherm，头部可穿戴配件头盔显示器（HMD），模拟真实环境条件提供了热、风的刺激，如环境温度和风力条件，增强虚拟现实（VR）的存在感。ambiotherm由环境温度模块，连接到用户的脖子，风仿真模块针对用户的脸，和一个利用蓝牙通讯控制模块。我们展示了Ambiotherm的两个虚拟现实环境，一个炎热的沙漠，和一座雪山，展示模拟环境条件的不同类型。我们进行了一些研究，1）解决系统设计因素2）观察到用户的存在感相关因素的Ambiotherm效应。我们的研究结果表明，增加风和热刺激显着改善感官和现实主义因素，有助于增强的存在感相比，传统的VR经验。 article link

149. Multi-moji: Combining Thermal, Vibrotactile & Visual Stimuli to Expand the Affective Range of Feedback

SESSION:Temperature Interfaces

This paper explores the combination of multiple concurrent modalities for conveying emotional information in HCI: temperature, vibration and abstract visual displays. Each modality has been studied individually, but can only convey a limited range of emotions within two-dimensional valence-arousal space. This paper is the first to systematically combine multiple modalities to expand the available affective range. Three studies were conducted: Study 1 measured the emotionality of vibrotactile feedback by itself; Study 2 measured the perceived emotional content of three bimodal combinations: vibrotactile + thermal, vibrotactile + visual and visual + thermal. Study 3 then combined all three modalities. Results show that combining modalities increases the available range of emotional states, particularly in the problematic top-right and bottom-left quadrants of the dimensional model. We also provide a novel lookup resource for designers to identify stimuli to convey a range of emotions

> 本文探讨了在HCI中传递情感信息的多种并发方式：温度、振动和抽象视觉显示器。每种模式都被单独研究，但只能在二维价激发空间中表达有限的情绪范围。本文首次系统地结合多种模式，扩大现有的情感范围。进行了三项研究：研究1测量振动触觉反馈的情感本身；研究2测量感知的情感内容三双峰组合：振动+振动+热，视觉和视觉+热。研究3然后结合所有三种模式。结果表明，组合模式增加了情绪状态的可用范围，特别是在维度模型的右上下象限中。我们还为设计师提供了一种新的查找资源来识别刺激来传达一系列的情绪。 article link

150. The Heat is On: A Temperature Display for Conveying Affective Feedback

SESSION:Temperature Interfaces

Previous research has investigated whether temperature can augment a range of media including music, images and video. We describe the first experiment to investigate whether temperature can augment emotion conveyed by text messages. A challenge in prior work has been ensuring users can discern different thermal signals. We present an improved technique for thermal feedback that uses an array of three thermal stimulators. We demonstrate that the Thermal Array Display (TAD) increases users' ability to identify temperatures within a narrower range, compared to using a single thermal stimulator. While text messages dominate valence in the absence of context for temperature, the TAD consistently conveys arousal, and can enhance arousal of text messages, especially those that are emotionally neutral. We discuss potential applications of augmenting text with temperature.

> 先前的研究已经调查了温度是否能增加包括音乐、图像和视频在内的各种媒体。我们描述了第一个实验，研究温度是否能增强文本信息传递的情感。以前工作中的一个挑战是确保用户能够辨别不同的热信号。我们目前的热反馈使用三热刺激阵列技术的改进。我们表明，热阵列显示（泰德）增加了用户的能力，以确定在较窄的范围内的温度，比使用一个单一的热刺激器。虽然在没有上下文温度的情况下，文本信息支配着配价，但它始终表达了唤醒，并能增强短信的兴奋性，尤其是那些情感中立的信息。我们讨论了用温度增强文本的潜在应用。 article link

151. Exploring Novice Approaches to Smartphone-based Thermographic Energy Auditing: A Field Study

SESSION:Temperature Interfaces

The recent integration of thermal cameras with commodity smartphones presents an opportunity to engage the public in evaluating energy-efficiency issues in the built environment. However, it is unclear how novice users without professional experience or training approach thermographic energy auditing activities. In this paper, we recruited 10

participants for a four-week field study of end-user behavior exploring novice approaches to semi-structured thermographic energy auditing tasks. We analyze thermographic imagery captured by participants as well as weekly surveys and post-study debrief interviews. Our findings suggest that while novice users perceived thermal cameras as useful in identifying energy-efficiency issues in buildings, they struggled with interpretation and confidence. We characterize how novices perform thermographic-based energy auditing, synthesize key challenges, and discuss implications for design.

> 最近，热摄像机与商品智能手机的集成为公众提供了一个机会，让公众参与评估建筑环境中的能源效率问题。然而，目前还不清楚如何新手用户无专业经验或训练方法热能源审计活动。在本文中，我们招募了10名参与者进行四周的实地研究用户行为探索热能源审计任务新手半结构化方法。我们分析参与者拍摄的热成像图像以及每周的调查和学习后汇报访谈。我们的研究结果表明，虽然新手用户认为热摄像机在识别建筑能效问题方面很有用，但他们却难以解释和信心。我们描述如何新手进行能源审计的热像，合成关键的挑战，并讨论对设计的影响。 article link

152. "People Are Either Too Fake or Too Real": Opportunities and Challenges in Tie-Based Anonymity

SESSION:Behavior in Online Communities

In recent years, several mobile applications allowed individuals to anonymously share information with friends and contacts, without any persistent identity marker. The functions of these "tie-based" anonymity services may be notably different than other social media services. We use semi-structured interviews to qualitatively examine motivations, practices and perceptions in two tie-based anonymity apps: Secret (now defunct, in the US) and Mimi (in China). Among the findings, we show that: (1) while users are more comfortable in self-disclosure, they still have specific practices and strategies to avoid or allow identification; (2) attempts for deidentification of others are prevalent and often elaborate; and (3) participants come to expect both negativity and support in response to posts. Our findings highlight unique opportunities and potential benefits for tie-based anonymity apps, including serving disclosure needs and social probing. Still, challenges for making such applications successful, for example the prevalence of negativity and bullying, are substantial.

> 近年来，一些移动应用程序允许个人匿名地与朋友和联系人共享信息，而无需任何持久身份标识。这些“基于连接的”匿名服务的功能可能与其他社交媒体服务显著不同。我们采用半结构化访谈的定性研究的动机、行为和两系匿名应用的看法：秘密（现在已经死了，在美国）和Mimi（在中国）。调查结果中，我们发现：（1）当用户自我表露更舒适，他们仍然有具体的做法和策略来避免或允许鉴定；（2）为deidentification别人尝试普遍和经常的阐述；和（3）的参与者来期待消极响应柱子支撑。我们的发现强调了基于网络的匿名应用程序的独特的机会和潜在的好处，包括服务披露的需要和社会探测。然而，使这种应用成功的挑战，例如消极和欺凌的盛行，是非常重要的。 article link

153. Environment-Scale Fabrication: Replicating Outdoor Climbing Experiences

SESSION:Connect, Move, Touch, Build

Despite rapid advances in 3D printing, fabricating large, durable and robust artifacts is impractical with current technology. We focus on a particularly challenging environment-scale artifact: rock climbing routes. We propose a prototype fabrication method to replicate part of an outdoor climbing route and enable the same sensorimotor experience in an indoor gym. We start with 3D reconstruction of the rock wall using multi-view stereo and use reference videos of a climber in action to identify localized rock features that are necessary for ascent. We create 3D models akin to traditional indoor climbing holds, fabricated using rapid prototyping, molding and casting techniques. This results in robust holds accurately replicating the features and configuration of the original rock route. Validation was performed on two rock climbing sites in New Hampshire and Utah. We verified our results by comparing climbers' moves on the indoor replicas and original outdoor routes.

> 尽管3D打印技术有了长足的进步，但是用当前的技术制造大型、耐用和健壮的工件是不切实际的。我们专注于一个特别具有挑战性的环境尺度工件：攀岩路线。我们提出了一个原型制作方法来复制一个室外攀登路线的一部分，使室内体育馆的感觉体验相同。我们首先利用多视角立体对岩壁进行三维重建，并使用登山者的参考录像，以确定攀登所需的局部岩石特征。我们创建了类似于传统室内攀岩架的3D模型，采用快速成型、成型和铸造技术制造。这就使得它能准确地复制原岩路线的特征和结构。在新罕布什尔州和犹他两个攀岩场进行了验证。我们通过比较攀岩者在室内复制品和原始户外路线上的移动，验证了我们的研究结果。 article link

154. Why Tangibility Matters: A Design Case Study of At-Risk Children Learning to Read and Spell

SESSION:Connect, Move, Touch, Build

Tangibles may be effective for reading applications. Letters can be represented as 3D physical objects. Words are spatially organized collections of letters. We explore how tangibility impacts reading and spelling acquisition for young Anglophone children who have dyslexia. We describe our theory-based design rationale and present a mixed-methods case study of eight children using our PhonoBlocks system. All children made significant gains in reading and spelling on trained and untrained (new) words, and could apply all spelling rules a month later. We discuss the design features of our system that contributed to effective learning processes, resulting in successful learning outcomes: dynamic colour cues embedded in 3D letters, which can draw attention to how letter(s) position changes their sounds; and the form of 3D tangible letters, which can enforce correct letter orientation and enable epistemic strategies in letter organization that simplify spelling tasks. We conclude with design guidelines for tangible reading systems.

> Tangibles可能是有效的阅读应用。字母可以表示为三维物理对象。单词是空间组织的字母集合。我们将探讨如何具体影响阅读和拼写收购年轻的英语为母语的儿童有阅读障碍的人。我们描述的理论为基础的设计原理和目前的八个孩子phonoblocks系统使用混合方法的案例研究。所有的孩子在训练和未训练（新单词）的阅读和拼写上都有很大的进步，一个月后可以应用所有的拼写规则。我们讨论我们的系统，有助于有效的学习过程的设计特点，导致成功的学习成果：嵌入三维信动态颜色线索，可以提请注意字母（S）位置变化的声音；和三维有形的信件的形式，它可以执行正确的字母定位使信组织简化拼写任务的认知策略。我们的结论是有形阅读系统的设计准则。 article link

155. WeBuild: Automatically Distributing Assembly Tasks Among Collocated Workers to Improve Coordination

SESSION:Connect, Move, Touch, Build

Physical construction and assembly tasks are often carried out by groups of collocated workers, and they can be difficult to coordinate. Group members must spend time deciding how to split up the task, how to assign subtasks to each other, and in what order subtasks should be completed. Informed by an observational study examining group coordination challenges, we built a task distribution system called WeBuild. Our custom algorithm dynamically assigns subtasks to workers in a group, taking into account factors such as the dependencies between subtasks and the skills of each group member. Each worker views personalized step-by-step instructions on a mobile phone, while a dashboard visualizes the entire process. An initial study found that WeBuild reduced the start-up time needed to coordinate and begin a task, and provides direction for future research to build on toward improving group efficiency and coordination for complex tasks.

> 物理结构和装配任务通常由一组并置的工人进行，它们很难协调。小组成员必须花时间决定如何分割任务，如何分配任务给对方，以什么样的顺序任务要完成。通过观察研究组的协调方面的挑战，我们建立了一个任务分配系统构建。我们的自定义算法动态分配任务在一组工人，考虑的因素，如任务和每个小组成员的技能之间的依赖关系。每个工人一步一步的指示意见，个性化的手机上，在仪表板的整个过程可视化。初步研究发现，减少需要协调和开始一个任务的启动时间，并提供未来研究方向的基础上对提高复杂任务组的工作效率和协调。 article link

156. Pressure-Based Gain Factor Control for Mobile 3D Interaction using Locally-Coupled Devices

SESSION:Connect, Move, Touch, Build

We present the design and evaluation of pressure-based interactive control of 3D navigation precision. Specifically, we examine the control of gain factors in tangible 3D interactions using locally-coupled mobile devices. By focusing on pressure as a separate input channel we can adjust gain factors independently from other input modalities used in 3D navigation, in particular for the exploration of 3D visualisations. We present two experiments. First, we determined that people strongly preferred higher pressures to be mapped to higher gain factors. Using this mapping, we compared pressure with rate control, velocity control, and slider-based control in a second study. Our results show that pressure-based gain control allows people to be more precise in the same amount of time compared to established input modalities. Pressure-based control was also clearly preferred by our participants. In summary, we demonstrate that pressure facilitates effective and efficient precision control for mobile 3D navigation.

> 介绍了基于压力的三维导航精度交互控制的设计与评价。具体来说，我们研究了利用本地耦合移动设备控制有形3D交互中的增益因子。以压力作为一个单独的输入通道可以调节增益因素独立于其他输入方式应用于三维导航，特别是三维可视化的探索。我们提出了两个实验。首先，我们确定人们强烈倾向于更高的压力被映射到更高的增益因子。利用这个映射，我们在第二项研究中比较了压力与速率控制、速度控制和基于滑块的控制。我们的研究结果表明，基于压力的增益控制允许人们在相同的时间内比既定的输入方式更精确。我们的参与者显然更倾向于基于压力的控制。总之，我们证明了压力有助于移动3D导航的高效和精确的精确控制。 article link

157. The Effect of Peripheral Micro-tasks on Crowd Ideation

SESSION:Crowd-powered Systems

Research has explored different ways of improving crowd ideation, such as presenting examples or employing facilitators. While such support is usually generated through peripheral tasks delegated to crowd workers who are not part of the ideation, it is possible that the ideators themselves could benefit from the extra thought involved in doing them. Therefore, we iterate over an ideation system in which ideators can perform one of three peripheral tasks (rating originality and usefulness, similarity, or idea combination) on demand. In controlled experiments with workers on Mechanical Turk, we compare the effects of these secondary tasks to simple idea exposure or no support at all, examining usage of the inspirations, fluency, breadth, and depth of ideas generated. We find tasks to be as good or better than exposure, although this depends on the period of ideation and the fluency level. We also discuss implications of inspiration size, homogeneity, and frequency.

> 研究探索了提高群体思维能力的不同途径，如示范或聘用主持人。而这种支持通常是通过外周的任务委托给人群工人不是思维的一部分所产生的，它是可能的，该自己能从额外的思考参与中受益。因此，我们重申了一个意念系统，该可执行一个三周的任务（评级的独创性和实用性，相似性，或思想的组合）的需求。在对机械土耳其人的控制实验中，我们比较了这些次要任务对简单想法暴露或根本不支持的影响，考察了灵感、流畅性、广度和深度产生的想法的用法。我们发现任务要比曝光更好或更好，但这取决于构思时间和流畅程度。我们还讨论了灵感的大小，同质性和频率的影响。 article link

158. Respeak: A Voice-based, Crowd-powered Speech Transcription System

SESSION:Crowd-powered Systems

Speech transcription is an expensive service with high turnaround time for audio files containing languages spoken in developing countries and regional accents of well-represented languages. We presentRespeak- a voice-based, crowd-powered system that capitalizes on the strengths of crowdsourcing and automatic speech recognition (instead of typing) to transcribe such audio files. We createdRespeakand optimized its design through a series of cognitive experiments. We deployed it with 25 university students in India who completed 5464 micro-transcription tasks, transcribing 55 minutes of widely-varied audio content, and collectively earning USD 46 as mobile airtime. TheRespeakengine aligned the transcript generated by five randomly selected users to transcribe Hindi and Indian English audio files with a word error rate (WER) of 8.6% and 15.2%, respectively. The cost of speech transcription was USD 0.83 per minute with a turnaround time of 39.8 hours, substantially less than industry standards. Using a mixed-methods analysis of cognitive experiments, system performance and qualitative interviews, we evaluateRespeak'sdesign, user experience, strengths, and weaknesses. Our findings suggest thatRespeakimproves the quality of speech transcription while enhancing the earning potential of low-income populations in resource-constrained settings.

> 语音转录是一种昂贵的服务，具有发展中国家所使用语言的音频文件的高周转时间和具有代表性语言的区域口音。我们presentrespeak -基于语音的，人群的供电系统，利用众包和自动语音识别的优势（而不是打字）把这些音频文件。我们createdrespeakand通过一系列认知实验的优化设计。我们部署这25大学的学生在印度完成5464微转录任务，录制55分钟的广泛多样的音频内容，和集体收入46美元的移动电话。therespeakengine对齐记录由五个随机选择的用户生成的转录印地语和印度英语用词错误率（WER）音频文件的8.6%和15.2%，分别。语音转录费用为每分钟0.83美元，周转时间为39.8小时，大大低于行业标准。使用混合方法分析认知实验，系统性能和定性访谈，我们evaluaterespeak'sdesign，用户体验，优势，劣势。我们的研究结果表明thatrespeakimproves语音转录的质量的同时，提高在资源有限的环境中的低收入人群的收入潜力。 article link

159. Subcontracting Microwork

SESSION:Crowd-powered Systems

Mainstream crowdwork platforms treat microtasks as indivisible units; however, in this article, we propose that there is value in re-examining this assumption. We argue that crowdwork platforms can improve their value proposition for all stakeholders by supporting subcontracting within microtasks. After describing the value proposition ofsubcontracting, we then define three models for microtask subcontracting:real-time assistance, task management, andtask improvement, and reflect on potential use cases and implementation considerations associated with each. Finally, we describe the outcome of two tasks on Mechanical Turk meant to simulate aspects of subcontracting. We reflect on the implications of these findings for the design of future crowd work platforms that effectively harness the potential of subcontracting workflows.

> 主流crowdwork平台对待microtasks作为不可分割的单位；然而，在这篇文章中，我们认为这是在重新审视这个假设值。我们认为，crowdwork平台可以提高所有利益相关者的支持分包范围内microtasks价值命题。在描述了价值主张转包，然后我们定义为微任务分包的三种模式：实时的协助，任务管理，任务的改善，反映潜在的使用案例和实施相关的各因素。最后，我们描述了两个关于机械土耳其人的任务，目的是模拟分包的各个方面。我们反思这些发现对未来人群工作平台设计的影响，有效地利用了外包工作流的潜

> 力。 article link

160. Scalable Annotation of Fine-Grained Categories Without Experts

SESSION:Crowd-powered Systems

We present a crowdsourcing workflow to collect image annotations for visually similar synthetic categories without requiring experts. In animals, there is a direct link between taxonomy and visual similarity: e.g. a collie (type of dog) looks more similar to other collies (e.g. smooth collie) than a greyhound (another type of dog). However, in synthetic categories such as cars, objects with similar taxonomy can have very different appearance: e.g. a 2011 Ford F-150 Supercrew-HD looks the same as a 2011 Ford F-150 Supercrew-LL but very different from a 2011 Ford F-150 Supercrew-SVT. We introduce a graph based crowdsourcing algorithm to automatically group visually indistinguishable objects together. Using our workflow, we label 712,430 images by ~1,000 Amazon Mechanical Turk workers; resulting in the largest fine-grained visual dataset reported to date with 2,657 categories of cars annotated at 1/20th the cost of hiring experts.

> 我们提出了一个众包的工作流程，收集图像注释的视觉相似的合成类别，而不需要专家。在动物中，有分类和视觉相似性之间的直接联系：如牧羊犬（狗的类型）看起来更类似于其他的牧羊犬（如光滑的牧羊犬）比“灰狗”（另一种类型的狗）。然而，在合成类，如汽车，类似的分类的对象可以有非常不同的外观：如2011福特F-150皮卡HD看起来一样的2011福特F-150皮卡将从2011福特F-150皮卡SVT非常不同。我们介绍了一个基于图的众包算法来自动分组视觉上无法区分的对象。使用我们的工作流程，我们将712430个图像标记为1000个亚马逊机械特克工人；结果是迄今为止报告的最大的细粒度视觉数据集，其中有2657类汽车标注为1 / 第二十，雇用专家的费用。 article link

161. The Effect of Performance Feedback on Social Media Sharing at Volunteer-Based Online Experiment Platforms

SESSION:Crowd-powered Systems

As an alternative to online labor markets, several platforms recruit unpaid online volunteers to participate in behavioral experiments that provide personalized feedback. These platforms rely on word-of-mouth sharing by previous participants for recruitment of new participants. We analyzed the impact of performance feedback provided at the end of an experiment on 81,131 participants' sharing behavior. We show that higher performing participants share significantly more. We also show that self-verification has a moderating effect: people who expected to do poorly are not affected by a high score, but people who expected to do as well as others or better, are. In a second experiment, we evaluate three distinct social comparison designs for the presentation of the results. As expected, the design that most emphasized participants' relative success led to most sharing. Contrary to our expectations, people who expected to do poorly benefited from the most optimistic social comparison more than participants who expected to do better than others.

> 作为在线劳动力市场的替代品，一些平台招募无偿的在线志愿者参与提供个性化反馈的行为实验。这些平台依靠先前参与者的口碑分享来招募新的参与者。我们分析了实验结束时提供的绩效反馈对81131个参与者分享行为的影响。我们发现高绩效的参与者分享更多。我们还证明了自我验证具有调节作用：期望做得不好的人不会受到高分的影响，但期望做得比别人好或更好的人是。在第二个实验中，我们评估了三种不同的社会比较设计来呈现结果。正如预期的那样，最强调参与者相对成功的设计导致了大部分共享。与我们的期望相反，期望做得不好的人受益于最乐观的社会比较，而不是期望做得比别人好的人。 article link

162. Toward Realistic Hands Gesture Interface: Keeping it Simple for Developers and Machines

SESSION:Gesture as Input

Development of a rich hand-gesture-based interface is currently a tedious process, requiring expertise in computer vision and/or machine learning. We address this problem by introducing a simple language for pose and gesture description, a set of development tools for using it, and an algorithmic pipeline that recognizes it with high accuracy. The language is based on a small set of basic propositions, obtained by applying four predicate types to the fingers and to palm center: direction, relative location, finger touching and finger folding state. This enables easy development of a gesture-based interface, using coding constructs, gesture definition files or an editing GUI. The language is recognized from 3D camera input with an algorithmic pipeline composed of multiple classification/regression stages, trained on a large annotated dataset. Our experimental results indicate that the pipeline enables successful gesture recognition with a very low computational load, thus enabling a gesture-based interface on low-end processors.

> 开发一个丰富的手势为基础的接口是目前一个繁琐的过程，需要在计算机视觉和/或机器学习的专业知识。我们解决这个问题，通过引入一个简单的语言姿势和手势描述，一套开发工具，使用它，和一个算法管道，承认它具有很高的准确性。该语言是基于一套小的基本命题，通过应用四个谓词类型的手指和手掌中心：方向，相对位置，手指触摸和手指折叠状态。这使得可以轻松地开发基于手势的界面，使用编码结构、手势定义文件或编辑GUI。该语言是从三维摄像机输入识别的算法管道组成的多个分类/回归阶段，受过训练的大注释数据集。我们的实验结果表明，流水线能够成功的手势识别，具有非常低的计算负载，从而使基于手势的接口在低端处理器上。 article link

163. Memory in Motion: The Influence of Gesture- and Touch-Based Input Modalities on Spatial Memory

SESSION:Gesture as Input

People's ability to remember and recall spatial information can be harnessed to improve navigation and search performances in interactive systems. In this paper, we investigate how display size and input modality influence spatial memory, especially in relation to efficiency and user satisfaction. Based on an experiment with 28 participants, we analyze the effect of three input modalities (trackpad, direct touch, and gesture-based motion controller) and two display sizes (10.6" and 55") on people's ability to navigate to spatially spread items and recall their positions. Our findings show that the impact of input modality and display size on spatial memory is not straightforward, but characterized by trade-offs between spatial memory, efficiency, and user satisfaction.

> 人们可以利用记忆和回忆空间信息的能力来提高交互式系统中的导航和搜索性能。本文研究了显示尺寸和输入方式对空间记忆的影响，特别是对效率和用户满意度的影响。基于一项有28人参加的实验中，我们分析三输入方式的影响（触控板，直接触摸和基于手势的运动控制器）和显示尺寸（10.6“和55”）对人们的浏览空间扩散项和召回他们的位置的能力。我们的研究结果表明，输入模式和显示大小对空间记忆的影响并不直接，但其特点是空间记忆、效率和用户满意之间的权衡。 article link

164. EarFieldSensing: A Novel In-Ear Electric Field Sensing to Enrich Wearable Gesture Input through Facial Expressions

SESSION:Gesture as Input

EarFieldSensing (EarFS)is a novel input method for mobile and wearable computing using facial expressions. Facial muscle movements induce both electric field changes and physical deformations, which are detectable with electrodes placed inside the ear canal. The chosen ear-plug form factor is rather unobtrusive and allows for facial gesture

recognition while utilizing the close proximity to the face. We collected 25 facial-related gestures and used them to compare the performance levels of several electric sensing technologies (EMG, CS, EFS,EarFS) with varying electrode setups. Our developed wearable fine-tuned electric field sensing employs differential amplification to effectively cancel out environmental noise while still being sensitive towards small facial-movement-related electric field changes and artifacts from ear canal deformations. By comparing a mobile with a stationary scenario, we found thatEarFScontinues to perform better in a mobile scenario. Quantitative results showEarFSto be capable of detecting a set of 5 facial gestures with a precision of 90% while sitting and 85.2% while walking. We provide detailed instructions to enable replication of our low-cost sensing device. Applying it to different positions of our body will also allow to sense a variety of other gestures and activities.

> earfieldsensing（earfs）是一种新型的移动和可穿戴计算使用面部表情输入法。面部肌肉的运动诱发电场变化和物理变形，这是可检测的电极放置在耳道内。所选择的耳塞形状因子是相当不显眼的，并允许面部手势识别，同时利用接近的脸。我们收集了25面相关的手势并用它们来比较几种电传感技术的性能水平（EMG，CS，EFS，EarFS）与不同的电极装置。我们开发的可穿戴微调电场传感采用差分放大，有效地消除了环境噪声，同时仍然对小的面部运动相关的电场变化和耳道变形的文物敏感。用一个固定的情况下比较移动，我们发现thatearfscontinues在移动的情况下更好地执行。定量的结果showearfsto能够检测5个一组的面部表情与精度90%坐85.2%而走。我们提供了详细的说明，使我们的低成本传感设备的复制。把它应用到身体的不同部位，也可以感知到其他各种姿势和活动。 article link

165. EchoFlex: Hand Gesture Recognition using Ultrasound Imaging

SESSION:Gesture as Input

Recent improvements in ultrasound imaging enable new opportunities for hand pose detection using wearable devices. Ultrasound imaging has remained under-explored in the HCI community despite being non-invasive, harmless and capable of imaging internal body parts, with applications including smart-watch interaction, prosthesis control and instrument tuition. In this paper, we compare the performance of different forearm mounting positions for a wearable ultrasonographic device. Location plays a fundamental role in ergonomics and performance since the anatomical features differ among positions. We also investigate the performance decrease due to cross-session position shifts and develop a technique to compensate for this misalignment. Our gesture recognition algorithm combines image processing and neural networks to classify the flexion and extension of 10 discrete hand gestures with an accuracy above 98%. Furthermore, this approach can continuously track individual digit flexion with less than 5% NRMSE, and also differentiate between digit flexion at different joints.

> 最近改进的超声成像技术为穿戴式设备进行手位检测提供了新的机会。尽管非侵入性的、无害的和能够成像身体内部部件的超声成像技术仍在探索之中，但它的应用包括智能手表交互、假肢控制和仪器收费。在本文中，我们比较了不同的前臂安装位置可穿戴式超声装置的性能。位置在人体工程学和性能方面起着基础性的作用，因为解剖特征在不同的位置上有所不同。我们还研究了由于交叉会话位置偏移造成的性能下降，并开发了一种补偿这种失调的技术。我们的手势识别算法结合图像处理和神经网络对10个离散手势的弯曲和伸展进行分类，精确度在98%以上。此外，这种方法可以连续不少于5% NRMSE追踪个别手指屈曲，并区分不同关节屈曲位。 article link

166. Virtuosos on the Screen: Playing Virtual Characters Like Instruments in Competitive Super Smash Bros. Melee

SESSION:Human Performance Gaming

Previous research on virtual sociality in games suggests that players use custom avatars to reflect, alter, and perform new identities in digital spaces. However, this study explores an alternative theory of social performance by analyzing a competitive game, Super Smash Bros. Melee, where players face off in timed matches and interact through pre-designed characters. This study shows how Melee players treat virtual characters as performative instruments, similar to the violin or the piano. In forum posts and player-created media, Melee players emphasize the need to train one's hands, eyes, and mind in order to master a character's complexity and express style and skills in live matches. Instrumental embodiment in a competitive game like Melee thus positions players as virtuosos who perform for perceptive audiences. This research points to a range of ways that players may relate to virtual bodies, connected to distinct kinds of social activities.

> 先前对游戏中虚拟社交性的研究表明，玩家在数字空间中使用自定义化身来反映、改变和执行新的身份。然而，这项研究通过分析一场竞争性的游戏——超级兄弟混战，探索了一种另类的社会表现理论：玩家在定时比赛中面对对手，通过预先设计的角色进行互动。这项研究表明，近战玩家对虚拟人物的表演乐器，类似于小提琴或钢琴。在论坛帖子和玩家创建的媒体中，近战玩家强调需要训练一个人的手、眼睛和心灵，以便掌握角色的复杂性，并在现场比赛中表达风格和技能。在一个竞争的游戏喜欢近战因此位置球员谁执行感知观众大师工具体现。这项研究指出玩家可能涉及到与各种社会活动有关的虚拟身体的一系列方法。 article link

167. Designing Leaderboards for Gamification: Perceived Differences Based on User Ranking, Application Domain, and Personality Traits

SESSION:Human Performance Gaming

Leaderboards, a common gamification technique, are used to enhance engagement through social comparisons. Prior research has demonstrated the overall utility of leaderboards but has not examined their effectiveness when individuals are ranked at particular levels or when the technique is applied in different application domains, such as social networking, fitness, or productivity. In this paper, we present a survey study investigating how preferences for leaderboards change based on individual differences (personality traits), ranking, social scoping, and application domains. Our results show that a respondent's position on the leaderboard had important effects on their perception of the leaderboard and the surrounding app, and that participants rated leaderboards most favorably in fitness apps and least favorably in social networking contexts. More extraverted people reported more positive experiences with leaderboards despite their ranking or the application domain. We present design implications for creating leaderboards targeted at different domains and for different audiences.

> 排行榜，一个共同的游戏化技术，用于通过社会比较，提升敬业度。以前的研究已经表明，排行榜的整体效用但未进行有效的当一个人被排在特定水平或当技术应用于不同的应用领域，如社交、健身，或生产力。在本文中，我们提出了一个调查研究如何喜好排行榜的变化根据个体差异（人格特质），排名，社交范围和应用领域。我们的研究结果显示，受访者的位置在排行榜上已经和周围的应用程序在他们的看板感知重要影响，而参与者排行榜最有利的健身应用程序和最有利的社交环境。更外向的人报道的排行榜更积极的经验，尽管他们的排名或应用领域。我们提出创建针对不同领域、不同受众的排行榜设计的影响。 article link

168. Inferring Motion Direction using Commodity Wi-Fi for Interactive Exergames

SESSION:Human Performance Gaming

In-air interaction acts as a key enabler for ambient intelligence and augmented reality. As an increasing popular example, exergames, and the alike gesture recognition applications, have attracted extensive research in designing accurate, pervasive and low-cost user interfaces. Recent advances in wireless sensing show promise for a ubiquitous

gesture-based interaction interface with Wi-Fi. In this work, we extract complete information of motion-induced Doppler shifts with only commodity Wi-Fi. The key insight is to harness antenna diversity to carefully eliminate random phase shifts while retaining relevant Doppler shifts. We further correlate Doppler shifts with motion directions, and propose a light-weight pipeline to detect, segment, and recognize motions without training. On this basis, we presentWiDance, a Wi-Fi-based user interface, which we utilize to design and prototype a contactless dance-pad exergame. Experimental results in typical indoor environment demonstrate a superior performance with an accuracy of 92%, remarkably outperforming prior approaches.

> 在空中交互是环境智能和增强现实的关键推动者。作为一种日益流行的例子，exergames，和相同的手势识别应用，有设计准确，引起了广泛的研究，普遍的和低成本的用户界面。无线传感方面的最新进展显示了一种基于Wi-Fi的无处不在的手势交互界面的前景。在这项工作中，我们只利用商品Wi-Fi提取运动诱导多普勒频移的完整信息。关键的见解是利用天线的多样性，以仔细消除随机相位偏移，同时保留相关多普勒频移。我们进一步将多普勒频移与运动方向联系起来，提出了一种轻量的流水线来检测、分割和识别运动而不需要训练。在此基础上，我们presentwidance，基于用户界面的Wi-Fi，我们利用与原型接触舞蹈垫exergame设计。在典型室内环境中的实验结果显示出了优越的性能，准确率为92%，明显优于先前的方法。 article link

169. Be Me or Be Mii?: A Study of Self-Presentation and Interaction in the Miitomo Mobile Application

SESSION:Human Performance Gaming

In this study, we consider what Nintendo's widely downloaded Miitomo mobile application, which simultaneously promotes non-idealized self-fictionalization and authentic self-presentation, can suggest to us about self-presentation and technology design. Ten groups of four friends each (N=40), all novice users, engaged with Miitomo for one week, and completed supplementary pre- and post-use surveys. The data were analyzed to assess the extent to which participants' engagement in Miitomo reflected their "real life" selves and correlated with in-app and "real life" features, respectively. Although most participants believed that their behaviors within the app accurately reflected their "true selves," we found that in-app traits generally correlated more strongly with Miitomo engagement patterns than did users' "real life" traits and qualities. We discuss implications for social network and online community design, and propose future plans to study authenticity and self-distancing in online self-presentation.

> 在这项研究中，我们认为任天堂的广泛miitomo下载移动应用，同时促进了非理想化的自我虚构和真实的自我介绍，可以建议我们自我介绍和技术设计。十四组（n = 40）的每一个朋友，所有的新手用户，有一周的Miitomo订婚，并完成补充前和使用后的调查。对数据进行分析评估，在miitomo参与者的参与反映了他们的“现实生活”的自我，与APP和“现实生活”特征的程度，分别。虽然大多数与会者认为，在应用程序中他们的行为准确地反映他们的“真正的自我，我们发现在应用特征更强烈的相关miitomo参与模式相比，用户的“现实生活”的特征与特性。我们讨论了社交网络和在线社区设计的影响，并提出了未来的计划研究的真实性和自我疏远的在线自我介绍。 article link

170. Why Players use Pings and Annotations in Dota 2

SESSION:Human Performance Gaming

Groupware research has long focused on representing gestures as a means to facilitate collaboration. However, this work has not led to wide support of gesturing in commercial groupware systems. In contrast, Dota 2, a popular MOBA game, provides two frequently-used gesturing tools: annotations - freely drawn lines on top of the gamespace - and pings - a combination of animation and sound indicating a point of interest. While gesturing tools are important for quickly coordinating with teammates in Dota 2, there is little information about how and why people use them. To gather this information, we performed two complementary studies: an interaction analysis of eight game replays, and a survey of 167 experienced players. Our findings include: six distinct motivations for the use of gesturing tools; when and how frequently gesture motivations occur during games; and, that players find pings an essential tool for winning, but not annotations. Our findings provide new directions for the design of gesturing tools in groupware and online games.

> 群件研究长期以来一直专注于将手势表示为促进协作的一种手段。然而，这并没有导致比商业群件系统的广泛支持。相比之下，守卫遗迹2，一个流行的MOBA游戏，提供了两种常用的手势：注释工具随意画线在顶部的“博弈”空间和坪-结合了动画和声音指示点的兴趣。而手势工具快速协调守卫遗迹2的队友都是重要的，没有信息关于人们如何以及为什么使用它们。收集这些信息，我们进行了两种互补的研究：八比赛录像的相互作用分析，和167个有经验的玩家的调查。我们的研究结果包括：对手势工具的使用六不同的动机；当和比赛过程中发生的动机如何，动作频繁；玩家找到坪必不可少的工具，胜利，但不是注释。我们的发现提供了新的方向，为设计工具组件和在线游戏的手势。 article link

171. Unpacking Visible Light Communication as a Material for Design

SESSION:Interdisciplinary Techniques

Communication through visible light (VLC) is gaining ground as an alternative to traditional radio communication in many settings. Effectively using VLC in creative design processes may however be difficult as the material properties of VLC can be hard to grasp and therefore to use. This paper presents a design exploration where a set of artifacts was created to enable designers to play around with VLC and better understand its properties and their potential use for design. Each artifact was designed to illustrate a particular property of light communication ranging from inner workings of transmission protocols to properties of light in itself. The set was used in two small scale workshops where users played around with the artifacts and afterward were interviewed about their experiences. Interviews and observations from the workshops suggest that users gained insights into the material properties of light communication and were also inspired to think of creative uses for VLC based on those insights

> 通过可见光通讯（VLC）正在作为一种替代传统的无线电通信在许多设置。有效地使用VLC的创意设计过程可能是困难的为VLC的材料性质很难把握，因此使用。本文提出了一种设计探索一套文物是为了使设计师玩VLC和更好地了解它的特性和设计应用的潜力。每个工件都是为了说明光通信的一个特殊特性，从传输协议的内部工作到光本身的特性。这套产品在两个小规模的车间里使用，用户在那里玩这些手工制品，然后对他们的经历进行了采访。从车间的访谈和观察表明，用户获得的见解的光通信材料性能，也启发思考的VLC基于这些见解的创造性使用 article link

172. Tobiko: A Contact Array for Self-Configuring, Surface-Powered Sensors

SESSION:Interdisciplinary Techniques

This paper describes a contact array that outputs the maximum and minimum voltages at its contacts. The goal is to extract power for a detachable touch sensor, display, or other human-computer interaction (HCI) device that is attached to a surface by a user, and that does not have its own power source. Experimental results are shown for an array that has positive and negative outputs and a pass-through at each contact position. It solves the startup problem for a randomly-placed batteryless sensor patch or sticker, which can scan its ports to discover neighboring devices only after it obtains power. Applications include user-configurable electronic textile circuits, and new methods for prototyping and repairing large-area flexible circuits. This note describes construction of a 7x7 array, provides design rules, and examines the signal quality on two kinds of electronic surfaces.

> 本文描述了一种在其触点上输出最大和最小电压的接触阵列。我们的目标是为一个可拆卸的触摸传感器、显示器或其他人机交互（HCI）设备提取电源，该设备通过用户连接到表面，并且没有自己的电源。实验结果表明，阵列具有正和负输出，并且在每个接触位置都有一个通过。它解决了启动问题的一个随机放置无源传感器贴片或贴纸，它可以扫描端口发现周边设备后才获得力量。应用包括用户可配置的电子纺织电路，以及大面积柔性电路的原型和修复的新方法。本文描述了一个7x7阵列结构，提供设计规则，并检查信号质量的两种电子表面。 article link

173. Live Physiological Sensing and Visualization Ecosystems: An Activity Theory Analysis

SESSION:Interdisciplinary Techniques

Wearable sensing poses new opportunities to enhance personal connections to learning and authentic scientific inquiry experiences. In our work, we leverage the body and physical action as an engaging platform for learning through live physiological sensing and visualization (LPSV). Prior research suggests the potential of this approach, but was limited to single-session evaluations in informal environments. In this paper, we examine LPSV tools in a classroom environment during a four-day deployment. To highlight the complex interconnections between space, teachers, curriculum, and tool use, we analyze our data through the lens of Activity Theory. Our findings show the importance of integrating model-based representations for supporting exploration and analytic representations for scaffolding scientific inquiry. Activity Theory highlights leveraging life-relevant connections available within a physical space and considering policies and norms related to learners' physical bodies.

> 可穿戴传感为加强个人与学习的联系和真实的科学探究体验提供了新的机会。在我们的工作中，我们利用身体和身体动作作为学习参与平台通过现场生理感知和可视化（LPSV）。先前的研究表明这种方法的潜力，但仅限于非正式环境中的单个会话评估。在本文中，我们研究LPSV工具在课堂环境中的一个为期四天的部署。为了突出空间、教师、课程和工具使用之间的复杂联系，我们通过活动理论的镜头来分析我们的数据。我们的研究结果显示了支持基于模型的表示支持支架科学探究和分析陈述的重要性。活动理论强调在物理空间中利用与生命有关的联系，并考虑与学习者身体相关的政策和规范。 article link

174. Thin Grey Lines: Confrontations With Risk on Colorado's Front Range

SESSION:Interdisciplinary Techniques

This paper reports on two years of ethnographic observation of the science and politics of flood risk in Colorado, as well as design research that examines citizen interaction with expert knowledge about flooding in the region. We argue that the 100-year floodplain standard that inform maps produced by the USA Federal Emergency Management Agency (FEMA)'s National Floodplain Insurance Program (NFIP) represent a problematic form of discursive closure of scientific understanding of flood hazard. We show that in order to meet the requirements of the NFIP, this standard acts as a closure that conveys a certainty that the underlying science does not warrant and foreshortens dialogue on disaster risk and public understanding of flood hazard. Engaging with literature in science and technology studies and human-centered computing, we investigate design opportunities for resisting closure and supporting public formation through encounters with the uncertainty and complexities of risk information.

> 本文报告了两年来对科罗拉多洪灾风险的科学和政治的人种学观察，以及设计研究，探讨该地区与洪水有关的专家知识的公民互动。我们认为，100年的洪泛区的标准，通知由美国联邦急救管理署（FEMA）的全国地图漫滩保险计划（NFIP）代表一个有问题的科学理解话语的封闭形式的洪水灾害。我们发现，为了满足NFIP的要求，本标准作为一个封闭的传达一个确定的基础科学并不保证和缩短对话对灾害风险和洪水灾害的公众理解。本文以科学与技术研究为中心，以人为中心的计算为切入点，通过对风险信息的不确定性和复杂性的分析，探讨了抵制封闭和支持公共组织的设计机遇。 article link

175. Deconstructing Cosmetic Virtual Goods Experiences in Dota 2

SESSION:Interdisciplinary Techniques

Cosmetic items do not provide functional advantages in games, but, nevertheless, they play an important role in the overall player experience. Possessing predominantly socially-constructed dimensions of value, cosmetic items are chosen, discussed, assessed, and valuated in an ongoing iterative collaborative process by communities of players. In our study, we explore the case of Dota 2 and apply Topic Modeling to community-discussions data gathered from Reddit.com. We describe social experiences related to the valuation of cosmetic items in interaction and collision of various logics, including artificial scarcity, decomposition of visual effects, and connectedness to the game lore. Our findings connect the collective experience of players in the game and on online community platforms, suggesting that non-utility-based social value construction becomes an important part of game experience.

> 化妆品在游戏中没有提供功能上的优势，但是，它们在整个玩家体验中起着重要的作用。具有主要的社会建构层面的价值，化妆品的选择，讨论，评估，评价正在进行中的迭代过程协同的玩家社群。在我们的研究中，我们探讨了守卫遗迹2的案例和应用主题建模社区讨论Reddit.com收集数据。我们描述了与各种不同的逻辑相互作用和碰撞的化妆品项目的评估有关的社会经验，包括人工稀缺性、视觉效果的分解以及与游戏知识的关联性。我们的发现将玩家在游戏和在线社区平台上的集体经验联系起来，表明非基于效用的社会价值建构成为游戏体验的重要组成部分。 article link

176. Shift+Tap or Tap+LongPress?: The Upper Bound of Typing Speed on InScript

SESSION:Interdisciplinary Techniques

This paper presents the results of a within-subject longitudinal evaluation on Inscript keyboard, which is the national standard layout for Indian scripts. We studied the practical upper bound speed and accuracy as well as the effect of practice. Through longitudinal transcription task of 400 repeated attempts, we observed typing speeds for highly experienced users consistently peak close to 120 cpm i.e. 2.5 times that of fastest speeds reported in literature. Our analysis compared the lower bound times for Tap, Tap+LongPress and Shift+Tap, the three text input mechanisms in this keyboard. Among the two alternative methods, our findings established Tap+LongPress method to be faster than Shift+Tap method and almost equally accurate. Also, we derived a model which explains the influence of corrected errors and number of practice attempts on the typing speed.

> 本文提出了一种学科内的纵向评价INSCRIPT键盘结果，这是印度脚本国家标准布局。我们研究了实际的上限速度和精度以及实践的效果。通过400次重复尝试的纵向转录任务，我们观察到有经验的用户的打字速度一致峰值接近120 CPM，即文献报道的最快速度的2.5倍。我们分析比较了下界的次龙头，龙头+ longpress和Shift +点击，三文本输入机制在键盘。两种方法中，我们发现了自来水+ longpress方法要比Shift +点击的方法更快，几乎同样准确。此外，我们还建立了一个模型来解释修正错误和练习次数对打字速度的影响。 article link

177. Evaluation of Prototypes and the Problem of Possible Futures

SESSION:It Could Be This Way

There is a blind spot in HCI's evaluation methodology: we rarely consider the implications of the fact that a prototype can never be fully evaluated in a study. A prototype under study exists firmly in the present world, in the circumstances created in the study, but its real context of use is a partially unknown future state of affairs. This present-future gap is implicit in any evaluation of prototypes, be they usability tests, controlled experiments, or field trials. A carelessly designed evaluation may inadvertently evaluate the wrong futures, contexts, or user groups, thereby leading to false conclusions and expensive design failures. The essay analyses evaluation methodology from this perspective, illuminating how to mitigate the present-future gap.

> 在人机交互的评估方法中存在着一个盲点：我们很少考虑这样一个事实：在一项研究中，原型永远无法得到充分的评估。研究中的原型存在于当前的世界，在研究中所创造的环境中，但其真正的使用背景是部分未知的未来事态。这种未来的差距是隐含在任何评估原型，无论是可用性测试，控制实验，或现场试验。草率设计的评估可能会不经意地评估错误的未来、上下文或用户组，从而导致错误的结论和昂贵的设计失败。本文从这一角度分析评价方法，阐明如何缓解未来的差距。 article link

178. Situated Dissemination through an HCI Workplace

SESSION:It Could Be This Way

Researchers working in domains such as Research through Design and Feminist HCI have been questioning "dissemination practices" and their impact on our capacity to produce reflexive accounts of research in publications. This paper examines academic dissemination practices within HCI research communities from an institutional to individual level. We unpack the practice via a meta-review of recent literature published in CHI and other venues on 'What is HCI?'. We review the core text on this debate and other similar discussions on HCI methodologies and reflexive accounts of research in domains such as 'Research through Design' and 'Feminist HCI'. We highlight the importance of practicing reflexivity through dissemination and introduce 'Research Fictions' in the form of video essays and live performances, produced by the first author with her colleagues, based on their HCI submissions. Through experimenting with alternative dissemination formats, we argue that our exploratory processes engender a practice of reflexivity within a research lab.

> 研究领域的研究人员，如通过设计和女性主义人机交互的研究，一直在质疑“传播实践”及其对我们在出版物中产生反思性研究报告的能力的影响。本文探讨了从机构到个人层面的HCI研究社区内的学术传播实践。我们通过最近在CHI和其他地点发表的关于“什么是人机交互”的文献的荟萃分析来总结实践。我们回顾了这场辩论的核心文本和其他关于HCI方法论的类似讨论以及在“设计研究”和“女权主义人机交互”领域的反思性研究报告。我们强调通过传播来实践反思性的重要性，并以她的互动作品为基础，由第一作者和她的同事们，以“视频散文”和现场表演的形式引入“研究小说”。通过实验与其他传播格式，我们认为，我们的探索过程产生了一个研究实验室内的自反性的实践。 article link

179. A Survey of the Trajectories Conceptual Framework: Investigating Theory Use in HCI

SESSION:It Could Be This Way

We present a case study of how Human-Computer Interaction (HCI) theory is reused within the field. We analyze the HCI literature in order to reveal the impact of one particular theory, the trajectories framework that has been cited as an example of both contemporary HCI theory and a strong concept that sits between theory and design practice. Our analysis of 60 papers that seriously engaged with trajectories reveals the purposes that the framework served and which parts of it they used. We compare our findings to the originally stated goals of trajectories and to subsequent claims of its status as both theory and strong concept. The results shed new light on what we mean by theory in HCI, including its relationship to practice and to other disciplines.

> 我们提出了一个案例研究如何人机交互（HCI）理论被重用的领域内。我们分析HCI文学，以揭示一个特定的理论的影响，轨迹框架，已被引用为一个例子，当代HCI理论和一个强大的概念，坐在理论和设计实践。我们认真分析了60篇与轨迹有关的论文，揭示了框架所服务的目的以及它们所使用的部分。我们将我们的研究结果与最初陈述的轨迹目标以及后来的理论和强有力的概念的主张相比较。这些结果揭示了我们在人机交互理论中的含义，包括它与实践以及其他学科的关系。 article link

180. ProtoMold: An Interactive Vacuum Forming System for Rapid Prototyping

SESSION:It Could Be This Way

In this paper, we propose a novel fabrication machine called ProtoMold, which uses interactive vacuum forming system for rapid prototyping. ProtoMold combines a dynamical shape-changing surface that consists of 12 × 8 linear actuators and a vacuum forming system. According to the shape of the surface, this system can mold various 2.5 dimensional objects quickly. Another characteristic of this system is that users can reuse molded objects and change their design; by applying tension and heat to a molded object, the object becomes flat and can be molded again. We also designed user several interaction methods for manipulating ProtoMold. In addition to loading predesigned data, the user can control the shape of the pin display directly using gesture input or physical objects.We propose several use scenarios for ProtoMold: changing the design of a plate based on objects placed on it, fabricating a facemask with a printed texture, and fabricating electrical devices with printed electronic circuits. By using this system, we conducted a user test and discuss the known limitations and potential applications of our system.

> 在本文中，我们提出了一种新的制造机器称为Protomold，采用互动式真空成型快速成型系统。Protomold结合动力形状变化的表面，由12×8线性执行器和真空成型系统。根据表面的形状，该系统可以快速成型各种2.5维物体。这个系统的另一个特点是用户可以重用成型的物体，改变他们的设计；通过将张力和热量施加到成型物体上，物体变得平坦，可以再次成型。我们还设计了几种交互方式用户操纵Protomold。除了加载预先设计好的数据，用户可以直接用手势控制输入或实物引脚显示的形状。我们提出了几个使用场景：改变Protomold放一盘基于对象的设计、制作与印刷纹理口罩，并与印刷电子电路制造电气设备。通过使用该系统，我们进行了用户测试，并讨论了我们的系统已知的局限性和潜在的应用。 article link

181. Extracting Gait Velocity and Stride Length from Surrounding Radio Signals

SESSION:Methods and Theories

Gait velocity and stride length are critical health indicators for older adults. A decade of medical research shows that they provide a predictor of future falls, hospitalization, and functional decline among seniors. However, currently these metrics are measured only occasionally during medical visits. Such infrequent measurements hamper the opportunity to detect changes and intervene early in the impairment process.In this paper, we develop a sensor that uses radio signals to continuously measure gait velocity and stride length at home. Our sensor hangs on a wall like a picture frame. It does not require the monitored person to wear or carry a device on her body. Our approach builds on recent advances in wireless systems which have shown that one can locate people based on how their bodies impact the surrounding radio signals. We demonstrate the accuracy of our method by comparing it to the gold standard in clinical tests, and the VICON motion tracking system. Our experience from deploying the sensor in 14 homes indicates comfort with the

technology and a high acceptance rate.

> 步态速度和步幅是老年人的重要健康指标。十年的医学研究表明，它们为老年人未来跌倒、住院和功能衰退提供了预测因素。然而，目前这些指标仅在就诊期间偶尔测量。这种罕见的测量妨碍了检测变化的机会，并在损伤过程早期进行干预。在本文中，我们开发了一种利用无线电信号连续测量在家中的步态速度和步幅的传感器。我们的传感器像镜框一样挂在墙上。它不要求被监视的人在她的身体上佩戴或携带装置。我们的方法建立在无线系统的最新进展上，它表明人们可以根据身体对周围无线电信号的影响来定位人们。我们通过比较它的金标准，在临床试验中证明了我们的方法的精度，和VICON动作跟踪系统。我们在14个家庭部署传感器的经验表明，这种技术的舒适性和高的接受率。 article link

182. Personas and Behavioral Theories: A Case Study Using Self-Determination Theory to Construct Overweight Personas

SESSION:Methods and Theories

Personas are a widely used tool to keep real users in mind, while avoiding stereotypical thinking in the design process. Yet, creating personas can be challenging. Starting from Cooper's approach for constructing personas, this paper details how behavioral theory can contribute substantially to the development of personas. We describe a case study in which Self-Determination Theory (SDT) is used to develop five distinctive personas for the design of a digital coach for sustainable weight loss. We show how behavioral theories such as SDT can help to understand what genuinely drives and motivates users to sustainably change their behavior. In our study, we used SDT to prepare and analyze interviews with envisioned users of the coach and to create complex, yet engaging and highly realistic personas that make users' basic psychological needs explicit. The paper ends with a critical reflection on the use of behavioral theories to create personas, discussing both challenges and strengths.

> 人物角色是一种被广泛使用的工具，可以让真正的用户记住，同时避免设计过程中的刻板思考。然而，创建人物角色可能是具有挑战性的。本文从库柏构建人物角色的方法入手，详细阐述了行为理论对人物角色发展的贡献。我们描述了在自我决定理论的案例研究（SDT）是用来开发的可持续减肥教练五个鲜明的人物角色设计的数字。我们如何行为的理论如SDT可以帮助了解真正的驱动和激励用户持续地改变他们的行为。在我们的研究中，我们使用SDT准备和分析与设想用户的教练访谈和创建复杂的，但参与和高度逼真的人物角色，让用户的基本心理需求明确。文章最后对使用行为理论创建人物角色进行了批判性的思考，讨论了挑战和优势。 article link

183. Designing for the "Universe of One": Personalized Interactive Media Systems for People with the Severe Cognitive Impairment Associated with Rett Syndrome

SESSION:Perspectives on Cognitive Impairment

The needs and capabilities of a person with severe disabilities are often so specific that designing for the person is like designing for a "universe of one." This project addresses this problem for women with Rett syndrome, a disorder accompanied by severe cognitive, communication, and motor impairment. The research team adapted participatory design techniques to work with five such women, and their families, to design and evaluate new assistive technology for these women. The process suggests a class of media-playing devices that would be generally useful to women with Rett syndrome: systems that can load multiple audio or video segments; be activated by many different switches; and respond instantly to switch-hits. As well, the systems should permit a caregiver to set the start and end time of each segment, and how the system advances through a sequence of segments. The paper also discusses patterns that were observed when collaborating with the families. For example, parents shared longstanding but untried ideas for new assistive technology; and expressed a strong interest in any device that would help their daughters do things for themselves.

> 一个有严重残疾的人的需要和能力往往是很特殊的，因为人的设计就像是一个“宇宙的一个设计。“这个项目地址与雷特综合征的女性的这个问题，一个障碍伴有严重的认知，沟通，和运动障碍。研究小组采用参与式设计技术，与五名这样的妇女及其家庭合作，为这些妇女设计和评估新的辅助技术。这一过程提出了一种媒体播放设备，这种设备对雷特综合症的女性通常是有用的：可以加载多个音频或视频段的系统；由许多不同的交换机激活；立即对交换机进行响应。同样，系统应该允许一个看护者设置每个片段的开始和结束时间，以及系统如何通过一系列的片段前进。本文还讨论了与家庭合作时所观察到的模式。例如，父母长期而尝试过新辅助技术思路；并表示任何设备，会帮助自己的女儿做自己的事情有强烈的兴趣。 article link

184. Supporting People with Dementia in Digital Social Sharing

SESSION:Perspectives on Cognitive Impairment

Sharing online is an important way in which people across the lifespan express themselves, maintain relationships, and connect with others. Yet, people with dementia are often not supported in engaging to the full extent of their abilities, particularly in their interaction with online technology. This paper presents a design case study that examines what it means todesign for agencyin online sharing involving individuals with dementia. Our work is situated in the context of art therapy for adults with dementia. We present the design and exploration of Moments, a system that allows individuals to share through artwork by manipulating their physical environment. We discuss how designing for agency calls attention to the ways in which the material workspace, including the tools we introduce, and the surrounding social context participate in the creation of agency.

> 分享在线是一种重要的方式，让人们在整个生活中表达自己，保持关系，并与他人联系。然而，痴呆症患者往往无法充分发挥他们的能力，特别是在他们与在线技术的互动中。本文提出了一种设计的案例研究，探讨是什么意思机构在线共享涉及个人痴呆设计。我们的工作是在痴呆症患者的艺术治疗的背景下进行的。我们提出的设计和探索的时刻，一个系统，允许个人分享通过艺术品通过操纵他们的物理环境。我们讨论了如何设计代理要求注意材料工作区，包括我们介绍的工具，以及周围的社会环境参与创建代理的方式。 article link

185. Care and Connect: Exploring Dementia-Friendliness Through an Online Community Commissioning Platform

SESSION:Perspectives on Cognitive Impairment

In this paper, we present "Care and Connect", a mobile application created through the App Movement platform that aims to identify and rate public places (e.g., parks, shops, cafes) on their 'dementia-friendliness' - their suitability for people with dementia and their carers. Care and Connect saw significant support in its early stages on the online platform, yet failed to engage participants in its design phase and deployment. To unpick this, we contribute an account of its initial use in the community, and then describe findings from research engagements with carers and people with dementia. These workshops used Care and Connect to structure discussions of participants' own experiences of dementia-friendliness, and uncovered themes of 1) trust, 2) exclusion versus inclusion, 3) duration and quality of time, and 4) empathy becoming action. Using this evidence, we advance an account of online community commissioning as a process which needs to understand not only the general issues ongoing in communities facing significant life challenges, but also the particularity of community members' experiences.

> 在本文中，我们提出了“护理与连接”，这是一个由应用程序移动平台创建的移动应用程序，旨在识别和评价公共场所（如公园、商店、咖啡馆）的“痴呆友好性”——它们适合痴呆患者及其照料者。关心和连接在在线平台的早期阶段获得了很大的支持，但未能让参与者参与其设计阶段和部署。要做到这些，我们的社区中首次使用一个帐户，然后描述研究结果与照顾者和老年痴呆症患者的研究活动。这些研讨会使用了关怀和连接的结构讨论参与者的自己的经验，老年痴呆症友好，并揭示了主题的1）信任，2）排斥与包容，3）时间和质量的时间，和4）移情成为行动。利用这一证据，我们提出了一个在线社区调试的过程，它不仅需要了解在面临重大生命挑战的社区中普遍存在的问题，而且需要了解社区成员经验的特殊性。 article link

186. A Critical Lens on Dementia and Design in HCI

SESSION:Perspectives on Cognitive Impairment

Designing new technologies with and for individuals with dementia is a growing topic of interest within HCI. Yet, predominant societal views contribute to the positioning of individuals with dementia as deficient and declining, and treat technology as filling a gap left by impairment. We present the perspective ofcritical dementiaas a way of reflecting on these views in the context of recent epistemological shifts in HCI. In addition to articulating how HCI can leverage the perspective of critical dementia, we present a case analysis of technology design in art therapy involving people with dementia aimed at challenging conventional narratives. This paper calls attention to and helps solidify an agenda for how the CHI community approaches dementia, design, and technology.

> 为老年痴呆症患者设计新的技术是HCI领域越来越受关注的课题。然而，主流的社会观点有助于将痴呆症患者定位为缺陷和衰退，并将技术视为填补缺陷留下的空白。我们目前的观点—dementiaas方式反映这些观点在近代认识论的转变背景下的人机交互。除了阐明人机交互如何利用关键性痴呆的观点外，我们还提供了一个病例分析技术设计，涉及痴呆症患者，旨在挑战传统的叙述。本文呼吁人们注意并帮助巩固一个关于CHI社区如何治疗痴呆症、设计和技术的议程。 article link

187. Stories from Survivors: Privacy & Security Practices when Coping with Intimate Partner Abuse

SESSION:Precautionary Behaviors

We present a qualitative study of the digital privacy and security motivations, practices, and challenges of survivors of intimate partner abuse (IPA). This paper provides a framework for organizing survivors' technology practices and challenges into three phases: physical control, escape, and life apart. This three-phase framework combines technology practices with three phases of abuse to provide an empirically sound method for technology creators to consider how survivors of IPA can leverage new and existing technologies. Overall, our results suggest that the usability of and control over privacy and security functions should be or continue to be high priorities for technology creators seeking ways to better support survivors of IPA.

> 我们对亲密伴侣虐待（IPA）幸存者的数字隐私和安全动机、做法和挑战进行了定性研究。本文提供了一个框架，将幸存者的技术实践和挑战分为三个阶段：物理控制、逃避和生命分离。这一三相框架将技术实践与三个滥用阶段相结合，为技术创造者提供一个经验丰富的方法，以考虑IPA的幸存者如何利用新技术和现有技术。总的来说，我们的研究结果表明，对隐私和安全功能的可用性和控制应该是或继续是寻求更好地支持IPA幸存者的技术创造者的高度优先事项。 article link

188. Self-Confidence Trumps Knowledge: A Cross-Cultural Study of Security Behavior

SESSION:Precautionary Behaviors

Computer security tools usually provide universal solutions without taking user characteristics (origin, income level, ...) into account. In this paper, we test the validity of using such universal security defenses, with a particular focus on culture. We apply the previously proposed Security Behavior Intentions Scale (SeBIS) to 3,500 participants from seven countries. We first translate the scale into seven languages while preserving its reliability and structure validity. We then build a regression model to study which factors affect participants' security behavior. We find that participants from different countries exhibit different behavior. For instance, participants from Asian countries, and especially Japan, tend to exhibit less secure behavior. Surprisingly to us, we also find that actual knowledge influences user behavior much less than user self-confidence in their computer security knowledge. Stated differently, what people think they know affects their security behavior more than what they do know.

> 计算机安全工具通常提供通用解决方案而不考虑用户特征（来源、收入水平、……）。在本文中，我们测试使用这种普遍的安全防御的有效性，特别侧重于文化。我们将先前提出的安全行为意向量表（塞比什）3500名来自七个国家。我们首先将尺度转换成七种语言，同时保持其可靠性和结构效度。然后建立一个回归模型来研究影响参与者安全行为的因素。我们发现来自不同国家的参与者表现出不同的行为。例如，来自亚洲国家，尤其是日本的参与者往往表现出不那么安全的行为。令人惊讶的是，我们还发现，实际的知识影响用户的行为远远低于用户的自信在他们的计算机安全知识。不同的是，人们认为他们知道的影响他们的安全行为比他们知道的更多。 article link

189. What Do We Really Know about How Habituation to Warnings Occurs Over Time?: A Longitudinal fMRI Study of Habituation and Polymorphic Warnings

SESSION:Precautionary Behaviors

A major inhibitor of the effectiveness of security warnings is habituation: decreased response to a repeated warning. Although habituation develops over time, previous studies have examined habituation and possible solutions to its effects only within a single experimental session, providing an incomplete view of the problem. To address this gap, we conducted a longitudinal experiment that examines how habituation develops over the course of a five-day workweek and how polymorphic warnings decrease habituation. We measured habituation using two complementary methods simultaneously: functional magnetic resonance imaging (fMRI) and eye tracking.Our results show a dramatic drop in attention throughout the workweek despite partial recovery between workdays. We also found that the polymorphic warning design was substantially more resistant to habituation compared to conventional warnings, and it sustained this advantage throughout the five-day experiment. Our findings add credibility to prior studies by showing that the pattern of habituation holds across a workweek, and indicate that cross-sectional habituation studies are valid proxies for longitudinal studies. Our findings also show that eye tracking is a valid measure of the mental process of habituation to warnings.

> 安全警告有效性的一个主要抑制因素是习惯性：对重复警告的响应减少。虽然习惯化的发展随着时间的推移，以前的研究已经审查习惯和可能的解决办法，其效果只在一个单一的实验会议，提供了一个不完整的问题的看法。为了解决这一差距，我们进行了一项实验，探讨如何发展纵向习惯在每周工作5天的课程如何减少习惯性多态性警告。我们测量的习惯，同时使用两种互补的方法：功能性磁共振成像（fMRI）和眼动跟踪。我们的结果表明，在急剧下降的关注整个工作周尽管部分恢复之间的工作日。我们还发现，与传统警告相比，多态警告设计对习惯性的抵抗能力更强，并且在为期5天的实验中保持了这种优势。我们的研究结果的可信性和以前的研究显示，习惯性的模式保存在一个工作日，并表明横断面成瘾研究的纵向研究，有效的代理。我们的研究结果还表明，眼动跟踪是对警告习惯化的心理过程的有效量度。 article link

190. Can People Self-Report Security Accurately?: Agreement Between Self-Report and Behavioral Measures

SESSION:Precautionary Behaviors

It is common for researchers to use self-report measures (e.g. surveys) to measure people's security behaviors. In the computer security community, we don't know what behaviors people understand well enough to self-report accurately, or how well those self-reports correlate with what people actually do. In a six week field study, we collected both behavior data and survey responses from 122 subjects. We found that a relatively small number of behaviors -- mostly related to tasks that require users to take a specific, regular action -- have non-zero correlations. Since security is almost never a user's primary task for everyday computer users, several important security behaviors that we directly measured were not self-reported accurately. These results suggest that security research based on self-report is only reliable for certain behaviors. Additionally, a number of important security behaviors are not sufficiently salient to users that they can self-report accurately.

> 研究人员使用自我报告的措施（如调查）来衡量人们的安全行为是很常见的。在计算机安全领域，我们不知道行为人了解自我报告的准确，或是那些自我报告与人们实际做的。在为期六周的实地研究中，我们收集了122名受试者的行为数据和调查答复。我们发现，一个相对较小的行为——主要与要求用户采取特定的、常规的操作相关的行为——具有非零相关关系。由于安全几乎从来不是用户日常计算机用户的主要任务，我们直接测量的几个重要的安全行为不是准确地自我报告的。这些结果表明，基于自我报告的安全性研究对于某些行为是可靠的。此外，一些重要的安全行为对用户来说不够突出，他们无法准确地自我报告。 article link

191. Toward Harmonizing Self-reported and Logged Social Data for Understanding Human Behavior

SESSION:Precautionary Behaviors

While self-reporting remains the most common method to understand human behavior, recent advances in social networks, mobile technologies, and other computer-mediated communication technologies are allowing researchers to obtain detailed logs of human behavior with ease. While the logged data is very useful (and accurate) at capturing the structure of the user's social network, the self-reported data provides an insight into the user's cognitive map of her social network. Based on a field study involving 47 users for a period of ten weeks we report that combining the two sets of data (self-reported and logged) gives higher predictive power than using either one of them individually. Further, the difference between the two types of values captures the level of dissonance between a user's actual and perceived social behavior and is found to be an important predictor of the person's social outcomes including social capital, social support and trust.

> 虽然自我报告仍然是理解人类行为最常用的方法，但社交网络、移动技术和其他以计算机为媒介的通信技术的最新进展使研究人员能够轻松地获得人类行为的详细记录。虽然记录的数据对于捕捉用户社交网络的结构非常有用（而且准确），但自我报告的数据提供了用户社交网络的认知地图。基于一项涉及47名用户的为期十周的实地研究，我们报告说，将两组数据（自报和登录）相结合，比单独使用其中一组数据具有更高的预测能力。此外，这两种类型的价值之间的差异捕获了用户实际和感知的社会行为之间的不一致程度，并被发现是社会社会资本、社会支持和信任的人的社会结果的重要预测因子。 article link

192. HeartChat: Heart Rate Augmented Mobile Chat to Support Empathy and Awareness

SESSION:Second Screen

Textual communication via mobile phones suffers from a lack of context and emotional awareness. We present a mobile chat application, HeartChat, which integrates heart rate as a cue to increase awareness and empathy. Through a literature review and a focus group, we identified design dimensions important for heart rate augmented chats. We created three concepts showing heart rate per message, in real-time, or sending it explicitly. We tested our system in a two week in-the-wild study with 14 participants (7 pairs). Interviews and questionnaires showed that HeartChat supports empathy between people, in particular close friends and partners. Sharing heart rate helped them to implicitly understand each other's context (e.g. location, physical activity) and emotional state, and sparked curiosity on special occasions. We discuss opportunities, challenges, and design implications for enriching mobile chats with physiological sensing.

> 手机短信传播缺乏语境和情感意识。我们提出了一个移动聊天应用，heartchat，集成了心率为线索，提高意识和移情。通过文献回顾和焦点小组，我们确定了重要的设计维度对于心率增强聊天。我们创建了三个概念，用于实时显示每个消息的心率，或者显式地发送它。我们在野生研究的两周内对我们的系统进行了测试，共有14名参与者（7对）。访谈和问卷调查显示，heartchat支持移情与人之间的关系，特别是亲密的朋友和合作伙伴。分享心率有助于他们含蓄地理解对方的背景（如地点、体力活动）和情绪状态，并在特殊场合激发好奇心。我们讨论了利用生理感知来丰富移动聊天的机会、挑战和设计影响。 article link

193. "I've been manipulated!": Designing Second Screen Experiences for Critical Viewing of Reality TV

SESSION:Second Screen

The recent proliferation of a reality TV genre that focusses on welfare recipients has led to concerns that prime-time media experiences are exacerbating misconceptions, and stifling critical debate, around major societal issues such as welfare reform and poverty. Motivated by arguments that 'second screening' practices offer opportunities to engage viewers with issues of political concern, we describe the design and evaluation of two smartphone apps that facilitate and promote more critical live-viewing of reality TV. Our apps,Spotting GuideandMoral Compass, encourage users to identify, categorise, tag and filter patterns and tropes within reality TV, as well as reinterpret social media posts associated with their broadcast. We show that such interactions encourage critical thinking around typical editing and production techniques and foster co-discussion and reflection amongst viewers. We discuss, more broadly, how these interactions encourage users to identify the wider consequences and framings of reality TV, and offer implications and considerations for design that provokes criticality and reflection in second screening contexts.

> 一个真实的电视类型，福利接受者集中导致的担忧，黄金时段的媒体经验是加剧误解最近的增殖，并抑制关键的辩论，如福利改革和贫困的主要社会问题。出于“第二次放映”的实践提供了让观众关注政治问题的机会，我们描述了两款智能手机应用程序的设计和评估，以促进和促进真人秀节目更为关键的现场观看。我们的应用程序，发现guideandmoral指南针，鼓励用户识别、归类，在现实电视标签和过滤器模式和比喻，以及重新诠释与广播相关的社交媒体帖子。我们表明，这种互动鼓励围绕典型的编辑和制作技术进行批判性思考，并促进观众之间的共同讨论和思考。我们讨论，更广泛地说，这些相互作用如何鼓励用户识别更广泛的后果和现实电视机架，并提供启示和设计激起二筛选环境临界和反射的思考。 article link

194. Interaction with a TV Companion App as Synopsis and Supplement

SESSION:Second Screen

Television companion apps on tablets and smartphones provide interactive content synchronized with TV shows. A key design question raised by this novel, multi-display, multimedia interface is whether the app's role is to be a synopsis of the show or a supplement. In other words, should the app help viewers better follow what they are watching on TV, or offer additional enriching content to respond to interest created by the show? We developed a companion app for a documentary with both synoptic and supplementary content. A laboratory study with 28 participants examined the effect of these different types of content on the experience of using the companion and the effect on engagement with the show in terms of participants' recall. Engagement with the show was not affected by supplementary content in the app but coordinated viewing of both screens was more difficult. Design guidelines evident from these results are discussed.

> 平板电脑和智能手机上的电视伴侣应用程序提供与电视节目同步的互动内容。这个新的、多显示器、多媒体界面提出的一个关键设计问题是应用程序的角色是否是该节目的摘要或补充。换句话说，这个应用程序是否有助于观众更好地跟踪他们在电视上看到的内容，或者提供额外的内容以满足节目的兴趣？我们开发了一个纪录片的辅助应用程序，包括天气和补充内容。一项由28名参与者进行的实验研究考察了这些不同类型的内容对同伴使用的体验以及参与者对回忆的影响。与节目的参与没有受到应用程序中附加内容的影响，但是两个屏幕的协调观看更加困难。讨论了从这些结果中得出的设计准则。 article link

195. Social Printers: A Physical Social Network for Political Debates

SESSION:Second Screen

Social Printersare physical devices that create a pseudonymous social network between households during televised political debates. Through studies conducted around the Scottish Parliamentary Election and EU Referendum in 2016, we aimed to understand how physical devices could be used to engage viewers with televised political debates. By displacing the interaction from conventional social media and second screens we observed that the printers were successful in encouraging the participants to share their thoughts and create a personal social experience. Based on the results we discuss potential implications for conventional social media and second screens in the context of political television programs.

> 社会体育设备，创建一个印刷厂都使用社会网络之间的家庭在电视政治辩论。通过围绕苏格兰议会选举和2016欧洲公投的研究，我们的目的是了解如何利用物理设备与观众进行电视政治辩论。通过取代传统社交媒体和第二屏幕的互动，我们发现打印机成功地鼓励参与者分享他们的想法，创造个人的社交体验。根据结果，我们讨论了传统的社会媒体和第二屏幕在政治电视节目中的潜在影响。 article link

196. A City in Common: A Framework to Orchestrate Large-scale Citizen Engagement around Urban Issues

SESSION:Civic Technology

Citizen sensing is an approach that develops and uses lightweight technologies with local communities to collect, share and act upon data. In doing so it enables them to become more aware of how they can tackle local issues. We report here on the development and uptake of the 'City- Commons Framework for Citizen Sensing', a conceptual model that builds on Participatory Action Research with the aim of playing an integrating role: outlining the processes and mechanisms for ensuring sensing technologies are co-designed by citizens to address their concerns. At the heart of the framework is the idea of a city commons: a pool of community-managed resources. We discuss how the framework was used by communities in Bristol to measure and monitor the problem of damp housing.

> 公民感知是一种开发和使用轻量级技术与当地社区收集、共享和处理数据的方法。这样做使他们能够更清楚地知道如何处理当地问题。我们在这里报告的“城市发展与吸收共享框架公民传感”，一个概念模型，建立参与式行动研究与发挥了整合的作用目的：概述保证传感技术联合设计的市民解决他们的问题的过程和机制。框架的核心是城市公共空间的概念：一个社区管理资源的集合。我们将讨论布里斯托尔的社区如何使用这个框架来测量和监测潮湿房屋的问题。 article link

197. Creating a Sociotechnical API: Designing City-Scale Community Engagement

SESSION:Civic Technology

Community engagement is to cities what user experience is to computing: it signifies a large category that simultaneously speaks to general qualities of interaction and to specific ways of doing that interaction. Recently, digital civics has emerged as a research area with a comprehensive approach to designing for civic encounters where community engagement is a primary concern for designing systems and processes that support broad civic interaction. In short, over the past year, we worked with municipal officials, service providers, and city residents to design a community engagement playbook detailing best practices for city-scale engagement. The playbook, as well as the collaborative process that produced it, provides a roadmap for thinking through the kinds of systems that might populate the design space of city-scale digital civics. This paper details our design-led research process and builds on emerging literature on designing for digital civic interaction.

> 社区参与是城市的用户体验是计算：它意味着一个大的类别，同时谈到互动的一般素质和具体的方式做这种互动。近年来，数字城市已经成为一个与城市中社区参与是设计流程和系统支持广泛的公民互动的一个主要关注的综合设计方法研究。总之，在过去的一年中，我们曾与市政官员，服务提供商，和城市居民社区参与剧本设计详细的城市规模参与的最佳实践。剧本，以及制造它的合作过程中，提供了一个路线图，通过系统，可以在城市规模的数字城市空间设计类的思考。本文详细介绍了我们设计的LED研究过程，并建立了关于数字思域交互设计的新兴文献。 article link

198. Empowered Participation: How Citizens Use Technology in Local Governance

SESSION:Civic Technology

The partnership between local residents and city officials to inform policy and decision-making about government resources, or participatory governance, has been extensively studied. In addition to numerous ethnographic studies about how citizens engage in-person, there has been increased focus in HCI to understand the impact of technology on citizen participation in local governance. Building upon those studies, this paper provides unique insight from a 3-year longitudinal study on the use of online tools that were organically adapted by citizens to engage in local governance in three diverse Chicago neighborhoods. Though the responsiveness of government officials varied across communities, our results suggest that citizens use technology to heighten the visibility of their concerns, to support mechanisms of government accountability, and to provide various options for resident participation in local governance. We argue that while communities may be effective in their use of ICTs, technology may not increase their political power.

> 地方居民和城市官员之间的伙伴关系，以通知政府资源或参与式治理的政策和决策，已被广泛研究。除了关于公民如何参与人的众多人种学研究之外，HCI也越来越受到人们的重视，以了解技术对公民参与地方治理的影响。在这些研究的基础上，本文提供了一个独特的见解，从3年的纵向研究，利用网上工具，有机地适应公民参与地方治理在三个不

> 同的芝加哥街区。虽然政府官员在不同社区的反应，我们的研究结果表明，公民利用技术来提高他们的关注度，支持政府的问责机制，并为地方治理中的居民参与各种选项。我们认为，社区可能会在他们的信息通信技术的使用有效的技术不可能增加他们的政治权力。 article link

199. Community Conversational: Supporting and Capturing Deliberative Talk in Local Consultation Processes

SESSION:Civic Technology

The development of platforms for community decision-making has been of growing interest to the HCI community, yet the ways technology might be woven into traditional consultation processes has been under-studied. We conducted fieldwork at consultation events where residents were invited to discuss and map assets related to their neighbourhoods to inform community decision-making. The fieldwork highlighted problems with equality, turn taking, the evidencing and elaborating on opinions by residents, and challenges related to capturing and documenting the events. We developed Community Conversational-a hybrid table-top game and digital capture and review platform-in response to these issues. Community Conversational was designed to provide a flexible structure to consultation events related to 'place', and support the production, capture and review of deliberative 'talk' to support decision-making. We study how the platform was used in two consultation events, and discuss the implications of capturing and evidencing local people's opinions for the accountability of decision-makers and community organisations.

> 社区决策平台的开发对HCI社区越来越感兴趣，但是技术可能被编织成传统的协商过程的方法正在研究中。我们在咨询活动中进行实地调查，邀请居民讨论和绘制与社区有关的资产，以告知社区决策。实地考察强调了平等、轮流采取、居民意见和详细阐述的问题以及与捕获和记录事件有关的挑战。我们开发的社区conversational-a混合桌面游戏和数字采集和审查在应对这些问题的平台。社区会话的目的是提供一个灵活的结构来协商与“地方”相关的事件，并支持生产、捕获和审查“商议”来支持决策。我们研究如何在两个咨询活动中使用该平台，并讨论捕捉和证明当地人的意见对决策者和社区组织问责的影响。 article link

200. Revolt: Collaborative Crowdsourcing for Labeling Machine Learning Datasets

SESSION:Crowdfunding and Crowdsourcing

Crowdsourcing provides a scalable and efficient way to construct labeled datasets for training machine learning systems. However, creating comprehensive label guidelines for crowdworkers is often prohibitive even for seemingly simple concepts. Incomplete or ambiguous label guidelines can then result in differing interpretations of concepts and inconsistent labels. Existing approaches for improving label quality, such as worker screening or detection of poor work, are ineffective for this problem and can lead to rejection of honest work and a missed opportunity to capture rich interpretations about data. We introduce Revolt, a collaborative approach that brings ideas from expert annotation workflows to crowd-based labeling. Revolt eliminates the burden of creating detailed label guidelines by harnessing crowd disagreements to identify ambiguous concepts and create rich structures (groups of semantically related items) for post-hoc label decisions. Experiments comparing Revolt to traditional crowdsourced labeling show that Revolt produces high quality labels without requiring label guidelines in turn for an increase in monetary cost. This up front cost, however, is mitigated by Revolt's ability to produce reusable structures that can accommodate a variety of label boundaries without requiring new data to be collected. Further comparisons of Revolt's collaborative and non-collaborative variants show that collaboration reaches higher label accuracy with lower monetary cost.

> 众包提供了一种可扩展和有效的方法来构建标记数据集，用于训练机器学习系统。然而，创造crowdworkers综合标签指南往往是望而却步，即使是看似简单的概念。不完全或不明确的标签指导方针会导致对概念和不一致标签的不同解释。现有的改善标签质量的方法，如工人筛选或检测不良工作，对这个问题是无效的，可能会导致拒绝诚实的工作和错过的机会，捕捉丰富的解释数据。我们引入反叛，这是一种从专家注释工作流到基于人群的标签的协作方法。反抗消除了创建详细的标签指南的负担，通过利用群体的不一致来识别模糊的概念，并为事后的标签决策创建丰富的结构（语义相关组）。对比实验表明，反叛传统的众包标记反抗产生高质量的标签，而不需要标签指南把货币成本增加。然而，这种先进的成本降低了反叛的能力，产生可重复使用的结构，可以容纳不同的标签边界，而不需要收集新的数据。进一步比较反叛的合作和非合作的变种表明，合作达到更高的标签精度与较低的货币成本。 article link

201. VoxPL: Programming with the Wisdom of the Crowd

SESSION:Crowdfunding and Crowdsourcing

Having a crowd estimate a numeric value is the original inspiration for the notion of "the wisdom of the crowd." Quality control for such estimated values is challenging because prior, consensus-based approaches for quality control in labeling tasks are not applicable in estimation tasks. We present VoxPL, a high-level programming framework that automatically obtains high-quality crowdsourced estimates of values. The VoxPL domain-specific language lets programmers concisely specify complex estimation tasks with a desired level of confidence and budget. VoxPL's runtime system implements a novel quality control algorithm that automatically computes sample sizes and obtains high quality estimates from the crowd at low cost. To evaluate VoxPL, we implement four estimation applications, ranging from facial feature recognition to calorie counting. The resulting programs are concise---under 200 lines of code---and obtain high quality estimates from the crowd quickly and inexpensively.

> “人群估计数值”是“人群智慧”概念的最初灵感。这种估计值的质量控制是具有挑战性的，因为在标注任务中，基于事先协商一致的质量控制方法不适用于估算任务。我们目前的voxpl，一个高层次的编程框架，自动获取高质量的众包的估计值。的voxpl领域特定语言允许程序员指定任务复杂地估计所需的信心和预算水平。VoxPL的运行时系统实现了一种新型的质量控制算法，自动计算样本大小和获得高质量的估计从人群中以较低的成本。评价voxpl，我们实现了四估计的应用，从面部特征识别计算卡路里。由此产生的程序是简洁的——在200行代码下，快速而廉价地从人群中获得高质量的估计。 article link

202. Embedding a Crowd inside a Relay Baton: A Case Study in a Non-Competitive Sporting Activity

SESSION:Crowdfunding and Crowdsourcing

This paper presents a digital relay baton that connects long-distance runners with distributed online spectators. The baton broadcasts athletes? locative data to a social network and communicates back remote-crowd support through haptic and audible cheers. Our work takes an exploratory design approach to bring new insights into the design of real-time techno-mediated social support. The prototype was deployed during a 170-mile charity relay race across the UK with 13 participants, 261 on-line supporters, and gathered a total of 3,153 'cheers'. We report on the insights collected during the design and deployment process and identify three fundamental design considerations: the degree of spectator expression that the design affords, the context applicability, and the data flow within the social network.

> 本文提出了一种数字接力棒，将长跑运动员与分布式的网上观众联系起来。接力棒广播运动员？居住处所的数据到一个社会网络和通信的远程支持通过触觉和听觉的欢呼的人群。我们的工作采用探索性设计方法，为实时技术介导的社会支持的设计带来新的见解。该原型在英国170英里慈善接力比赛中部署，共有13名参与者，261名在线支持者，共收集了3153个“欢呼”。我们报告了在设计和部署过程中收集到的见解，并确定了三个基本的设计考虑因素：设计提供的观众表达程度、上下文适用性和社交网络中的数据流。

> article link

203. Prioritizing Flexibility and Intangibles: Medical Crowdfunding for Stigmatized Individuals

SESSION:Crowdfunding and Crowdsourcing

HCI research on crowdfunding has primarily focused on creative or organizational endeavors. Yet a majority of crowdfunding campaigns are conducted by individuals in need, often for healthcare. To better understand and improve this common crowdfunding experience, especially for those that inhabit a vulnerable social status, we conducted 20 interviews with transmen crowdfunding for top-surgery. Design choices that optimizesite flexibility(e.g. control of personal information; enable cross-site communication) and foregroundintangibles, such as political values and emotional support, are priorities for individuals from a stigmatized community. Findings differed from previous crowdfunding research and contribute to limited research on transgender identities in HCI. Overall they provide unique insights into how design choices can facilitate marginalized identity management in highly public online spaces.

> HCI研究众筹主要集中在创意或组织的努力。然而，大多数的crowdfunding活动都是由个人需要经常进行，医疗保健。为了更好的了解和改善这种常见的融资经验，特别是对那些生活在一个脆弱的社会现状，我们进行了20次采访transmen crowdfunding顶手术。设计选择optimizesite灵活性（例如控制个人信息；使跨站点的通信）和foregroundintangibles，如政治价值和情感支持，优先从社区的个人烙印。结果不同于以往的研究，有助于众筹在人机交互上变性身份有限的研究。总体而言，他们提供了独特的见解，以了解如何选择设计可以促进边缘化的身份管理在高度公开的在线空间。 article link

204. Understanding the Effects of Endorsements in Scientific Crowdfunding

SESSION:Crowdfunding and Crowdsourcing

Understanding the factors that persuade backers to donate to research projects has become increasingly important with the rising popularity of scientific crowdfunding. Although there are many similarities between enterprise and scientific crowdfunding, some factors differentiate these two forms of crowdfunding. One such factor is the use of endorsements. The endorsement helps backers gain trust based on expert opinions about the competency of the researchers and the usefulness of the projects. We analyzed 810 endorsements from scientific campaigns posted on Experiment.com and derived a taxonomy of topics discussed in the endorsements. A regression analysis revealed that when endorsers explained the skills of the campaign owners, the probability of success of the campaign improved; on the contrary, when endorsers reiterated the goal of the project, the campaign was less likely to succeed. We conclude with design implications formulated from our findings to better support scientific crowdfunding.

> 理解的因素，说服支持者捐赠的研究项目，已成为越来越重要的科学crowdfunding的日益普及。尽管有诸多相似之处，企业和科学crowdfunding，一些因素区分这两种形式的众筹。其中一个因素就是使用背书。这种支持有助于支持者根据专家对研究人员的能力和项目有用性的意见获得信任。我们分析了810个广告代言从科学活动在experiment.com得到在代言讨论的主题分类。回归分析显示，当代言人解释了业主运动技能、运动的提高成功的概率；相反，当代言人重申，该项目的目标，运动是不可能成功的。我们的结论与设计的影响，制定了从我们的结果能够更好地支持科学的众筹。 article link

205. Calendar.help: Designing a Workflow-Based Scheduling Agent with Humans in the Loop

SESSION:Designing for the Workplace

Although we may complain about meetings, they are an essential part of an information worker's work life. Consequently, busy people spend a significant amount of time scheduling meetings. We present Calendar.help, a system that provides fast, efficient scheduling through structured workflows. Users interact with the system via email, delegating their scheduling needs to the system as if it were a human personal assistant. Common scheduling scenarios are broken down using well-defined workflows and completed as a series of microtasks that are automated when possible and executed by a human otherwise. Unusual scenarios fall back to a trained human assistant executing an unstructured macrotask. We describe the iterative approach we used to develop Calendar.help, and share the lessons learned from scheduling thousands of meetings during a year of real-world deployments. Our findings provide insight into how complex information tasks can be broken down into repeatable components that can be executed efficiently to improve productivity.

> 虽然我们可能会抱怨会议，但他们是信息工作者工作生活中必不可少的一部分。因此，忙碌的人们花了大量的时间安排会议。我们提出一个calendar.help，提供快速的系统，通过结构化的工作流调度效率。用户通过电子邮件与系统交互，将他们的调度需求委托给系统，就好像它是个人的私人助理一样。常见的调度方案是打破使用明确定义的工作流程，完成一系列microtasks自动化的可能时，由一人否则执行。不寻常的情况下回落到一个训练有素的助理执行非结构化微任务。我们描述了我们用来开发calendar.help迭代的方法，和大家分享从调度上千人的会议一年的实际部署过程中的教训。我们的发现提供了如何将复杂的信息任务分解成可重复执行的组件，以有效地提高生产力的方法。 article link

206. Conversational Chat Circles: Being All Here Without Having to Hear It All

SESSION:Designing for the Workplace

Live streaming services are a growing form of social media. Most live streaming platforms allow viewers to communicate with each other and the broadcaster via a text chat. However, interaction in a text chat does not work well with too many users. Existing techniques to make text chat work with a larger number of participants often limit who can participate or how much users can participate. In this paper, we describe a new design for a text chat system that allows more people to participate without overwhelming users with too many messages. Our design strategically limits the number of messages a user sees based on the concept of neighborhoods, and emphasizes important messages through upvoting. We present a study comparing our system to a chat system similar to those found in commercial streaming services. Results of the study indicate that the Conversational Circle system is easier to understand and interact with, while supporting community among viewers and highlighting important content for the streamer.

> 实时流媒体服务是社会媒体的一种日益增长的形式。大多数直播平台允许观众通过文本聊天与对方进行沟通。然而，文本聊天中的交互对太多用户不起作用。现有的使文本聊天与大量参与者工作的技术常常限制了谁可以参与或用户可以参与多少。在本文中，我们描述了一种新的文本聊天系统的设计，它允许更多的人参与，而无需压倒性的用户拥有太多的消息。我们的设计策略限制消息的用户看到的基于社区的概念，强调重要的信息通过upvoting。我们提出了一项研究，将我们的系统与类似于商业流媒体服务的聊天系统进行比较。研究结果表明，会话循环系统更容易理解和互动，同时支持观众之间的社区和突出重要内容的流光。 article link

207. A Predictive Model of Emergency Physician Task Resumption Following Interruptions

SESSION:Designing for the Workplace

Interruptions in the emergency department (ED) can have serious patient safety consequences, and few solutions exist to mitigate the disruptiveness of interruptions. We developed a theoretically motivated model to predict the likelihood of emergency physicians returning to an interrupted task. Eighteen emergency physicians were observed individually for two-hour blocks of time, resulting in a total of 2160 minutes of observation and 231 interruptions. We used a mixed effects logistic regression model to predict the likelihood of primary task resumption after interruptions. The likelihood of primary task resumption was predicted by memory decay, measured by the duration of the interruption, workload, measured by the patient volume during the shift, and whether shift was day or night. With a better understanding of these interruptions, we can help design interventions to manage interruptions, minimize medical errors, and improve patient safety.

> 在急救部门（ED）有严重干扰病人的安全后果，并存在一些解决方案来减轻中断的破坏。我们开发了一个理论上的动机模型来预测急诊医生返回中断任务的可能性。十八名急诊医生分别观察两小时的时间，总共观察了2160分钟，中断了231次。我们使用混合效应logistic回归模型来预测中断后初级任务恢复的可能性。主要任务恢复的可能性是由记忆衰减来预测的，以中断的持续时间、工作量、在轮班中的病人量来衡量，以及轮班是白天还是夜间。通过更好地理解这些干扰，我们可以帮助设计干预措施来控制中断，减少医疗差错，提高病人的安全性。 article link

208. Undertanding and Detecting Divided Attention in Mobile MOOC Learning

SESSION:Designing for the Workplace

The emergence of mobile apps for Massive Open Online Courses (MOOCs) allows learners to access quality learning materials at low cost and "to control where, what, how and with whom they learn". Unfortunately, when compared with traditional classroom education, learners face more distractions and are more likely to multitask when they study alone in an informal learning environment. In this paper, we investigate the impact of divided attention (DA) on both the learning process and learning outcomes in the context of mobile MOOC learning. We propose OneMind, a system and algorithm for detecting divided attention on unmodified mobile phones via implicit, camera-based heart rate tracking. In an 18-participant study, we found that internal divided attention has a significant negative impact on learning outcomes; and that the photoplethysmography (PPG) waveforms implicitly captured by OneMind can be used to detect the presence, type, and intensity of divided attention in mobile MOOC learning.

> 移动应用的出现为大规模开放在线课程（MOOCs）允许学习者以较低的成本获得高质量的学习材料和“控制在哪里，什么，如何与他们学习”。不幸的是，与传统的课堂教学相比，学习者在非正式学习环境中独自学习时更容易分心，更有可能进行多任务学习。在本文中，我们探讨分散注意的影响（DA）对移动MOOC学习中的学习过程和学习结果。我们提出了OneMind，一个用于检测分配注意对未改性的移动电话通过隐式算法，基于摄像头的心率跟踪。在18参与者的研究，我们发现内部分配注意对学习效果有显著的负向影响；，光电容积描记（PPG）隐式捕获OneMind波形可以用来检测存在，类型，和分散注意力的强度在移动MOOC学习。 article link

209. PinPad: Touchpad Interaction with Fast and High-Resolution Tactile Output

SESSION:Designing Haptic Interfaces

We explored new interaction scenarios that can be realized when a touchpad outputs fast and high-resolution spatio-temporal tactile patterns to the touch-sensitive skin on the fingertips of a user. We first constructed a special tactile multi-touch touchpad called PinPad, which was capable of outputting fast and high-resolution tactile patterns using a 40 x 25 array of actuated pins. We then developed various interaction scenarios that could be realized using the prototype: 1) Tactile Target, 2) Guide and Constraint, 3) Multi-finger Output, and 4) Dynamic Partition. To evaluate the PinPad scenarios, we implemented demo applications, and conducted interviews with users to collect feedback about their experiences with PinPad and the PinPad scenarios. The participants confirmed the effectiveness of spatio-temporal outputs of PinPad in the scenarios. In particular, they provided diverse feedback regarding the unique tactile experiences of the fast and high-resolution outputs of PinPad.

> 我们探索了一种新的交互场景，当触摸屏输出到用户指尖的触敏皮肤时，可以快速、高分辨率地获得时空触觉模式。我们首先建立了一个特殊的触觉多点触摸的触摸板，称为密码键盘，并可输出快速、高分辨率触觉模式采用40×25阵列的驱动引脚。然后，我们开发了各种交互场景，可以使用原型：1）触觉目标，2）指南和约束，3）多指输出，和4）动态分区。评价密码键盘的情况下，我们实现了演示应用程序，和用户进行了采访，收集有关PinPad和PinPad的情况下的经验反馈。与会者确定场景中的时空性密码键盘输出。特别是，他们提供了不同的反馈，对于PinPad的快速和高分辨率输出的独特的触觉体验。 article link

210. Agency in Mid-air Interfaces

SESSION:Designing Haptic Interfaces

Touchless interfaces allow users to view, control and manipulate digital content without physically touching an interface. They are being explored in a wide range of application scenarios from medical surgery to car dashboard controllers. One aspect of touchless interaction that has not been explored to date is the Sense of Agency (SoA). The SoA refers to the subjective experience of voluntary control over actions in the external world. In this paper, we investigated the SoA in touchless systems using the intentional binding paradigm. We first compare touchless systems with physical interactions and then augmented different types of haptic feedback to explore how different outcome modalities influence intentional binding. From our experiments, we demonstrated that an intentional binding effect is observed in both physical and touchless interactions with no statistical difference. Additionally, we found that haptic and auditory feedback help to increase SoA compared with visual feedback in touchless interfaces. We discuss these findings and identify design opportunities that take agency into consideration.

> 非接触式接口允许用户查看、控制和操纵的数字内容，而无需接触界面。他们正在探索从医疗手术到汽车仪表板控制器的广泛应用场景。非接触式交互，没有探索到一个方面是代理的意义（SOA）。SOA指的是在外部世界中自愿控制行动的主观经验。在本文中，我们使用非接触式系统的有意结合SOA范式研究。我们首先比较非接触式系统与物理相互作用并增强不同类型的触觉反馈来探索不同的方式影响结果故意结合。从我们的实验中，我们证实了在物理和非接触无明显统计学差异的相互作用是一种故意的约束力。此外，我们发现，触觉和听觉反馈有助于提高SOA与非接触式接口相比，视觉反馈。我们讨论这些发现，并确定考虑代理的设计机会。 article link

211. Frozen Suit: Designing a Changeable Stiffness Suit and its Application to Haptic Games

SESSION:Designing Haptic Interfaces

We present the concept of Frozen Suit, a type of clothing that restricts users' movements at joint positions (e.g. elbow, knee) via a changeable stiffness jamming material. The suit can "freeze" users' body parts, for example during a game in order to provide the physical sensation of being frozen by an enemy. In this paper we first present the Frozen Suit concept and its potential applications. We then systematically investigate how to design jamming patches in order to sufficiently restrict an arm or a leg. In particular we used low-

fidelity prototypes to explore the restricting power of different material and particles. In order to push this analysis further we conducted a controlled experiment in order to compare the perceived stiffness of different patches sizes attached to the elbow. We performed a paired comparison experience and used a Bradley-Terry-Luce model to analyze the subjective feedback from participants. We found that 20cm long x 7cm large is the most restrictive patch and that an increase in patch area correlates with an increase in perceived stiffness (quadratic). We finish by presenting a use case application with a game that we implemented where enemies can freeze the player.

> 我们提出的概念，冻结西装，一种服装，限制用户的运动在关节位置（如肘关节，膝关节）通过可变刚度干扰材料。该套装可以“冻结”用户的身体部位，例如在游戏中，以提供身体的感觉被冻结的敌人。本文首先介绍了冰冻服的概念及其潜在应用。然后，我们系统地研究如何设计干扰贴片，以充分限制手臂或腿部。特别是我们使用低保真原型来探索不同材料和粒子的限制力。为了进一步推动这一分析，我们进行了一项对照实验，以比较肘部不同补片大小的感知刚度。我们进行了配对比较的经验用Bradley Terry Luce模型来分析受试者的主观反馈。我们发现，20cm×7cm大是最严格的补丁，补丁的面积的增加与认为刚度增加（二次）。我们完成了一个用例应用程序的一个游戏，我们实现了敌人可以冻结播放器。 article link

212. Haptic-Enabled Handheld Mobile Robots: Design and Analysis

SESSION:Designing Haptic Interfaces

The Cellulo robots are small tangible robots that are designed to represent virtual interactive point-like objects that reside on a plane within carefully designed learning activities. In the context of these activities, our robots not only display autonomous motion and act as tangible interfaces, but are also usable as haptic devices in order to exploit, for instance, kinesthetic learning. In this article, we present the design and analysis of the haptic interaction module of the Cellulo robots. We first detail our hardware and controller design that is low-cost and versatile. Then, we describe the task-based experimental procedure to evaluate the robot's haptic abilities. We show that our robot is usable in most of the tested tasks and extract perceptive and manipulative guidelines for the design of haptic elements to be integrated in future learning activities. We conclude with limitations of the system and future work.

> 明胶的机器人小有形的机器人代表了虚拟交互点驻留在一个平面内精心设计的学习活动对象。在这些活动中，我们不仅显示机器人的自主运动和作为有形的接口，也可用作为触觉设备的开发，例如，动觉型学习。在这篇文章中，我们提出了对明胶机器人触觉交互模块的设计与分析。我们首先详细说明我们的硬件和控制器设计，成本低，通用性强。然后，我们描述了基于任务的实验过程来评估机器人的触觉能力。我们表明，我们的机器人是可用的，在大多数测试任务，并提取触觉和设计指导方针的触觉元素的设计，以集成在未来的学习活动。我们总结了系统的局限性和未来的工作。 article link

213. A Thing of Beauty: Steering Behavior in an Interactive Playground

SESSION:Exertion, Sport, Bodies

Interactive playgrounds are spaces where players engage in collocated, playful activities, in which added digital technology can be designed to promote cognitive, social, and motor skills development. To promote such development, different strategies can be used to implement game mechanics that change player's in-game behavior. One of such strategies is enticing players to take action through incentives akin to game achievements. We explored if this strategy could be used to influence players' proxemic behavior in the Interactive Tag Playground, an installation that enhances the traditional game of tag. We placed the ITP in an art gallery, observed hundreds of play sessions, and refined the mechanics, which consisted in projecting collectible particles around the tagger that upon collection by runners resulted only in the embellishment of their circles. We implemented the refined mechanics in a study with 48 children. The playground automatically collected the players' positions, and analyses show that runners got closer to and moved more towards taggers when using our enticing strategy. This suggests an enticing strategy can be used to influence physical in-game behavior.

> 互动游戏场是玩家参与并置的、嬉戏的活动的场所，在那里，增加的数字技术可以被设计来促进认知、社交和运动技能的发展。为了促进这种发展，不同的策略可以用来实现改变玩家游戏行为的游戏机制。这种策略之一是诱使玩家通过类似游戏成就的奖励行动。我们探讨了如果这种策略可以用来影响互动标签操场运动员空间关系的行为，一个安装了标签的传统游戏。我们将ITP在一个艺术画廊，观察体验数百，精制而成的机械，包括投影收藏粒子周围的恶搞，在收集运动员只导致他们圈点缀。我们在48名儿童的研究中实施了精细力学。操场上自动收集玩家的位置，并分析表明，跑步接近和走向者使用我们的诱人策略时。这表明一个诱人的策略可以用来影响物理游戏中的行为。 article link

214. Five Lenses for Designing Exertion Experiences

SESSION:Exertion, Sport, Bodies

The field of HCI has increasingly looked at ways to support the physically active human being, however, new work suggests that the field has only begun to understand the many virtues of exertion. To further the field, we present a set of five design lenses extended primarily from sports philosophy literature to help approach exertion not just as a means of deferring death, but also as an opportunity for personal growth. The lenses facilitate learning how to appreciate a void (Reverie), welcome pleasure (Pleasure), become humble (Humility), as well as be fearful and excited simultaneously (Sublime), whilst being more carefully aware of one's own body (Oneness). Using these lenses, we articulate associated technology opportunities through related work as well as our own craft knowledge. With our work, we aim to support designers who want to facilitate the many virtues of exertion so that ultimately more people profit from the many benefits of being physically active.

> 人机交互领域越来越多地研究支持身体活动的人的方法，然而，新的研究表明，这个领域仅仅开始了解了许多实用的优点。为了进一步研究这一领域，我们提出了一套五个设计镜头，主要是从体育哲学文献中延伸出来的，以帮助人们不仅是延缓死亡的手段，而且是个人成长的机会。镜头有助于学习如何欣赏空虚（幻想），欢迎快乐（愉悦），变得谦逊（谦卑），以及恐惧和兴奋同时（崇高），同时更仔细地意识到自己的身体（合一）。使用这些镜头，我们通过相关的工作以及我们自己的工艺知识来阐明相关的技术机会。在我们的工作中，我们的目标是支持那些想要促进运动的许多优点的设计师，以便最终更多的人从体力活动中获益。 article link

215. Recording and Sharing Non-Visible Information on Body Movement while Skateboarding

SESSION:Exertion, Sport, Bodies

Knowing your own body movement is an essential element of sports. Recently, the popularization of smartphones has enabled people to easily record their performance in most situations. However, these observations have limited applicability in assisting with a clear understanding of body movement. In this paper, we propose the Motion Log Skateboard, which records and shares non-visible information about body movement that is difficult to obtain through current observation methods in skateboarding. A pressure-sensor matrix on a skateboard deck is used to record the pressure distribution data, which are then played using the video function of a smartphone camera. With this logged data, a user can access the feet positions, pressure intensity, and timing of the foot movements. To verify the proposed concept and determine the specific context of its use, an experimental session and interviews were conducted with skateboarders of various skill levels. Based on the results of this research, the shared experiences of non-visible information, which is

perceived differently depending on the individual, are expected to become a standard for exploring and training body movement.

> 了解自己的身体动作是运动的基本要素。最近，智能手机的普及使人们可以轻松地记录他们在大多数情况下的表现。然而，这些观察在帮助清楚了解身体运动方面的适用性有限。在本文中，我们提出了运动日志滑板，它记录和共享不可见的身体运动信息，很难通过目前的观察方法在滑板。滑板甲板上的压力传感器矩阵用来记录压力分布数据，然后使用智能手机摄像机的视频功能进行播放。有了这个记录的数据，用户可以访问脚的位置，压力强度，和时间的脚运动。为了验证所提出的概念和确定其使用的具体语境，一个实验性会议和采访进行的各种技能水平的滑板。根据本研究的结果，非可视信息的共享经验，视个体不同而有所不同，可望成为探索和训练身体运动的标准。 article link

216. The Pokémon GO Experience: A Location-Based Augmented Reality Mobile Game Goes Mainstream

SESSION:Exertion, Sport, Bodies

Pokémon GOis a location-based augmented reality mobile game based on the Pokémon franchise. After the game was launched globally in July 2016, it quickly became the most successful mobile game in both popularity and revenue generation at the time, and the first location-based augmented reality game to reach a mainstream status. We explore the game experiences through a qualitative survey (n=1000) in Finland focusing on the positive and the negative aspects ofPokémon GOas told by the players. The positive experiences are related to movement, sociability, game mechanics, and brand while the negative experiences emerge from technical problems, unequal gaming opportunities, bad behavior of other players and non-players, and unpolished game design. Interestingly, the augmented reality features, safety issues or the free-to-play revenue model did not receive considerable feedback. The findings are useful for academics and industry practitioners for studying and designing location-based augmented reality game experiences.

> 博爱éMon去的话是基于位置的增强基于博爱é周一特许现实移动游戏。该游戏于2016年7月在全球推出后，迅速成为当时最受欢迎和创收的移动游戏，也是第一款基于位置的增强现实游戏，以达到主流地位。我们探索游戏经验通过定性研究（n = 1000）在芬兰以积极和消极的方面ofpoké周一GOAS告诉球员。正面的经验是运动、社交、游戏机制相关，而负面的经验和品牌出现的技术问题，不平等的游戏机会，其他玩家和非玩家的不良行为，糙的游戏设计。有趣的是，增强现实功能、安全问题或自由发挥收入模型没有得到相当大的反馈。这一发现对于学术界和工业界研究和设计基于位置的增强现实游戏经验是有用的。 article link

217. Manifesting the Cyborg through Techno-Body Modification: From Human-Computer Interaction to Integration

SESSION:Human Computer Integration

A community of DIY cyborgs has emerged, known as 'grinders', who practice techno-body modification-the embedding of computing technology into the body. This paper reports on an ethnographic study following GrinderTech, an organization working to design, build and sell these technological artifacts, as it shifts from hacker collective to biotech startup. As technologies are embedded in the body, the boundary between human and machine starts to blur. We find that GrinderTech members, through the design and making of technologies for embedding, do so as a means to move beyond social and gendered binary constructions-or, societal norms that are practiced and performed, and re-enforced through language, as a way of creating power differentials in society, e.g. citizen/scientist and man/woman. Moreover, their motivations for designing and making these devices reflects their desire to re-imagine society. Finally, we re-conceptualize Human-Computer Interaction to include Integration-when technology is embedded in the human body-and discuss the theoretical and design implications of human-computer integration.

> 一个DIY机器人社区的出现，被称为“磨”，谁实践技术改变身体嵌入计算技术进入人体。本文报道了人种学研究以下grindertech、组织设计、建造并出售这些技术的文物，因为它的变化从黑客集体生物技术启动。随着技术嵌入人体，人与机器之间的界限开始模糊。我们发现，grindertech成员，通过设计和技术的嵌入，这样做意味着超越社会和性别的二元结构、社会规范，进行执行，并重新执行通过语言，作为一种建立在社会权力差异，例如公民/科学家和男人/女人。此外，他们设计和制造这些设备的动机反映了他们重新想象社会的愿望。最后，我们将人机交互概念化为包含在技术嵌入人体中的集成，并讨论人机集成的理论和设计意义。 article link

218. Factors in Fairness and Emotion in Online Case Resolution Systems

SESSION:Human Computer Integration

Courts are increasingly adopting online information and communication technology, creating a need to consider the potential consequences of these tools for the justice system. Using survey responses from 209 litigants who had recently used an online case resolution system, we investigate factors that influenced litigants' experiences of fairness and emotional feelings toward court officials. Our results show that ease of using the online case resolution system, the outcome of the case, and a litigant's perceptions of procedural justice are positively associated both with whether the litigant views the process as fair and whether the litigant ultimately feels positive emotions toward court officials. We also analyze the online explanations litigants offer in their arguments to courts and litigant answers to an open-ended question about their court experiences, and highlight design and practical implications for online systems seeking to improve access to justice.

> 法院越来越多地采用在线信息和通信技术，这就需要考虑这些工具对司法系统的潜在后果。利用最近使用网上案件解决系统的209名当事人的调查答复，我们调查了影响当事人对法院官员的公平和情感感受的因素。我们的研究结果表明，易用的在线案例解析系统，案件的结果，和当事人对程序正义正与当事人是否意见过程公平和当事人是否最终感觉积极的情绪对法院官员有关。我们还分析了在线解释当事人提出的论点，以法院和当事人的答案，以一个不限成员名额的问题，他们的法院经验，并强调设计和实际影响的在线系统寻求改善司法机会。 article link

219. Us vs. Them: Understanding Artificial Intelligence Technophobia over the Google DeepMind Challenge Match

SESSION:Human Computer Integration

Various forms of artificial intelligence (AI), such as Apple's Siri and Google Now, have permeated our everyday lives. However, the advent of such "human-like" technology has stirred both awe and a great deal of fear. Many consider it a woe to have an unimaginable future where human intelligence is exceeded by AI. This paper investigates how people perceive and understand AI with a case study of the Google DeepMind Challenge Match, a Go match between Lee Sedol and AlphaGo, in March 2016. This study explores the underlying and changing perspectives toward AI as users experienced this historic event. Interviews with 22 participants show that users tacitly refer to AlphaGo as an "other" as if it were comparable to a human, while dreading that it would come back to them as a potential existential threat. Our work illustrates a confrontational relationship between users and AI, and suggests the need to prepare for a new kind of user experience in this nascent socio- technological change. It calls for a collaborative research effort from the HCI community to study and accommodate users for a future where they interact with algorithms, not just interfaces.

> 各种形式的人工智能（如苹果的西丽和谷歌）已经渗透到我们的日常生活中。然而，这种“类人”技术的出现激起了人们的敬畏和极大的恐惧。许多人认为有一个不可思议的未来，人类智能超过了人工智能。本文研究了人们如何看待和理解人工智能与谷歌DeepMind挑战赛为例，Lee Sedol和alphago之间的围棋比赛，2016年3月。本研究探讨了使用

> 者在经历这一历史事件时对AI的潜在的和变化的看法。22名学员的访谈表明，用户默认是指alphago作为“其他”就相当于人，而担心它会回到他们作为一个潜在的威胁。我们的工作说明了用户与人工智能之间的对抗关系，并建议在这一新兴的社会技术变革中为新用户体验做准备。它要求来自HCI社区的协作研究工作，研究和适应用户的未来，他们与算法交互，而不仅仅是接口。 article link

220. Tell Me Where to Look: Investigating Ways for Assisting Focus in 360° Video

SESSION:Improving Gaze Mechanisms

360° videos give viewers a spherical view and immersive experience of surroundings. However, one challenge of watching 360° videos is continuously focusing and re-focusing intended targets. To address this challenge, we developed two Focus Assistance techniques: Auto Pilot (directly bringing viewers to the target), and Visual Guidance (indicating the direction of the target). We conducted an experiment to measure viewers' video-watching experience and discomfort using these techniques and obtained their qualitative feedback. We showed that: 1) Focus Assistance improved ease of focus. 2) Focus Assistance techniques have specificity to video content. 3) Participants' preference of and experience with Focus Assistance depended not only on individual difference but also on their goal of watching the video. 4) Factors such as view-moving-distance, salience of the intended target and guidance, and language comprehension affected participants' video-watching experience. Based on these findings, we provide design implications for better 360° video focus assistance.

> 360度的视频给观众一个球形的视野和身临其境的环境体验。然而，观看360°视频的一个挑战是不断聚焦并重新聚焦预定的目标。为了应对这一挑战，我们开发了两种焦点辅助技术：自动引导（直接将观众带到目标）和视觉指导（指明目标的方向）。我们使用这些技术进行了一项实验来测量观众的观看体验和不适，并获得了他们的定性反馈。我们发现：1）焦点帮助提高了注意力的集中度。2）焦点辅助技术对视频内容具有特殊性。3）参与者对焦点帮助的偏好和体验不仅取决于个体差异，还取决于他们观看视频的目的。（4）观看距离、目标和引导的显著性以及语言理解等因素影响了参与者的视频观看体验。基于这些发现，我们为更好的360°视频聚焦帮助提供了设计启示。 article link

221. ScreenGlint: Practical, In-situ Gaze Estimation on Smartphones

SESSION:Improving Gaze Mechanisms

Gaze estimation has widespread applications. However, little work has explored gaze estimation on smartphones, even though they are fast becoming ubiquitous. This paper presents ScreenGlint, a novel approach which exploits the glint (reflection) of the screen on the user's cornea for gaze estimation, using only the image captured by the front-facing camera. We first conduct a user study on common postures during smartphone use. We then design an experiment to evaluate the accuracy of ScreenGlint under varying face-to-screen distances. An in-depth evaluation involving multiple users is conducted and the impact of head pose variations is investigated. ScreenGlint achieves an overall angular error of 2.44º without head pose variations, and 2.94º with head pose variations. Our technique compares favorably to state-of-the-art research works, indicating that the glint of the screen is an effective and practical cue to gaze estimation on the smartphone platform. We believe that this work can open up new possibilities for practical and ubiquitous gaze-aware applications.

> 凝视估计有着广泛的应用。然而，很少有人探索智能手机上的凝视估计，尽管他们正在迅速成为无处不在。本文提出了一种新的方法screenglint，利用反射（反射）的屏幕对用户的角膜的视线估计，仅利用图像的前置摄像头拍摄。我们首先对用户使用智能手机时的常见姿势进行研究。然后我们设计了一个实验来评估不同的面对屏幕的距离下screenglint精度。进行深入的评估涉及多个用户和头部姿势变化的影响进行了研究。screenglint达到2.44º整体角度误差没有头部姿势的变化，和2.94º与头部姿势的变化。我们的技术与最先进的研究成果相比，显示出闪烁的屏幕是一个有效和实用的提示凝视估计在智能手机平台。我们相信，这项工作可以为实际的和无处不在的目光感知应用开辟新的可能性。 article link

222. Improving Dwell-Based Gaze Typing with Dynamic, Cascading Dwell Times

SESSION:Improving Gaze Mechanisms

We presentcascading dwell gaze typing, a novel approach to dwell-based eye typing that dynamically adjusts the dwell time of keys in an on-screen keyboard based on the likelihood that a key will be selected next, and the location of the key on the keyboard. Our approach makes unlikely keys more difficult to select and likely keys easier to select by increasing and decreasing their required dwell times, respectively. To maintain a smooth typing rhythm for the user, wecascadethe dwell time of likely keys, slowly decreasing the minimum allowable dwell time as a user enters text. Cascading the dwell time affords users the benefits of faster dwell times while causing little disruption to users' typing cadence. Results from a longitudinal study with 17 non-disabled participants show that our dynamic cascading dwell technique was significantly faster than a static dwell approach. Participants were able to achieve typing speeds of 12.39 WPM on average with our cascading technique, whereas participants were able to achieve typing speeds of 10.62 WPM on average with a static dwell time approach. In a small evaluation conducted with five people with ALS, participants achieved average typing speeds of 9.51 WPM with our cascading dwell approach. These results show that our dynamic cascading dwell technique has the potential to improve gaze typing for users with and without disabilities.

> 我们presentcascading驻留凝视打字，一种居住的眼睛打字，动态调整驻留时间的钥匙在一个基于一个键将选择下一步的可能途径和屏幕键盘，键盘上的键的位置。我们的方法使不太可能的键更难选择，并且可能通过增加和减少它们所需的停留时间来更容易地选择键。保持平稳的打字节奏的用户，wecascadethe住在可能钥匙时间，慢慢减少允许的最小停留时间为用户输入文本。级联驻留时间给用户带来更快的驻留时间的好处，而不会对用户的键入节奏造成干扰。17名非残疾参与者的纵向研究结果表明，我们的动态级联驻留技术比静态驻留方法快得多。参与者可以实现打字每分钟12.39字的平均速度与我们的级联技术，而参与者能够实现打字速度每分钟10.62字的平均静态停留时间的方法。在一个小的评价五ALS患者进行的，参与者达到平均每分钟9.51字的打字速度与我们居住的方式级联。这些结果表明，我们的动态级联驻留技术有助于改善有或无残疾用户的凝视类型。 article link

223. Looking Coordinated: Bidirectional Gaze Mechanisms for Collaborative Interaction with Virtual Characters

SESSION:Improving Gaze Mechanisms

Successful collaboration relies on the coordination and alignment of communicative cues. In this paper, we present mechanisms of bidirectional gaze - the coordinated production and detection of gaze cues - by which a virtual character can coordinate its gaze cues with those of its human user. We implement these mechanisms in a hybrid stochastic/heuristic model synthesized from data collected in human-human interactions. In three lab studies wherein a virtual character instructs participants in a sandwich-making task, we demonstrate how bidirectional gaze can lead to positive outcomes in error rate, completion time, and the agent's ability to produce quick, effective nonverbal references. The first study involved an on-screen agent and the participant wearing eye-tracking glasses. The second study demonstrates that these positive outcomes can be achieved using head-pose estimation in place of full eye tracking. The third study demonstrates that these effects also transfer into virtual-reality interactions.

> 成功的合作依赖于交际线索的协调和一致。在本文中，我们提出了双向凝视的机制-协调生产和检测的视线线索-虚拟人物可以协调它的视线线索与它的人类用户。我们在一个混合的随机/启发式模型中实现这些机制。在三个实验室研究中，其中一个虚拟角色指导了一个三明治制作任务的参与者，我们演示了双向凝视如何导致错误率、完成时间以及代理生成快速、有效的非语言参考的积极结果。第一项研究涉及屏幕代理和参与者戴眼睛跟踪眼镜。第二项研究表明，使用头部姿势估计代替全眼跟踪可以获得这些积极的结果。第三项研究表明，这些影响也转移到虚拟现实交互中。 article link

224. Pineal: Bringing Passive Objects to Life with Embedded Mobile Devices

SESSION:Innovative Fabrication Techniques

Interactive, smart objects-customized to individuals and uses-are central to many movements, such as tangibles, the internet of things (IoT), and ubiquitous computing. Yet, rapid prototyping both the form and function of these custom objects can be problematic, particularly for those with limited electronics or programming experience. Designers often need to embed custom circuitry; program its workings; and create a form factor that not only reflects the desired user experience but can also house the required circuitry and electronics. To mitigate this, we createdPineal, a design tool that lets end-users: (1) modify 3D models to include a smart watch or phone as its heart; (2) specify high-level interactive behaviours through visual programming; and (3) have the phone or watch act out such behaviours as the objects' "smarts". Furthermore, a series of prototypes show how Pineal exploits mobile sensing and output, and automatically generates 3D printed form-factors for rich, interactive, objects.

> 互动，智能对象定制个人使用是许多运动中心，如有形，物联网（IOT），和无处不在的计算。然而，快速定制这些定制对象的形式和功能可能会有问题，特别是对于那些具有有限的电子或编程经验的人来说。设计人员通常需要嵌入定制电路；编程其工作方式；创建一个表单因子，它不仅能反映所需的用户体验，还能容纳所需的电路和电子学。为了解决这个问题，我们createdpineal，设计工具，让最终用户：（1）修改3D模型包括一个智能手表或手机为中心；（2）指定高级交互行为通过可视化编程；和（3）有电话或看表演这种行为为对象的“智慧”。此外，一系列原型展示了松果体如何利用移动传感和输出，并自动生成丰富、交互式、对象的3D打印表单因子。 article link

225. CalibMe: Fast and Unsupervised Eye Tracker Calibration for Gaze-Based Pervasive Human-Computer Interaction

SESSION:Innovative Fabrication Techniques

As devices around us become smart, our gaze is poised to become the next frontier of human-computer interaction (HCI). State-of-the-art mobile eye tracker systems typically rely on eye-model-based gaze estimation approaches, which do not require a calibration. However, such approaches require specialized hardware (e.g., multiple cameras and glint points), can be significantly affected by glasses, and, thus, are not fit for ubiquitous gaze-based HCI. In contrast, regression-based gaze estimations are straightforward approaches requiring solely one eye and one scene camera but necessitate a calibration. Therefore, a fast and accurate calibration is a key development to enable ubiquitous gaze-based HCI. In this paper, we introduce CalibMe, a novel method that exploits collection markers (automatically detected fiducial markers) to allow eye tracker users to gather a large array of calibration points, remove outliers, and automatically reserve evaluation points in a fast and unsupervised manner. The proposed approach is evaluated against a nine-point calibration method, which is typically used due to its relatively short calibration time and adequate accuracy. CalibMe reached a mean angular error of 0.59 (0=0.23) in contrast to 0.82 (0=0.15) for a nine-point calibration, attesting for the efficacy of the method. Moreover, users are able to calibrate the eye tracker anywhere and independently in - 10 s using a cellphone to display the collection marker.

> 随着我们周围设备的智能化，我们的目光将成为人机交互（HCI）的下一个前沿。最先进的移动眼动仪系统通常依赖于基于眼睛模型的视线估计方法，这种方法不需要校准。然而，这种方法需要专门的硬件（例如，多个相机和闪烁点），可以受到眼镜的显著影响，因此，不适合无处不在的基于凝视的人机交互。与此相反，基于回归的凝视估计是直接的方法，只需要一个眼睛和一个场景相机，但需要校准。因此，快速准确的校准是实现基于普适凝视的人机交互的关键。在本文中，我们介绍了calibme，一种新的方法，利用收集的标记（自动检测基准标记）让人眼跟踪用户收集大量的校准点，去除异常值，并自动储备评价点在一个快速和监督的方式。所提出的方法是针对九点校准方法，这是典型的使用，由于其相对较短的校准时间和足够的精度。CalibMe达到了平均角误差为0.59（0 = 0.23）与0.82（0 = 0.15）进行九点标定，证明了该方法的有效性。此外，用户可以使用手机在10秒的时间内独立地对眼睛跟踪器进行校准，以显示采集标记。 article link

226. TrussFab: Fabricating Sturdy Large-Scale Structures on Desktop 3D Printers

SESSION:Innovative Fabrication Techniques

We present TrussFab, an integrated end-to-end system that allows users to fabricate large scale structures that are sturdy enough to carry human weight. TrussFab achieves the large scale by complementing 3D print with plastic bottles. It does not use these bottles as "bricks" though, but as beams that form structurally sound node-link structures, also known as trusses, allowing it to handle the forces resulting from scale and load. TrussFab embodies the required engineering knowledge, allowing non-engineers to design such structures and to validate their design using integrated structural analysis. We have used TrussFab to design and fabricate tables and chairs, a 2.5 m long bridge strong enough to carry a human, a functional boat that seats two, and a 5 m diameter dome.

> 我们目前的trussfab，集成的终端到终端的系统，允许用户制作，足够坚固携带人体重量的大尺度结构。trussfab达到大规模补充3D打印的塑料瓶。它并不把这些瓶子当作砖块来使用，而是作为构成结构声音的节点连接结构，也称为桁架，允许它处理由尺度和载荷引起的力。trussfab体现了工程知识，允许非工程师来设计这样的结构和使用结构整体分析验证他们的设计。我们用trussfab和制作桌椅的设计，一个2.5米长的桥足以把人的功能船座位，和一个直径5米的圆顶。 article link

227. StretchEBand: Enabling Fabric-based Interactions through Rapid Fabrication of Textile Stretch Sensors

SESSION:Innovative Fabrication Techniques

The increased interest in interactive soft materials, such as smart clothing and responsive furniture, means that there is a need for flexible and deformable electronics. In this paper, we focus on stitch-based elastic sensors, which have the benefit of being manufacturable with textile craft tools that have been used in homes for centuries. We contribute to the understanding of stitch-based stretch sensors through four experiments and one user study that investigate conductive yarns from textile and technical perspectives, and analyze the impact of different stitch types and parameters. The insights informed our design of new stretch-based interaction techniques that emphasize eyes-free or causal interactions. We demonstrate with StretchEBand how soft, continuous sensors can be rapidly fabricated with different parameters and capabilities to support interaction with a wide range of performance requirements across wearables, mobile devices, clothing, furniture, and toys.

> 对交互式软材料（如智能服装和响应性家具）的兴趣日益增加，意味着需要灵活和可变形的电子产品。在本文中，我们重点研究了基于弹性传感器针脚，具有制造和纺织工艺的工具已被用于在家百年效益。我们通过四个实验和一个用户研究，从纺织和技术角度研究导电纱线，并分析不同针脚类型和参数的影响，从而有助于理解针式拉伸传感器。这些见解告诉我们设计新的基于拉伸的交互技术，强调无眼或因果交互作用。我们展示了StretchEBand如何软，连续的传感器可以迅速制造出不同的参数和功能，具有广泛的性能

> 要求在服饰，支持互动的移动设备，服装，家具，玩具。 article link

228. GraphScape: A Model for Automated Reasoning about Visualization Similarity and Sequencing

SESSION:Intelligent Visualization Systems

We present GraphScape, a directed graph model of the vi- sualization design space that supports automated reasoning about visualization similarity and sequencing. Graph nodes represent grammar-based chart specifications and edges rep- resent edits that transform one chart to another. We weight edges with an estimated cost of the difficulty of interpreting a target visualization given a source visualization. We con- tribute (1) a method for deriving transition costs via a partial ordering of edit operations and the solution of a resulting lin- ear program, and (2) a global weighting term that rewards consistency across transition subsequences. In a controlled experiment, subjects rated visualization sequences covering a taxonomy of common transition types. In all but one case, GraphScape's highest-ranked suggestion aligns with subjects' top-rated sequences. Finally, we demonstrate applications of GraphScape to automatically sequence visualization presen- tations, elaborate transition paths between visualizations, and recommend design alternatives (e.g., to improve scalability while minimizing design changes).

> 我们目前的graphscape，一个有向图模型的VI设计的空间数据，支持自动推理可视化相似和测序。图节点表示基于语法的图表规范和边表示-编辑将一个图表转换为另一个图表。我们以估计源可视化的困难为代价估计边缘。我们认为，贡（1）一个导出转换成本通过一个偏序的编辑操作，导致林耳程序解决的方法，及（2）全球加权项奖励过渡序列一致性。在受控制的实验中，受试者将可视化序列列为一般过渡类型的分类。但在所有情况下，graphscape排名最高的建议与受试者的顶级序列。最后，我们展示了graphscape自动序列可视化与应用，阐述转型路径之间的可视化，并推荐设计方案（例如，提高可扩展性的同时最大限度地减少设计变更）。 article link

229. GIAnT: Visualizing Group Interaction at Large Wall Displays

SESSION:Intelligent Visualization Systems

Large interactive displays are increasingly important and a relevant research topic, and several studies have focused on wall interaction. However, in many cases, thorough user studies currently require time-consuming video analysis and coding. We present the Group Interaction Analysis Toolkit GIAnT, which provides a rich set of visualizations supporting investigation of multi-user interaction at large display walls. GIAnT focuses on visualizing time periods, making it possible to gain overview-level insights quickly. The toolkit is designed to be extensible and features several carefully crafted visualizations: A novel timeline visualization shows movement in front of the wall over time, a wall visualization shows interactions on the wall and gaze data, and a floor visualization displays user positions. In addition, GIAnT shows the captured video stream along with basic statistics. We validate our tool by analyzing how it supports investigating major research topics and by practical use in evaluating a cooperative game.

> 大型交互显示器越来越重要，也是一个相关的研究课题。然而，在许多情况下，深入的用户研究目前需要耗时的视频分析和编码。我们提供了组交互分析工具包巨人，它提供了丰富的可视化集合，支持大屏幕显示中多用户交互的研究。巨人专注于可视化时间段，从而有可能快速获得概述级的洞察力。该工具包的设计是可扩展的，并具有几个精心制作的可视化：一个新的时间轴可视化显示在墙上的运动随着时间的推移，墙上的可视化显示在墙壁上的互动和凝视数据，并显示用户的地板可视化位置。此外，巨人还展示了捕获的视频流以及基本统计信息。我们验证我们的工具，通过分析它是如何支持调查主要研究课题，并通过实际使用评估合作博弈。 article link

230. Voyager 2: Augmenting Visual Analysis with Partial View Specifications

SESSION:Intelligent Visualization Systems

Visual data analysis involves both open-ended and focused exploration. Manual chart specification tools support question answering, but are often tedious for early-stage exploration where systematic data coverage is needed. Visualization recommenders can encourage broad coverage, but irrelevant suggestions may distract users once they commit to specific questions. We presentVoyager 2, a mixed-initiative system that blends manual and automated chart specification to help analysts engage in both open-ended exploration and targeted question answering. We contribute two partial specification interfaces:wildcardslet users specify multiple charts in parallel, whilerelated viewssuggest visualizations relevant to the currently specified chart. We present our interface design and applications of theCompassQLvisualization query language to enable these interfaces. In a controlled study we find that Voyager 2 leads to increased data field coverage compared to a traditional specification tool, while still allowing analysts to flexibly drill-down and answer specific questions.

> 视觉数据分析包括开放式和集中式的探索。手动图表规范工具支持问答，但对于需要进行系统数据覆盖的早期探索来说，常常是乏味的。可视化的推荐系统可以鼓励广泛覆盖，但不相干的建议可能会分散用户一旦他们承诺的具体问题。我们presentvoyager 2、主动混合系统融合了手动和自动图规范帮助分析师从事开放式探索和有针对性的问答。我们有两部分规范接口：wildcardslet用户指定多个图并行，whilerelated viewssuggest显示当前指定的图相关。我们提出我们的界面设计和应用thecompassqlvisualization查询语言使这些接口。在一项对照研究中，我们发现旅行者2号与传统的规范工具相比，导致了数据字段覆盖率的增加，同时也使分析师能够灵活地钻取并回答特定的问题。 article link

231. TouchPivot: Blending WIMP & Post-WIMP Interfaces for Data Exploration on Tablet Devices

SESSION:Intelligent Visualization Systems

Recent advancements in tablet technology pose a great opportunity for information visualization to expand its horizons beyond desktops. In this paper, we present TouchPivot, a novel interface that assists visual data exploration on tablet devices. With novices in mind, TouchPivot supports data transformations, such as pivoting and filtering, with simple pen and touch interactions, and facilitates understanding of the transformations through tight coupling between a data table and visualization. We bring in WIMP interfaces to TouchPivot, leveraging their familiarity and accessibility to novices. We report on a user study conducted to compare TouchPivot with two commercial interfaces, Tableau and Microsoft Excel's PivotTable. Our results show that novices not only answered data-driven questions faster, but also created a larger number of meaningful charts during freeform exploration with TouchPivot than others. Finally, we discuss the main hurdles novices encountered during our study and possible remedies for them.

> 平板电脑技术的最新进展给信息可视化提供了一个极好的机会，可以扩展桌面以外的视野。在本文中，我们提出一个新的接口touchpivot，协助视觉在平板设备上数据的探索。新手在心，touchpivot支持数据的变换，如旋转、过滤，用简单的笔和触摸交互，便于理解的转换通过数据表和可视化之间的紧密耦合。我们把WIMP界面到TouchPivot，利用他们熟悉和方便新手。我们报告进行比较touchpivot两商业界面用户研究，和微软Excel的数据透视表。我们的研究结果表明，新手不仅回答了数据驱动的问题更快，但也创造了大量的有意义的自由探索与touchpivot比其他图表中。最后，我们将讨论初学者在学习过程中遇到的主要障碍和可能的补救措施。 article link

232. A Framework for Interactive Mindfulness Meditation Using Attention-Regulation Process

SESSION:Mindfulness and Reflection

We are often overwhelmed by everyday stressors. Mindfulness meditation can help slow things down and bring one's attention into the present moment. Given the prevalence of smartphones, mindfulness-based mobile applications (MBMAs) have received much attention. Current MBMAs mainly use the guided meditation method which may not be always effective, e.g., users may not be able to follow the pace of instructions and they need a private environment. This paper presents a framework for interactive MBMAs which allows users to self-regulate their attention according to their abilities and conditions. The framework is described by anAttention-Regulation Processand has two components: (1)Relaxation Responseand (2)Attention Restoration Theory. The framework is validated by our experiment. It also informs future development for interactive meditation and has broad implications for designing mindfulness and well-being.

> 我们常常被日常的压力所压倒。正念冥想有助于减缓事物的发展，并将注意力集中到当下。由于智能手机的普及，基于移动应用（MBMAS）备受关注。目前主要使用MBMAS冥想的方法可能并不总是有效的，例如，用户可能无法遵循指示的步伐，他们需要一个私人的环境。本文提出了一种交互式MBMAS允许用户自我调节注意根据自己的能力和条件的框架。该框架是由周围的调节过程的描述有两个组成部分：（1）及（2）放松注意力恢复理论。我们的实验验证了该框架。它还告诉互动冥想未来的发展，并有广泛的设计正念和福祉的影响。 article link

233. Designing Digital Mindfulness: Presence-In and Presence-With versus Presence-Through

SESSION:Mindfulness and Reflection

The digital health and wellbeing movement has led to development of digital mindfulness applications that aim to help people to become mindful. In this paper we suggest a broad scheme for classifying and ordering apps intended to support mindfulness. This scheme consists of four levels of what we here term digital mindfulness. One crucial aspect of the fourth level is that artifacts at this level allow for what we term as presence-with and presence-in as opposed to presence-through, which occurs at the first three levels. We articulate our four levels along with specific design qualities through concrete examples of existing mindfulness apps and through research through design (RtD) work conducted with design fiction examples. We then use a working design case prototype to further illustrate the possibilities of presence-with and presence-in. We hope our four levels of digital mindfulness framework will be found useful by other researchers in discussing and planning the design of their own mindfulness apps and digital artifacts.

> 数字健康与幸福运动导致了数字正念应用的发展，旨在帮助人们变得正念。在本文中，我们提出了一个广泛的计划来分类和订购支持正念的应用程序。这个计划由四个层次组成，我们称之为数字正念。第四级的一个关键方面是，这个级别的工件允许我们称之为存在和存在，而不是存在于前三个层次。我们通过具体的正念应用实例和通过设计（RTD）与设计小说实例进行的研究来阐明我们的四个层次以及具体的设计质量。然后，我们使用一个工作设计案例原型进一步说明存在和存在的可能性。我们希望我们的四个层次的数字正念框架将被发现，其他研究人员在讨论和规划自己的正念应用程序和数字文物设计。 article link

234. Reflective Practicum: A Framework of Sensitising Concepts to Design for Transformative Reflection

SESSION:Mindfulness and Reflection

Designing for reflection is becoming an increasingly important part of many HCI systems in a wide range of application domains. However, there is a gap in our understanding of how the process of reflection can be supported through technology. In fact, an implicit assumption in the majority of existing work is that, just by providing access to well-selected data, in-depth reflection can and will occur. To counter this view, we draw on Schön's notion of reflective practicum and apply it as a sensitising concept to identify the complex interplay of factors that support transformative reflection in the context of two social-emotional learning (SEL) studies. The results highlight the need to carefully scaffold the process of reflection, rather than simply assume that the capability to reflect is a broadly available trait to be 'triggered' through data. Building on this analysis, we develop a conceptual framework that extends the concept of the reflective practicum towards identifying appropriate roles of technology to support transformative reflection. While our case is within the context of SEL, we argue that a deeper understanding of these opportunities can also benefit designing for reflection in other areas.

> 在许多应用领域，反射设计正在成为许多HCI系统的一个越来越重要的部分。然而，我们对如何通过技术来支持反射过程的理解存在着差距。事实上，大多数现有工作的一个隐含假设是，只要提供对选定数据的访问，深入的思考就能够而且将发生。针对这一观点，我们从学校öN的概念反思性实习并把它作为一个敏感的概念确定的因素，支持变革体现在两个社会情感学习环境的复杂的相互作用（SEL）的研究。研究结果强调，需要仔细地考虑反射过程，而不是简单地假设反射能力是通过数据触发的可广泛使用的特性。在此分析的基础上，我们开发了一个概念框架，扩展了反思性实习的概念对确定合适的技术角色支持变革的反思。虽然我们的案例是在SEL的背景下，我们认为，更深入地了解这些机会，也有利于在其他领域的反思设计。 article link

235. mHealth for Maternal Mental Health: Everyday Wisdom in Ethical Design

SESSION:Mindfulness and Reflection

Health and wellbeing applications increasingly raise ethical issues for design. User-centred and participatory design approaches, while grounded in everyday wisdom, cannot be expected to address ethical reflection consistently, as multiple value systems come into play. We explore the potential of phronesis, a concept from Aristotelian virtue ethics, for mHealth design. Phronesis describes wisdom and judgment garnered from practical experience of specific situations in context. Applied phronesis contributes everyday wisdom to challenging issues for vulnerable target users. Drawing on research into mHealth technologies for psychological wellbeing, we explore how phronesis can inform ethical design. Using a case study on an app for self-reporting symptoms of depression during pregnancy, we present a framework for incorporating a phronetic approach into design, involving: (a) a wide feedback net to capture phronetic input early in design; (b) observing the order of feedback, which directly affects value priorities in design; (c) ethical pluralism recognising different coexisting value systems; (d) acknowledging subjectivity in the disclosure and recognition of individual researcher and participant values. We offer insights into how a phronetic approach can contribute everyday wisdom to designing mHealth technologies to help designers foster the values that promote human flourishing.

> 健康和福利应用日益增加设计的伦理问题。以用户为中心和参与式的设计方法，虽然以日常智慧为基础，但不能指望随着多元价值体系的发挥，一致地解决伦理问题。我们探索的实践智慧的潜力，从Aristotelian的德性伦理学的一个概念，为移动医疗的设计。实践智慧了智慧和判断从语境中的具体情况的实践经验积累。应用实践智慧有助于日常智慧，富有挑战性的问题，为脆弱的目标用户。图为移动医疗技术的研究对于心理健康，我们将探讨如何实践智慧可以告知伦理设计。通过对妊娠期抑郁症状的自我报告的应用案例研究，我们提出了一个框架，整合phronetic方法的设计，包括：（一）广泛的反馈网捕捉phronetic输入早在设计；（b）观察反馈订单，这直接影响到价值优先的设计；（C）多元道德认识不同的共存的价值系统；（d）承认主体在信息披露和识别个体研究者和参与者的价值。我们提供的见解如何方法可以每天phronetic智慧设计移动医疗技术帮助设计师培养，促进人类繁荣的价值。 article link

236. Uncovering the Values and Constraints of Real-time Ridesharing for Low-resource Populations

SESSION:Supporting Low Resource Communities

Real-time ridesharing services (e.g., Uber and Lyft) are often touted as sharing-economy leaders and dramatically lower the cost of transportation. However, how to make these services work better among low-income and transportation-scarce households, how these individuals experience these services, and whether they encounter barriers in enlisting these services is unknown. To address these questions, we onboarded 13 low-income individuals living in transportation-scarce environments to Uber as passengers. Our participants found these services to be reliable and benefited from rich social interactions with drivers; however, barriers such as cost, limited payment methods, and low digital literacy can make such services infeasible. We contribute platform designs that could lead to increased digital literacy and application transparency. To be more inclusive and to reach critical mass, we suggest that these companies foster belief in commons and community trust by coordinating with local businesses in low-resource areas with lower digital literacy.

> 实时面向服务（例如，Uber和Lyft）经常被吹捧为共享经济领袖和运输成本大幅降低。然而，如何使这些服务在低收入和运输稀缺户更好的工作，这些人如何体验这些服务，以及他们是否遇到障碍参与这些服务是未知的。为了解决这些问题，我们13个人住在低收入onboarded运输稀缺环境Uber的乘客。我们的参与者发现这些服务是可靠的，并得益于与司机的丰富的社会互动；然而，诸如成本、有限的支付方式和低数字素养等障碍会使这些服务不可行。我们提供能够提高数字素养和应用透明性的平台设计。为了更具包容性，并达到关键的质量，我们建议这些公司通过在低资源领域与当地企业进行协作，以降低数字素养，从而培养对公共空间和社区信任的信念。 article link

237. Supporting Community Health Workers in India through Voice- and Web-Based Feedback

SESSION:Supporting Low Resource Communities

Our research aims to support community health workers (CHWs) in low-resource settings by providing them with personalized information regarding their work. This information is delivered through a combination of voice- and web-based feedback that is derived from data already collected by CHWs. We describe the in situ participatory design approach used to create usable and appropriate feedback for low-literate CHWs and present usage data from a 12-month study with 71 CHWs in India. We show how the system supported and motivated CHWs, and how they usedboththe web- and voice-based systems, and each of the visualizations, for different reasons. We also show that the comparative feedback provided by the system introduced elements of competition that discouraged some CHWs while motivating others. Taken together, our findings suggest that providing personalized voice- and web-based feedback could be an effective way to support and motivate CHWs in low-resource settings.

> 我们的研究旨在支持社区卫生工作者（社区卫生工作者）在低资源设置为他们提供个性化的信息对他们的工作。这个信息是通过结合语音传输和网络的反馈是来自社区卫生工作者已经收集的数据。我们描述了在原位的参与式设计方法，用于创建可用的和适当的71社区卫生工作者在印度低识字的社区卫生工作者和当前使用的数据从一个月的研究反馈。我们展示了如何系统的支持和积极的社区卫生工作者，以及他们如何usedboththe Web和基于语音的系统，并且每个可视化，因为不同的原因。我们还表明，系统的介绍了竞争因素，影响了社区卫生工作者而激励他人提供反馈的比较。总之，我们的研究结果表明，提供个性化的语音和网络反馈可以支持和激励在低资源设置社区卫生工作者的有效途径。 article link

238. We Play We Learn: Exploring the Value of Digital Educational Games in Rural Egypt

SESSION:Supporting Low Resource Communities

The Egyptian education system faces urgent challenges. Proposed governmental reforms tend to focus on increasing access to physical and digital resources. There is insufficient understanding as to how the provided resources are currently used in rural areas. We explored the extent to which digital technology could motivate primary students to collaboratively learn a challenging topic in the National Mathematics Curriculum. We designed and researched a digital game to support memorizing multiplication facts. We used an incentive structure that encouraged individual learning with rewarding teamwork. The game was tested with mixed ability and gender groups of students using the Teams-Game-Tournament collaboration technique. A key outcome was that the students with educationally disadvantaged backgrounds benefited from using the game format. They devised their own play and study strategies. We discuss implications on future designs of the game, and considerations for its integration in Egyptian schools.

> 埃及教育系统面临严峻挑战。拟议的政府改革往往侧重于增加对实物和数字资源的获取。农村地区目前所使用的资源是如何得到充分了解的。我们探讨了数字技术在多大程度上可以激励小学生在国家数学课程中合作学习具有挑战性的课题。我们设计并研究了一种支持乘法事实记忆的数字游戏。我们使用鼓励个人学习和奖励团队的激励结构。该游戏测试的混合能力和性别群体的学生使用团队游戏比赛合作技术。一个关键的结果是，随着教育弱势背景得益于使用游戏格式的学生。他们设计了自己的剧本和学习策略。我们讨论对未来游戏设计的影响，以及在埃及学校整合的考虑。 article link

239. Sidestepping the Elephant in the Classroom: Using Culturally Localized Technology To Teach Around Taboos

SESSION:Supporting Low Resource Communities

Cultural taboos can restrict student learning on topics of critical importance. In India, such taboos have led multiple states to ban materials intended to educate youth about HIV, putting millions at risk. We present the design of TeachAIDS, a software application that leverages cultural insights, learning science, and affordances of technology to provide comprehensive HIV education while circumventing taboos. Using a mixed-methods evaluation, we demonstrate that this software leaves students with significantly increased knowledge about HIV and reduced stigma toward individuals infected with the virus. Validating the effectiveness of TeachAIDS in circumventing taboos, students report comfort in learning from the software, and it has since been deployed in tens of thousands of schools throughout India. The methodology presented here has broader implications for the design and implementation of interactive technologies for providing education on sensitive topics in health and other areas.

> 文化禁忌可以限制学生在关键问题上的学习。在印度，这种禁忌导致多个州禁止向年轻人宣传艾滋病毒的材料，使数百万人处于危险之中。我们目前的teachaids设计，软件应用程序，利用文化的了解，学习科学，技术和启示为感染者提供综合性的教育而绕过禁忌。使用混合方法评估，我们证明，该软件使学生大大增加了对艾滋病毒的认识，减少了对感染病毒的人的污名。在teachaids规避禁忌的有效性验证，从软件学习的学生报告的舒适，并且它已经被部署在整个印度成千上万的学校。这里介绍的方法对设计和实施交互式技术提供更广泛的影响，以便为卫生和其他领域的敏感话题提供教育。 article link

240. What Can Be Predicted from Six Seconds of Driver Glances?

SESSION:Technology Augmented Driving

We consider a large dataset of real-world, on-road driving from a 100-car naturalistic study to explore the predictive power of driver glances and, specifically, to answer the following question: what can be predicted about the state of the driver and the state of the driving environment from a 6-second sequence of macro-glances? The context-based

nature of such glances allows for application of supervised learning to the problem of vision-based gaze estimation, making it robust, accurate, and reliable in messy, real-world conditions. So, it's valuable to ask whether such macro-glances can be used to infer behavioral, environmental, and demographic variables? We analyze 27 binary classification problems based on these variables. The takeaway is that glance can be used as part of a multi-sensor real-time system to predict radio-tuning, fatigue state, failure to signal, talking, and several environment variables.

> 我们考虑一个大的数据集的真实道路驾驶从100辆车的自然主义的研究探讨司机目光的预测能力，具体地说，要回答以下问题：什么是可以预测的关于从宏观的眼光6秒序列和司机的驾驶环境状态？基于这种视角的基于上下文的性质允许将监督学习应用到基于视觉的凝视估计问题中，使其在杂乱、真实的环境中健壮、准确和可靠。因此，问这样的宏观眼光是否可以用来推断行为、环境和人口统计学变量是很有价值的。我们分析了基于这些变量的27个二进制分类问题。这种方法可以作为多传感器实时系统的一部分，用来预测无线电调谐、疲劳状态、信号故障、通话和几个环境变量。 article link

241. Using Advisory 3D Sound Cues to Improve Drivers' Performance and Situation Awareness

SESSION:Technology Augmented Driving

Within vehicle Human Machine Interface design, visual displays are predominant, taking up more and more of the visual channel for each new system added to the car, e.g. navigation systems, blind spot information and forward collision warnings. Sounds however, are mainly used to alert or warn drivers together with visual information. In this study we investigated the design of auditory displays for advisory information, by designing a 3D auditory advisory traffic information system (3DAATIS) which was evaluated in a drive simulator study with 30 participants. Our findings indicate that overall, drivers' performance and situation awareness improved when using this system. But, more importantly, the results also point towards the advantages and limitations of the use of advisory 3D-sounds in cars, e.g. attention capture vs. limited auditory resolution. These findings are discussed and expressed as design implications.

> 在车辆人机界面设计中，视觉显示器占主导地位，为汽车中添加的每一个新系统占用越来越多的视觉通道，如导航系统、盲点信息和前方碰撞警告。然而，声音主要用于与视觉信息一起提醒或警告司机。本文研究了咨询信息的听觉显示器的设计，通过三维听觉咨询交通信息系统的设计（3daatis）进行了评估，驾驶模拟器的研究与30名。我们的研究结果表明，总体而言，司机的表现和情况意识提高时使用该系统。但是，更重要的是，结果也指出了在汽车中使用3D声音的优点和局限性，例如注意捕获和有限听觉分辨力。这些发现被讨论并表示为设计含义。 article link

242. Designing Gamified Applications that Make Safe Driving More Engaging

SESSION:Technology Augmented Driving

Low levels of engagement while driving can pose road safety risks, e.g., inattention during low traffic or routine trips. Interactive technologies that increase task engagement could therefore offer safety benefits, e.g., through performance feedback, increased challenge, and incentives. As a means to build upon these notions, we chose to explore gamification of the driving task. The research aim was to study how to design gamified applications that make safe driving more engaging. We present six design lenses which bring into focus considerations most relevant to creating engaging car applications. A user study enhanced our understanding of design requirements and revealed user personas to support the development of such applications. These lenses and personas informed two prototypes, which we evaluated in driving simulator studies. Our results indicate that the gamified conditions increased driver engagement and reduced driving speeds. As such, our work contributes towards the design of engaging applications that are both appropriate to the safety-critical driving context and compelling to users.

> 开车时接触的低水平会造成道路安全风险，例如在交通拥挤或例行旅行时注意力不集中。因此，增加任务参与的交互技术可以提供安全效益，例如，通过绩效反馈、增加的挑战和奖励。作为一种手段来建立这些概念，我们选择了探索驾驶任务游戏化。本研究的目的是研究如何设计游戏化的应用，使安全驾驶更迷人。我们提出了六个设计镜头，将重点考虑到最相关的创建引人入胜的汽车应用程序。用户研究增强了我们对设计需求的理解，并揭示了用户角色以支持此类应用程序的开发。这些镜头和人物角色告知了两个原型，我们在驾驶模拟器研究中评估了这些原型。我们的研究结果表明，游戏化的条件下提高司机参与和降低行驶速度。因此，我们的工作有助于设计适合于安全关键驱动上下文和吸引用户的吸引应用程序。 article link

243. Tunneled In: Drivers with Active Secondary Tasks Need More Time to Transition from Automation

SESSION:Technology Augmented Driving

In partially automated driving, rapid transitions of control present a severe hazard. How long does it take a driver to take back control of the vehicle when engaged with other non-driving tasks? In this driving simulator study, we examined the performance of participants (N=30) after an abrupt loss of automated vehicle control. We tested three transition time conditions, with an unstructured transition of control occurring 2s, 5s, or 8s before entering a curve. As participants were occupied with an active secondary task (playing a game on a tablet) while the automated driving mode was enabled, they needed to disengage from the task and regain control of the car when the transition occurred. Few drivers in the 2 second condition were able to safely negotiate the road hazard situation, while the majority of drivers in the 5 or 8 second conditions were able to navigate the hazard situation safely.

> 在部分自动驾驶中，快速的控制转换带来了严重的危险。当司机从事其他非驾驶任务时，需要多长时间恢复车辆的控制？在这个驾驶模拟器的研究中，我们检查了参与者（N = 30）在突然失去自动车辆控制后的表现。我们测试了三个过渡时间的条件下，随着控制发生2S，5S一个结构化的转变，或8s进入弯道前。当参与者处于主动的次要任务（在平板电脑上玩游戏）时，当自动驾驶模式被启用时，他们需要脱离任务并在转换发生时重新控制汽车。在2秒的情况下，很少有司机能够安全地谈判道路危险情况，而大多数司机在5或8秒的条件下能够安全地航行危险情况。 article link

244. An Evaluation of Input Controls for In-Car Interactions

SESSION:Technology Augmented Driving

The way drivers operate in-car systems is rapidly changing as traditional physical controls, such as buttons and dials, are being replaced by touchscreens and touch-sensing surfaces. This has the potential to increase driver distraction and error as controls may be harder to find and use. This paper presents an in-car, on the road driving study which examined three key types of input controls to investigate their effects: a physical dial, pressure-based input on a touch surface and touch input on a touchscreen. The physical dial and pressure-based input were also evaluated with and without haptic feedback. The study was conducted with users performing a list-based targeting task using the different controls while driving on public roads. Eye-gaze was recorded to measure distraction from the primary task of driving. The results showed that target accuracy was high across all input methods (greater than 94%). Pressure-based targeting was the slowest while directly tapping on the targets was the faster selection method. Pressure-based input also

caused the largest number of glances towards to the touchscreen but the duration of each glance was shorter than directly touching the screen. Our study will enable designers to make more appropriate design choices for future in-car interactions.

> 路上司机驾驶汽车系统正在迅速改变传统的物理控件，如按钮和转盘，是由触摸屏和触摸感应表面取代。这有可能增加司机分心和错误，因为控制可能很难找到和使用。本文提出了一种在汽车上的道路驾驶研究，检查三种关键类型的输入控制，以调查其效果：一个物理拨号，在触摸表面上的压力输入和触摸输入触摸屏。物理拨号和压力为基础的输入也评估和没有触觉反馈。这项研究是由用户在公共道路上驾驶时使用不同的控件执行基于列表的目标任务。眼睛的注视被记录来衡量分心的主要任务。结果表明，所有输入方法的目标精度都很高（大于94%）。基于压力的目标定位是最慢的，而直接瞄准目标是更快的选择方法。基于压力的输入也引起了对触摸屏的最大数量的注视，但每次扫视的时间比直接触摸屏幕要短。我们的研究将使设计师能够为汽车交互的未来做出更合适的设计选择。 article link

245. When Empathy Is Not Enough: Assessing the Experiences of Autistic Children with Technologies

SESSION:Autism, disabilities and assistive technology

Capturing and describing the multi-faceted experiences autistic children have with technologies provides a unique research challenge. Approaches based on pragmatist notions of experience, which mostly rely on empathy, are particularly limited if used alone. To address this we have developed an approach that combines Actor-Network Theory and Critical Discourse Analysis. Drawing on this approach, we discuss the experiences autistic children had with technologies resulting from the collaborative design process in the OutsideTheBox project. We construct a holistic picture of the experience by drawing on diverse data sources ranging from interviews to log-data, and most importantly, the first-hand perspective of autistic children. In four case studies, we demonstrate how this approach allowed us to develop unique individual and structural insights into the experiences of autistic children with technology.

> 捕捉和描述自闭症儿童使用技术的多方面经验，提供了独特的研究挑战。基于实用主义的观念的经验方法，它主要依赖于移情，特别有限，如果单独使用。为了解决这个问题，我们提出了一种结合行动者网络理论和批评性话语分析的方法。利用这种方法，我们讨论在outsidethebox项目协同设计过程中产生的技术有经验的自闭症儿童。我们利用不同的数据来源，从访谈到日志数据，以及最重要的是自闭症儿童的第一手资料，构建了一幅完整的经验图。在四个案例研究中，我们演示了这种方法如何使我们能够用技术独特的个人和结构洞察自闭症儿童的经验。 article link

246. ProCom: Designing and Evaluating a Mobile and Wearable System to Support Proximity Awareness for People with Autism

SESSION:Autism, disabilities and assistive technology

People with autism are at risk for social isolation due to differences in their perception and engagement with the social world. In this work, we aim to address one specific concern related to socialization the understanding, awareness, and use of interpersonal space. Over the course of a year, we iteratively designed and tested a series of concepts for supporting children with autism in perceiving, understanding, and responding to physical proximity with other people. During this process, we developed ProCom, a prototype system for measuring proximity without requiring instrumentation of the environment or another person. We used a variety of low and high fidelity prototypes, culminating in ProCom, to assess the feasibility, utility, and challenges of this approach. The results of these iterative design engagements indicate that wearable assistive technologies can support people in developing awareness of physical proximity in social settings. However, challenges related to both personal and collective use remain

> 自闭症患者由于他们的感知能力和与社会世界的接触而处于社会孤立的危险之中。在这项工作中，我们的目标是解决一个与社会化有关的理解，认识和使用人际空间的具体关注。在一年的时间里，我们反复设计和测试了一系列的概念，以支持自闭症儿童在感知、理解和应对与他人的身体亲近方面做出反应。在这个过程中，我们开发了该，一个不需要的环境或他人的仪器测量接近原型系统。我们使用各种低和高保真原型，最终在该，评估其可行性，实用性，以及这种方法的挑战。这些迭代设计任务的结果表明，可穿戴辅助技术可以支持人们在社会环境中发展对物理接近性的认识。然而，与个人和集体使用有关的挑战仍然存在。 article link

247. Smartphone-Based Gaze Gesture Communication for People with Motor Disabilities

SESSION:Autism, disabilities and assistive technology

Current eye-tracking input systems for people with ALS or other motor impairments are expensive, not robust under sunlight, and require frequent re-calibration and substantial, relatively immobile setups. Eye-gaze transfer (e-tran) boards, a low-tech alternative, are challenging to master and offer slow communication rates. To mitigate the drawbacks of these two status quo approaches, we created GazeSpeak, an eye gesture communication system that runs on a smartphone, and is designed to be low-cost, robust, portable, and easy-to-learn, with a higher communication bandwidth than an e-tran board. GazeSpeak can interpret eye gestures in real time, decode these gestures into predicted utterances, and facilitate communication, with different user interfaces for speakers and interpreters. Our evaluations demonstrate that GazeSpeak is robust, has good user satisfaction, and provides a speed improvement with respect to an e-tran board; we also identify avenues for further improvement to low-cost, low-effort gaze-based communication technologies.

> 目前对ALS或其他运动损伤患者的眼睛跟踪输入系统昂贵，在阳光下不牢固，需要频繁重新校准和实质上相对静止的设置。视线转移（e-tran）板，一个低技术含量的选择，是掌握和提供通信速率慢的挑战。为了减轻这两现状的方法存在的弊端，我们创造了gazespeak，眼睛的手势通信系统上运行的智能手机，并设计成低成本、坚固，便携，易于学习，比e-tran板更高的通信带宽。gazespeak可以解释在实时的眼神，解码这些手势成预言的话语，并促进沟通，为扬声器和翻译不同的用户界面。我们的评估表明，gazespeak具有较好的鲁棒性，具有良好的用户满意度，并提供改善的速度相对于e-tran板；我们还确定了进一步改进的低成本途径，低努力凝视基于通信技术。 article link

248. Exploring the Design Space of AAC Awareness Displays

SESSION:Autism, disabilities and assistive technology

Augmentative and alternative communication (AAC) devices are a critical technology for people with disabilities that affect their speech. One challenge with AAC systems is their inability to portray aspects of nonverbal communication that typically accent, complement, regulate, or substitute for verbal speech. In this paper, we explore the design space of awareness displays that can supplement AAC devices, considering their output features and their effects on the perceptions of interlocutors. Through designing prototypes and getting feedback on our designs from people with ALS, their primary caregivers, and other communication partners, we consider (1) the consistent tensions that arose between abstractness and clarity in meaning for these designs and (2) the ways in which these designs can further mark users as "other." Overall, we contribute a generative understanding of designing AAC awareness displays to augment and contextualize communication.

> 辅助和替代性沟通（AAC）设备与影响其言语障碍的人的一个关键技术。AAC系统面临的一个挑战是他们无法描述非言语交际的各个方面，它们通常强调、补充、调节或替代口头语言。在本文中，我们探讨意识的显示，可以补充AAC设备的设计空间，考虑到它们的输出特性和交际者的认知的影响。通过设计原型和反馈对我们的设计从ALS患者，他

> 们的主要照顾者，和其他的通信合作伙伴，我们认为（1）一致的紧张局势出现的抽象性和清晰度之间对这些设计的意义和（2）的方式，这些设计可以进一步标记用户为“其他”。总的来说，我们有助于生成理解设计意识增强和背景显示AAC通信。 article link

249. Trust, but Verify: Optimistic Visualizations of Approximate Queries for Exploring Big Data

SESSION:Big Data Intelligent Visualization Systems

Analysts need interactive speed for exploratory analysis, but big data systems are often slow. With sampling, data systems can produce approximate answers fast enough for exploratory visualization, at the cost of accuracy and trust. We propose optimistic visualization, which approaches these issues from a user experience perspective. This method lets analysts explore approximate results interactively, and provides a way to detect and recover from errors later. Pangloss implements these ideas. We discuss design issues raised by optimistic visualization systems. We test this concept with five expert visualizers in a laboratory study and three case studies at Microsoft. Analysts reported that they felt more confident in their results, and used optimistic visualization to check that their preliminary results were correct.

> 分析人员需要交互式速度进行探索性分析，但大数据系统往往很慢。有了采样，数据系统就可以以精确和信任的代价产生足够快的答案，用于探索性可视化。我们提出乐观的可视化，从用户体验的角度来处理这些问题。这种方法允许分析人员交互式地探索近似结果，并提供了一种稍后检测和恢复错误的方法。潘格洛斯实现这些想法。我们讨论了乐观可视化系统提出的设计问题。我们测试这个概念在实验室研究和案例研究三微软五专家可视化工具。分析人士报告说，他们对自己的研究结果更加自信，并用乐观的形象检验他们的初步结果是否正确。 article link

250. iSphere: Focus+Context Sphere Visualization for Interactive Large Graph Exploration

SESSION:Big Data Intelligent Visualization Systems

Interactive exploration plays a critical role in large graph visualization. Existing techniques, such as zoom-and-pan on a 2D plane and hyperbolic browser facilitate large graph exploration by showing both the details of a focal area and its surrounding context that guides the exploration process. However, existing techniques for large graph exploration are limited in either providing too little context or presenting graphs with too much distortion. In this paper, we propose a novel focus+context technique, iSphere, to address the limitation. iSphere maps a large graph onto a Riemann Sphere that better preserves graph structures and shows greater context information. We conduct extensive experiment studies on different graph exploration tasks under various conditions. The results show that iSphere performs the best in task completion time compared to the baseline techniques in link and path exploration tasks. This research also contributes to understanding large graph exploration on small screens.

> 交互探索在大型图形可视化中起着至关重要的作用。现有的技术，如在2D平面上的缩放和平移和双曲线浏览器促进大图形探索显示的焦点区域及其周围的环境，指导勘探过程的细节。然而，现有的大图形探索技术要么局限于提供太少的上下文，要么呈现失真过大的图形。在本文中，我们提出了一个新的焦点+背景下的技术，半球，以解决限制。半球地图大的图上的黎曼球，更好的保留了图结构，显示出更大的上下文信息。对不同图形探测任务在不同条件下进行了广泛的实验研究。结果表明，半球执行任务完成时间最好的相比，在链路和路径探索任务的基线技术。这项研究也有助于理解大屏幕小屏幕图形探索。 article link

251. TagRefinery: A Visual Tool for Tag Wrangling

SESSION:Big Data Intelligent Visualization Systems

We present TagRefinery, an interactive visual application aiding the cleaning and processing of open tag spaces, such as those in Last.fm or YouTube. Our pre-design analysis showed a need to support a spectrum of user expertise from novice to advanced, which resulted in two distinct interface modes. Summative evaluations of TagRefinery showed that it could effectively guide the novice users through the workflow by giving them brief but helpful explanations on why each step was required, and providing visual and statistical aids to help them in making important decisions. This is while our more expert users greatly appreciated the amount of control and granularity over the workflow that our more advanced interface mode offered. Both the underlying tag cleaning workflow and the interface were designed iteratively in a participatory design process in collaboration with research on a music recommendation interface based on Last.fm tags.

> 我们目前的tagrefinery，交互式可视化应用帮助清洁和开放标签的空间处理，如在Last.fm或YouTube。我们的预设计分析表明，需要支持从新手到高级用户的专门知识，这导致了两种不同的接口模式。tagrefinery终结性评价的结果可有效地指导新手用户通过工作流给他们简短但有助于解释为什么每一步都需要，并帮助他们在重大决策提供可视化和统计艾滋病。这是我们更专业的用户非常欣赏我们的更先进的接口模式提供的工作流控制和粒度的数量。的基本标签清洗流程和界面进行反复地参与设计过程基于Last.fm音乐推荐界面研究合作设计的标签。 article link

252. TopoGroups: Context-Preserving Visual Illustration of Multi-Scale Spatial Aggregates

SESSION:Big Data Intelligent Visualization Systems

Spatial datasets, such as tweets in a geographic area, often exhibit different distribution patterns at multiple levels of scale, such as live updates about events occurring in very specific locations on the map. Navigating in such multi-scale data-rich spaces is often inefficient, requires users to choose between overview or detail information, and does not support identifying spatial patterns at varying scales. In this paper, we propose TopoGroups, a novel context-preserving technique that aggregates spatial data into hierarchical clusters to improve exploration and navigation at multiple spatial scales. The technique uses a boundary distortion algorithm to minimize the visual clutter caused by overlapping aggregates. Our user study explores multiple visual encoding strategies for TopoGroups including color, transparency, shading, and shapes in order to convey the hierarchical and statistical information of the geographical aggregates at different scales.

> 空间数据集，例如地理区域中的推特，常常在多个尺度上表现出不同的分布模式，如在地图上非常具体的位置发生的事件的实时更新。在如此多尺度的数据丰富的空间中导航通常效率不高，要求用户在概览或细节信息之间进行选择，并且不支持在不同的尺度上识别空间模式。在本文中，我们提出了一个新的上下文技术topogroups，聚集空间数据层次的集群，提高在多个空间尺度上探测和导航保。该技术使用边界失真算法来减少重叠聚集引起的视觉杂波。我们的用户研究探讨多视觉编码策略topogroups包括颜色、透明度、阴影和形状来传达地理聚集的层次和统计信息在不同的尺度。 article link

253. A Design Perspective on Data

SESSION:Data as Design Material

Empirical studies invariably show that data generation is situationally contingent and interpretively flexible, even when data is collected automatically. This essay situates data generation within a design perspective, demonstrating how data creation can be understood as a multilayered set of interlocking design activities. By showing how data is infused with design, this paper argues that any "use" of data represents a continuation of its design. We are always designers of data, never its mere appropriators.

> 实证研究表明，数据的产生是一种必然条件和弹性解释，即使数据自动采集。本文将数据生成在设计的角度来看，演示如何创建的数据可以被理解为一个多层套联锁设计活动。通过展示数据是如何注入设计的，本文认为任何“使用”数据都是设计的延续。我们总是设计数据，不单纯的人。 article link

254. Bitbarista: Exploring Perceptions of Data Transactions in the Internet of Things

SESSION:Data as Design Material

We are surrounded by a proliferation of connected devices performing increasingly complex data transactions. Traditional design methods tend to simplify or conceal this complexity to improve ease of use. However, the hidden nature of data is causing increasing discomfort. This paper presents BitBarista, a coffee machine designed to explore perceptions of data processes in the Internet of Things. BitBarista reveals social, environmental, qualitative and economic aspects of coffee supply chains. It allows people to choose a source of future coffee beans, situating their choices within the pool of decisions previously made. In doing so, it attempts to engage them in the transactions that are required to produce coffee. Initial studies of BitBarista with 42 participants reveal challenges of designing for connected systems, particularly in terms of perceptions of data gathering and sharing, as well as assumptions generated by current models of consumption. A discussion is followed by a series of suggestions for increasing positive attitudes towards data use in interactive systems.

> 我们被日益复杂的数据交易的连接设备所包围。传统的设计方法倾向于简化或隐藏这种复杂性以提高易用性。然而，数据隐藏的性质造成了越来越多的不适。本文介绍了BitBarista，在物联网的一个咖啡机设计探索感知数据的过程。BitBarista揭示了社会、环境、咖啡供应链的定性和经济方面。它允许人们选择未来的咖啡豆来源，将他们的选择决定了前面的池中。在这样做时，它试图让他们参与生产咖啡所需的交易。有42名bitbarista初步研究揭示连接的系统设计的挑战，特别是在数据收集和共享的看法，以及现在的消费模型的假设。随后讨论了一系列建议，以提高对交互式系统中数据使用的积极态度。 article link

255. Centralized, Parallel, and Distributed Information Processing during Collective Sensemaking

SESSION:Data as Design Material

Widespread rumoring can hinder attempts to make sense of what is going on during disaster scenarios. Understanding how and why rumors spread in these contexts could assist in the design of systems that facilitate timely and accurate sensemaking. We address a basic question in this line: To what extent does rumor evolution occur (1) through reliance on a centralized information source, (2) in parallel information silos, or (3) through a web of complex informational interactions? We develop a conceptual model and associated analysis algorithms that allow us to distinguish between these possibilities. We analyze a case of rumoring on Twitter during the Boston Marathon Bombing. We find that rumor spreading was predominantly a parallel process in this case, which is consistent with a hypothesis that information silos may underlie the persistence of false rumors. Special attention towards detecting and resolving parallel information threads during collective sensemaking may hence be warranted.

> 普遍的传闻可以阻碍使事情在灾难感。了解在这些情况下如何和为什么谣言的传播有助于促进及时、准确地生成系统的设计。我们处理这一行中的一个基本问题：谣言的发生在多大程度上发生（1）依赖于一个集中的信息源，（2）在平行信息孤岛，或（3）通过复杂的信息交互网络？我们开发了一个概念模型和相关的分析算法，使我们能够区分这些可能性。我们分析一个名誉上推特波士顿马拉松轰炸下。我们发现，在这种情况下，谣言传播主要是一个平行的过程，这与一个假设：信息孤岛可能是谣言持续存在的基础。特别注意对检测和在集体意义建构解决并行信息的线程可能因此是必要的。 article link

256. Quietto: An Interactive Timepiece Molded in Concrete and Milled Wood

SESSION:Data as Design Material

We introduce Quietto: an interactive timepiece made of molded concrete and milled wood. It shows upcoming daily schedules and the time through the quiet, ambient motions of a clock hand and light through the concrete touch interface. The results of an in-field user observation of 10 participants over 3 days showed the possibilities of using concrete as a unique and attractive material for designing a tangible interface due to its unexpected haptic feeling. We also found that Quietto provides an intuitive and effective representation of its users' daily schedules and can be used as a private, personal device. Through its distinctive design, Quietto can provide a new way of understanding scheduling through its concrete texture and amusing interaction qualities.

> 我们介绍了宁静：交互式钟表制成成型混凝土和木材。它显示了即将到来的每日时间表和时间，通过安静的，环境的时钟指针和光通过具体的触摸界面。在3天的10名参与者的现场用户观察的结果表明，使用混凝土作为一个独特的和有吸引力的材料设计一个有形的接口，由于其意想不到的触觉感觉的可能性。我们还发现，宁静提供了一个直观的、有效的用户的日常表现和可以作为一个私人的，个人的装置。通过其独特的设计，Quietto提供了一种新的理解方式调度通过混凝土纹理和有趣的互动品质。 article link

257. Locked or Not?: Mental Models of IoT Feature Interaction

SESSION:Data as Design Material

Internet of Things (IoT) frequently involves conflicting interactions between devices and features that must be resolved to a single system state. The problem of feature interaction (FI) resolution has been investigated in Software Engineering through approaches that focus on verifiability but usually do not include the user in the evaluation. This paper bridges the gap between IoT approaches in HCI and Software Engineering by applying qualitative methods to understanding users' mental models of one representative FI resolution mechanism. Our contributions are in identifying common mental model errors and biases and how these may inform future IoT systems and research.

> 物联网经常涉及设备和功能之间的冲突交互，必须将其分解为单一的系统状态。特征交互问题（FI）的分辨率进行了软件工程方法，重点通过性但通常不包括在评估用户。本文通过应用定性的方法来理解一种具有代表性的FI解析机制的用户心智模型，从而弥补了HCI和软件工程中物联网方法之间的差距。我们的贡献在于识别常见的心理模型错误和偏见，以及这些可能如何告知未来物联网系统和研究。 article link

258. Robust Gaze Features for Enabling Language Proficiency Awareness

SESSION:Designing Gaze-based Gestures and Features

We are often confronted with information interfaces designed in an unfamiliar language, especially in an increasingly globalized world, where the language barrier inhibits interaction with the system. In our work, we explore the design space for building interfaces that can detect the user's language proficiency. Specifically, we look at how a user's gaze properties can be used to detect whether the interface is presented in a language they understand. We report a study (N=21) where participants were presented with questions in multiple languages, whilst being recorded for gaze behavior. We identified fixation and blink durations to be effective indicators of the participants' language proficiencies. Based on these findings, we propose a classification scheme and technical guidelines for enabling language proficiency awareness on information displays using gaze data.

> 我们经常面临着用陌生语言设计的信息接口，特别是在日益全球化的世界中，语言障碍抑制了与系统的交互。在我们的工作中，我们探讨了构建接口的设计空间，该接口可以检测用户的语言能力。具体来说，我们将研究如何使用用户的注视属性来检测接口是否以他们理解的语言呈现。我们报告一项研究（N＝21），参与者以多种语言提出问题，同时记录注视行为。我们确定了固定和眨眼时间是学生语言水平的有效指标。基于这些发现，我们提出了一个分类方案和技术指南，用凝视数据实现对信息显示的语言熟练程度的认识。 article link

259. A Multifaceted Study on Eye Contact based Speaker Identification in Three-party Conversations

SESSION:Designing Gaze-based Gestures and Features

To precisely understand human gaze behaviors in three-party conversations, this work is dedicated to look into whether the speaker can be reliably identified from the interlocutors in a three-party conversation on the basis of the interactive behaviors of eye contact, where speech signals are not provided. Derived from a pre-recorded, multimodal, and three-party conversational behavior dataset, a statistical framework is pro- posed to determinewho is the speakerfrom the interactive behaviors of eye contact. Additionally, with the aid of virtual human technologies, a user study is conducted to study whether subjects are capable of distinguishing the speaker from the listeners according to the gaze behaviors of the interlocutors alone. Our results show that eye contact provides a reliable cue for the identification of the speaker in three-party conversations.

> 要正确理解三方对话人的注视行为，这项工作是专门研究是否扬声器可以在对目光接触的交互行为的基础上，三方对话者的可靠识别，语音信号不提供。来自一个预先录制的，多式联运，以及三方会话的行为数据，统计框架亲定到determinewho是speakerfrom目光接触的互动行为。此外，随着虚拟人技术的帮助下，一个用户进行研究，研究受试者是否能够区别说话人从听众根据单独的对话者的凝视行为。我们的研究结果表明，眼神交流为说话人在三方会话中的识别提供了可靠的线索。 article link

260. Supporting Making Fixations and the Effect on Gaze Gesture Performance

SESSION:Designing Gaze-based Gestures and Features

Gaze gestures are deliberate patterns of eye movements that can be used to invoke commands. These are less reliant on accurate measurement and calibration than other gaze-based interaction techniques. These may be used with wearable displays fitted with eye tracking capability, or as part of an assistive technology. The visual stimuli in the information on the display that can act as fixation targets may or may not be sparse and will vary over time. The paper describes an experiment to investigate how the amount of information provided on a display to assist making fixations affects gaze gesture performance. The impact of providing visualization guides and small fixation targets on the time to complete gestures and error rates is presented. The number and durations of fixations made during gesture completion is used to explain differences in performance as a result of practice and direction of eye movement.

> 凝视手势是可以用来调用命令的眼部动作的有意模式。与其他基于凝视的交互技术相比，这些依赖于精确的测量和校准。这些可用于具有眼睛跟踪能力的可穿戴显示器，或作为辅助技术的一部分。可以作为固定目标的显示信息中的视觉刺激可以是稀疏的，也可以是随时间变化的。本文描述了一个实验来研究信息量在显示器上提供协助制作固定凝视的姿态表现的影响。提供可视化指南和小固定目标的时间完成手势和错误率的影响。数和完成时间在固定的手势是用来解释在性能上的差异是由于眼球运动的实践及发展方向。 article link

261. GazeEverywhere: Enabling Gaze-only User Interaction on an Unmodified Desktop PC in Everyday Scenarios

SESSION:Designing Gaze-based Gestures and Features

Eye tracking is becoming more and more affordable, and thus gaze has the potential to become a viable input modality for human-computer interaction. We present the GazeEverywhere solution that can replace the mouse with gaze control by adding a transparent layer on top of the system GUI. It comprises three parts: i) the SPOCK interaction method that is based on smooth pursuit eye movements and does not suffer from the Midas touch problem; ii) an online recalibration algorithm that continuously improves gaze-tracking accuracy using the SPOCK target projections as reference points; and iii) an optional hardware setup utilizing head-up display technology to project superimposed dynamic stimuli onto the PC screen where a software modification of the system is not feasible. In validation experiments, we show that GazeEverywhere's throughput according to ISO 9241-9 was improved over dwell time based interaction methods and nearly reached trackpad level. Online recalibration reduced interaction target ('button') size by about 25%. Finally, a case study showed that users were able to browse the internet and successfully run Wikirace using gaze only, without any plug-ins or other modifications.

> 眼睛跟踪变得越来越便宜，因此凝视有可能成为一种可行的人机交互输入方式。我们目前的gazeeverywhere溶液，可以代替鼠标的目光控制加上一层透明的系统界面。它由三部分组成：I）的斯波克相互作用的方法，是基于光滑追求眼球运动，没有点石成金的问题；ii）在线校准算法，不断提高运用斯波克指标预测凝视作为参考点的跟踪精度；和iii）利用平视显示器技术项目上叠加动态刺激在系统软件的修改是不可行的电脑屏幕上一个可选的硬件设置。在验证实验中，我们发现，gazeeverywhere吞吐量根据ISO 9241-9改善驻留时间的交互方法和接近触控板水平。在线校准降低作用的靶点（按钮”）大小约25%。最后，案例研究表明，用户能够浏览互联网，成功运行仅用目光wikirace，无任何插件或其他修改。 article link

262. Trajectories of Engagement and Disengagement with a Story-Based Smoking Cessation App

SESSION:Enabling Healthy Behaviors

Strong user engagement with digital technologies for behaviour change is often taken as a precursor to their longer-term efficacy. We critically examine this assumption through a qualitative study of a smoking cessation app, called NewLeaf, which allows quitters to swap personal stories. The study examined what influenced people to engage or disengage with NewLeaf, and how the app was deployed in quit attempts during a four week trial. Several properties of swapped stories were reported to promote engagement, including: authenticity, currency, contextualization of advice, and evoking a sense of community. But while the resulting engagement was sometimes productive in supporting quitting, other trajectories of use were observed involving counterproductive engagement, and a surprising pattern of productive disengagement especially among stronger quitters. We discuss how this analysis of different trajectories problematizes any simple interpretation of user engagement as an early indicator of success for behaviour change technologies.

> 用户对数字技术行为变化的强烈参与常常被视为其长期有效性的先导。我们仔细研究这一假设通过戒烟程序，定性的研究称为NewLeaf，使戒烟者分享自己的故事。该研究是什么影响人们接合或脱离与NewLeaf，以及如何在应用程序部署在戒烟四周的试验中。交换故事的几个性质的报道促进参与，包括：真实性、货币、语境化的建议，并唤起社区意识。但由此产生的参与支持戒烟有时生产，其他使用轨迹观察涉及适得其反的订婚，在更强的戒烟者一个令人惊讶的生产脱离特别模式。我们讨论不同的轨迹分析探讨的问题，用户参与的任何简单的解释为行为改变技术成功的早期指标。 article link

263. Lessons from Practice: Designing Tools to Facilitate Individualized Support for Quitting Smoking

SESSION:Enabling Healthy Behaviors

Many health care providers, with a variety of trainings, counsel clients on quitting smoking on a day-to-day basis. In their clinical practice, they draw from and adapt guidelines and research-based strategies to fit individual client situations and challenges. Designers of technologies to support quitting smoking can learn from these real world practices to create tools that better adapt to individual differences. We present findings from interviews with 28 providers with diverse experiences in smoking cessation counselling. Through analysis of their individualization strategies, challenges, and perceptions of technology, we find that providers: (1) individualize context appropriate coping strategies by involving clients in brainstorming, (2) emphasize the need to support nicotine withdrawal in clients, (3) mitigate social triggers and mediate social support for clients, and (4) need to navigate dependencies with other providers for managing medications and comorbid health conditions of clients. With this empirical understanding, we extend the discussion on the design of technology to support quitting smoking, highlight current barriers to individualization, and suggest future opportunities to address these barriers.

> 许多医疗服务提供者，通过各种培训，为客户提供日常戒烟服务。在他们的临床实践中，他们借鉴和调整指导方针和研究策略，以适应个别客户的情况和挑战。支持戒烟的技术设计者可以从这些实际的实践中学习，以创造更好的适应个体差异的工具。我们的调查结果显示，在戒烟咨询方面有着不同经验的28家供应商。通过他们的个性化策略，挑战分析，和感知技术，我们发现供应商：（1）个性化背景下相应的应对策略，通过客户进行头脑风暴，（2）强调需要在客户尼古丁戒断的支持，（3）减轻社会触发器和调解客户的社会支持，和（4）需要导航依赖关系与其他供应商和客户管理药物并存的健康状况。有了这一经验的理解，我们扩展了关于支持戒烟的技术设计的讨论，突出了当前个性化的障碍，并提出了未来解决这些障碍的机会。 article link

264. Toward Usable Evidence: Optimizing Knowledge Accumulation in HCI Research on Health Behavior Change

SESSION:Enabling Healthy Behaviors

Over the last ten years, HCI researchers have introduced a range of novel ways to support health behavior change, from glanceable displays to sophisticated game dynamics. Yet, this research has not had as much impact as its originality warrants. A key reason for this is that common forms of evaluation used in HCI make it difficult to effectively accumulate- and use-knowledge across research projects. This paper proposes a strategy for HCI research on behavior change that retains the field's focus on novel technical contributions while enabling accumulation of evidence that can increase impact of individual research projects both in HCI and the broader behavior-change science. The core of this strategy is an emphasis on the discovery of causal effects of individual components of behavior-change technologies and the precise ways in which those effects vary with individual differences, design choices, and contexts in which those technologies are used.

> 在过去的十年中，人机交互的研究人员推出了一系列支持健康行为改变的新方法，从弹出显示复杂的游戏动态。然而，这项研究没有其原创性的影响那么大。这样做的一个关键原因是，用于HCI的常用评估形式使得在研究项目中难以有效地积累和使用知识。本文提出了一种关于行为变化的人机交互研究策略，它保留了该领域对新技术贡献的关注，同时使证据积累，可以增加HCI和更广泛的行为变化科学中单个研究项目的影响。这一战略的核心是强调发现行为变化技术的各个组成部分的因果效应，以及这些影响随个人差异、设计选择和使用这些技术的环境而变化的确切方式。 article link

265. Investigating Haptic Perception of and Physiological Responses to Air Vortex Rings on a User's Cheek

SESSION:Haptics on Skin

Haptic perception is one of the primary means of interaction with the world. Recent research on affective haptics suggests that it can affect emotional and behavioral responses. In this study, we evaluate user perceptions of haptic stimuli generated by air vortex rings on the cheek and investigate the effects on their physiological responses. To develop a cheek haptic display, we investigated and found that the cheek had enough resolution to perceive the differences in haptic stimuli in a two-point discrimination threshold test of the face. Additionally, the intensities of the haptic stimuli for experiments were determined by investigating the subjective impressions of different stimuli pairs. Finally, we conducted experiments to evaluate quantitatively the effects of four different combinations of haptic stimuli on the physiological responses in terms of stress modification, brainwave activities, task performance, and subjective assessment. The results suggest that different stimuli affect physiological responses and task performance.

> 触觉感知是与世界互动的主要手段之一。最近的研究表明，情感性触觉可以影响情绪和行为反应。在这项研究中，我们评估了用户对脸颊上空气涡流环产生的触觉刺激的感知，并研究了它们对生理反应的影响。为了发展脸颊触觉显示，我们调查发现，脸颊有足够的分辨率来感知在两个歧视阈值测试面部的触觉刺激的差异。此外，实验研究了不同刺激对的主观印象，确定了实验的触觉刺激强度。最后，我们进行了实验，四种不同组合的触觉刺激对应激的生理反应改性效果进行定量评估的脑波活动，任务绩效，与主观评价。结果表明，不同的刺激对生理反应和任务绩效有影响。 article link

266. SkinMarks: Enabling Interactions on Body Landmarks Using Conformal Skin Electronics

SESSION:Haptics on Skin

The body provides many recognizable landmarks due to the underlying skeletal structure and variations in skin texture, elasticity, and color. The visual and spatial cues of such body landmarks can help in localizing on-body interfaces, guide input on the body, and allow for easy recall of mappings. Our main contribution are SkinMarks, novel skin-worn I/O devices for precisely localized input and output on fine body landmarks. SkinMarks comprise skin electronics on temporary rub-on tattoos. They conform to fine wrinkles and are compatible with strongly curved and elastic body locations. We identify five types of body landmarks and demonstrate novel interaction techniques that leverage SkinMarks' unique touch, squeeze and bend sensing with integrated visual output. Finally, we detail on the conformality and evaluate sub-millimeter electrodes for touch sensing. Taken together, SkinMarks expands the on-body interaction space to more detailed, highly curved and challenging areas on the body.

> 由于骨骼结构和皮肤纹理、弹性和颜色的变化，身体提供了许多可识别的地标。这种身体标志物的视觉和空间线索有助于定位身体接口，引导身体上的输入，并便于对映射的回忆。我们的主要贡献是SkinMarks，新的皮肤磨损的I/O设备的精确定位和精细的身体标志输出输入。skinmarks包括临时擦皮电子纹身。他们符合细皱纹，并与强烈弯曲和弹性的身体位置兼容。我们确定了五种类型的机构的标志和展示新的互动技术，利用skinmarks独特的触摸，挤压和弯曲集成可视化输出传感。最后，我们详细的协调和评估触摸传感亚毫米的电极。总之，SkinMarks扩大了对身体的互动空间更详细，高度弯曲的和具有挑战性的部位。 article link

267. tactoRing: A Skin-Drag Discrete Display

SESSION:Haptics on Skin

Smart rings are an emerging wearable technology particularly suitable for discrete notifications based on haptic cues. Previous work mostly focused on tactile actuators that stimulate only specific skin receptors on the finger, resulting in limited information expressiveness. We propose tactoRing, a novel tactile display that, by dragging a small tactor on the skin around the finger, excites multiple skin areas resulting in more accurate cue recognition. In this paper, we present the hardware and a perception study to understand the ability of users to recognize eight distinct points around the finger. Moreover, we show two different techniques to encode information through skin-dragging motion with accuracy up to 94%. We finally showcase a set of applications that, by combining sequences of tactile stimuli, achieve higher expressiveness than prior methods.

> 智能环是一种新兴的可穿戴技术，特别适用于基于触觉线索的离散通知。以前的工作主要集中在触觉致动器，刺激只在手指特定的皮肤受体，导致有限的信息表现力。我们提出了一个新的tactoring，触觉显示，通过拖动一个小因子在手指皮肤，激发多个皮肤区域导致更准确的线索识别。在本文中，我们提出的硬件和感知研究，以了解用户识别八个手指周围不同的点的能力。此外，我们展示了两种不同的技术来编码信息通过皮肤拖动运动精度高达94%。最后，我们展示了一组应用程序，通过结合触觉刺激序列，实现比以前的方法更高的表达能力。 article link

268. Fingertip Tactile Devices for Virtual Object Manipulation and Exploration

SESSION:Haptics on Skin

One of the main barriers to immersivity during object manipulation in virtual reality is the lack of realistic haptic feedback. Our goal is to convey compelling interactions with virtual objects, such as grasping, squeezing, pressing, lifting, and stroking, without requiring a bulky, world-grounded kinesthetic feedback device (traditional haptics) or the use of predetermined passive objects (haptic retargeting). To achieve this, we use a pair of finger-mounted haptic feedback devices that deform the skin on the fingertips to convey cutaneous force information from object manipulation. We show that users can perceive differences in virtual object weight and that they apply increasing grasp forces when lifting virtual objects as rendered mass is increased. Moreover, we show how naive users perceive changes of a virtual object's physical properties when we use skin deformation to render objects with varying mass, friction, and stiffness. These studies demonstrate that fingertip skin deformation devices can provide a compelling haptic experience appropriate for virtual reality scenarios involving object manipulation.

> 一个主要的障碍，以immersivity对象操作过程中虚拟现实是现实的触觉反馈的缺乏。我们的目标是将虚拟物体引人注目的相互作用，如抓、挤、压、起重、抚摸，而不需要一个庞大的、世界扎根动觉反馈装置（传统的触觉）或预定的被动对象的使用（触觉重定向）。为了实现这一点，我们使用一对手指安装的触觉反馈装置，使手指上的皮肤变形，以从物体操作中传递皮肤力信息。我们发现，用户可以感知虚拟物体重量的差异，当增加虚拟质量时，它们增加了抓取力。此外，我们展示了天真的用户感知虚拟物体的物理属性的变化，当我们使用皮肤变形渲染物体不同的质量，摩擦和刚度。这些研究表明，指尖皮肤变形装置可以提供一个令人信服的触觉经验适合虚拟现实场景涉及对象操作。 article link

269. BrushTouch: Exploring an Alternative Tactile Method for Wearable Haptics

SESSION:Haptics on Skin

Haptic interfaces are ideal in situations where visual/auditory attention is impossible, unsafe, or socially unacceptable. However, conventional (vibrotactile) wearable interfaces often possess a limited bandwidth for expressing information. We explore a novel form of tactile stimulation through brushing, and demonstrate BrushTouch, a wearable prototype for brushing haptics. We also present schemes for conveying information such as time and direction through multi-tactor wrist-worn haptic interfaces. To evaluate BrushTouch, two user studies were run, comparing it to a conventional vibrotactile wristband across a number of tasks in both lab and mobile conditions. We show that for certain cues brushing can be more accurately recognized than vibration, enabling more effective spatial schemes for presenting information through haptic means. We then show that BrushTouch is capable of greater information transfer using such cues. We believe that brushing, as with other non-vibrotactile haptic techniques, merits further investigation as potential vehicles for richer haptic feedback.

> 触觉接口是理想的情况下，视觉/听觉的关注是不可能的，不安全的，或社会不可接受的。然而，传统的（振动）的可穿戴式接口往往具有表达信息有限带宽。我们探索了一种新的触觉刺激的形式通过刷牙，并展示BrushTouch，刷的触觉可穿戴原型。我们还提出了传递信息如时间和方向通过多因子腕戴式触觉接口方案。评价BrushTouch，两个用户研究，比较其在实验室和移动条件下的任务数的常规振动腕带。我们发现，对于某些线索，刷牙可以更准确地识别比振动，使更有效的空间方案，提出信息通过触觉手段。然后，brushtouch能够更大的信息传输使用这样的线索。我们相信，刷牙，与其他非触觉触觉技术，值得进一步调查作为潜在的车辆更丰富的触觉反馈。 article link

270. HCI, Solidarity Movements and the Solidarity Economy

SESSION:HCI and Collective Action

The financial crisis and austerity politics in Europe has had a devastating impact on public services, social security and vulnerable populations. Greek civil society responded quickly by establishing solidarity structures aimed at helping vulnerable citizens to meet their basic needs and empower them to co-create an anti-austerity movement. While digital technology and social media played an important role in the initiation of the movement, it has a negligible role in the movement's on-going practices. Through embedded work with several solidarity structures in Greece, we have begun to understand the "solidarity economy" (SE) as an experiment in direct democracy and self-organization. Working with a range of solidarity structures we are developing a vision for a "Solidarity HCI" committed to designing to support personal, social and institutional transformation through processes of agonistic pluralism and contestation, where the aims and objectives of the SE are continuously re-formulated and put into practice.

> 欧洲的金融危机和紧缩政策对公共服务、社会保障和弱势人口产生了毁灭性的影响。希腊民间社会迅速作出反应，建立了团结结构，旨在帮助弱势公民满足其基本需要，并赋予他们共同创造反紧缩运动的权利。虽然数字技术和社会媒体在发起这场运动中发挥了重要作用，但它在该运动的持续实践中却起着微不足道的作用。通过在希腊的几个团结结构的嵌入工作，我们已经开始理解“团结经济”（SE）作为直接民主和自组织的实验。工作范围与团结的结构，我们正在开发一个“团结HCI”致力于设计支持个人愿景，社会和制度通过竞争多元与论争过程转化，在SE的目标是不断的重新制定和实施。 article link

271. Environmental Protection and Agency: Motivations, Capacity, and Goals in Participatory Sensing

SESSION:HCI and Collective Action

In this paper we consider various genres of citizen science from the perspective of citizen participants. As a mode of scientific inquiry, citizen science has the potential to "scale up" scientific data collection efforts and increase lay engagement with science. However, current technological directions risk losing sight of the ways in which citizen science is actually practiced. As citizen science is increasingly used to describe a wide range of activities, we begin by presenting a framework of citizen science genres. We then present findings from four interlocking qualitative studies and technological interventions of community air quality monitoring efforts, examining the motivations and capacities of citizen participants and characterizing their alignment with different types of citizen science. Based on these studies, we suggest that data acquisition involves complex multi-dimensional tradeoffs, and the commonly held view that citizen science systems are a win-win for citizens and science may be overstated.

> 本文从公民参与的角度对公民科学的各种流派进行了思考。作为科学探究的一种模式，公民科学有可能“扩大”科学数据收集工作并增加与科学的接触。然而，目前的技术方向可能忽略了公民科学实践的方式。随着公民科学越来越多地用来描述各种各样的活动，我们首先提出一个公民科学流派的框架。然后，我们提出了四个环环相扣的定性研究和技术干预的社区空气质量监测工作的结果，研究公民参与的动机和能力，并说明他们与不同类型的公民科学的对齐方式。基于这些研究，我们认为，数据采集涉及复杂的多维权衡，人们普遍认为，公民科学系统是一个双赢的公民和科学可能被夸大。 article link

272. Providing Online Crisis Information: An Analysis of Official Sources during the 2014 Carlton Complex Wildfire

SESSION:HCI and Collective Action

Using the 2014 Carlton Complex Wildfire as a case study, we examine who contributes official information online during a crisis event, and the timeliness and relevance of the information provided. We identify and describe the communication behaviors of four types of official information sources (Event Based Resources, Local Responders, Local News Media, and Cooperating Agencies), and collect message data from each source's website, public Facebook page, and/or Twitter account. The data show that the Local News Media provided the highest quantity of relevant information and the timeliest information. Event Based Resources shared the highest percentage of relevant information, however, it was often unclear who managed these resources and the credibility of the information. Based on these findings, we offer suggestions for how providers of official crisis information might better manage their online communications and ways that the public can find more timely and relevant online crisis information from official sources.

> 以2014卡尔顿复杂野火为例，我们研究了谁在危机事件期间在线提供官方信息，以及提供的信息的及时性和相关性。我们确定并描述了四种官方信息来源（基于事件的资源、本地反应者、当地新闻媒体和合作机构）的通信行为，并从每个源网站、公共脸谱网页面和/或Twitter帐户中收集消息数据。数据显示，当地新闻媒体提供相关信息的数量最高和最及时的信息。基于事件的资源共享最高百分比的相关信息，然而，谁管理这些资源和信息的可信度却常常不清楚。基于这些发现，我们提供了关于官方危机信息提供者如何更好地管理他们的在线通信和公众可以从官方渠道找到更及时和相关的在线危机信息的建议。 article link

273. "Algorithms ruin everything": #RIPTwitter, Folk Theories, and Resistance to Algorithmic Change in Social Media

SESSION:HCI and Collective Action

As algorithmically-driven content curation has become an increasingly common feature of social media platforms, user resistance to algorithmic change has become more frequent and visible. These incidents of user backlash point to larger issues such as inaccurate understandings of how algorithmic systems work as well as mismatches between designer and user intent. Using a content analysis of 102,827 tweets from #RIPTwitter, a recent hashtag-based backlash to rumors about introducing algorithmic curation to Twitter's timeline, this study addresses the nature of user resistance in the form of the complaints being expressed, folk theories of the algorithmic system espoused by users, and how these folk theories potentially frame user reactions. We find that resistance to algorithmic change largely revolves around expectation violation, with folk theories acting as frames for reactions such that more detailed folk theories are expressed through more specific reactions to algorithmic change.

> 算法驱动的内容管理已经成为一个越来越普遍的社会媒体平台的特点，用户抵制变更日益频繁，可见。这些用户反弹事件指出了更大的问题，如对算法系统如何工作的不准确理解以及设计者和用户意图之间的不匹配。利用# riptwitter 102827微博内容分析，最近的一个标签的间隙引入算法的策展，推特的时间表的传闻，这项研究涉及用户阻力性质的投诉表示形式的算法系统得到了用户的民间理论，以及这些理论框架的民间潜在用户反应。我们发现，对算法变化的抵抗主要围绕着期望违背，民间理论充当了反应的框架，从而通过算法变化的更具体的反应来表达更详细的民间理论。 article link

274. The Bag of Communities: Identifying Abusive Behavior Online with Preexisting Internet Data

SESSION:Online Content

Since its earliest days, harassment and abuse have plagued the Internet. Recent research has focused on in-domain methods to detect abusive content and faces several challenges, most notably the need to obtain large training corpora. In this paper, we introduce a novel computational approach to address this problem called Bag of Communities (BoC)---a technique that leverages large-scale, preexisting data from other Internet communities. We then apply BoC toward identifying abusive behavior within a major Internet community. Specifically, we compute a post's similarity to 9 other communities from 4chan, Reddit, Voat and MetaFilter. We show that a BoC model can be used on communities "off the shelf" with roughly 75% accuracy---no training examples are needed from the target community. A dynamic BoC model achieves 91.18% accuracy after seeing 100,000 human-moderated posts, and uniformly outperforms in-domain methods. Using this conceptual and empirical work, we argue that the BoC approach may allow communities to deal with a range of common problems, like abusive behavior, faster and with fewer engineering resources.

> 自早期以来，骚扰和谩骂一直困扰着互联网。最近的研究集中在域的方法来检测滥用内容，并面临着一些挑战，最明显的是需要获得大型培训语料库。在本文中，我们介绍了一种新的计算方法来解决这个问题，称为社区袋（BOC）-一种技术，利用大规模，现有的数据来自其他互联网社区。然后我们使用BOC来识别主要互联网社区中的虐待行为。具体来说，我们计算后的相似性9其他社区4Chan，Reddit，Voat和MetaFilter。我们表明，一个BOC模型可用于社区“现成的”，大约有75%的准确性-没有培训的例子是需要从目标社区。一个动态的BOC模型达到91.18%的准确率后，看到100000人放缓员额，并均匀优于域方法。使用这一概念和经验的工作，我们认为，BOC方法可以让社区处理一系列常见问题，如虐待行为，更快，更少的工程资源。 article link

275. PersaLog: Personalization of News Article Content

SESSION:Online Content

Content personalizationautomatically modifying text and multimedia featureswithinarticles based on the reader's individual features'is evolving as a new form of journalism. Informed by constraints articulated through a survey of journalists, we have implemented PersaLog, a novel system for creating personalized content (e.g., text and interactive visualizations). Because crafting, and validating, personalized content can be challenging to scale across articles (unlike feed personalization), we offer a simple Domain Specific Language (DSL), and editing environment, to support this task. PersaLog is particularly designed to support the personalization of existing text and visualizations. Our work

provides guidelines for personalization as well as a system that allows for both subtle and dramatic personalization-driven content changes. We validate PersaLog using case and lab studies.

> 内容personalizationautomatically修改文本和多媒体featureswithinarticles基于读者的个人features'is作为新的新闻形式演变。通知约束通过记者的调查，我们已经实现了一个新的persalog，创建个性化的内容体系（例如，文本和交互式可视化）。由于手工制作和验证个性化内容对跨文章的规模具有挑战性（与饲料个性化不同），我们提供了一个简单的特定于域的语言（DSL）和编辑环境来支持这项任务。persalog是特别设计来支持现有的文本和可视化的个性化。我们的工作为个性化提供了指导方针，并且提供了一个允许细微和戏剧性的个性化驱动的内容更改的系统。我们验证使用情况和实验室研究persalog。 article link

276. You Want Me to Work withWho?: Stakeholder Perceptions of Automated Team Formation in Project-based Courses

SESSION:Online Content

Instructors are increasingly using algorithmic tools for team formation, yet little is known about how these tools are applied or how students and instructors perceive their use. We studied a representative team formation tool (CATME) in eight project-based courses. An instructor uses the tool to form teams by surveying students' working styles, skills, and demographics; then configuring these criteria as input into an algorithm that assigns teams. We surveyed students (N=277) in the courses to gauge their perceptions of the strengths and weaknesses of the tool and ideas for improving it. We also interviewed instructors (N=13) different from those who taught the eight courses to learn about their criteria selections and perceptions of the tool. Students valued the rational basis for forming teams but desired a stronger voice in criteria selection and explanations as to why they were assigned to a particular team. Instructors appreciated the efficiency of team formation but wanted to view exemplars of criteria used in similar courses. This work contributes recommendations for deploying team formation tools in educational settings and for better satisfying the goals of all stakeholders.

> 教师越来越多地使用算法工具来形成团队，但很少有人知道这些工具是如何应用的，学生和教师如何看待他们的使用。我们研究了一个代表队形成工具（CATME）八基于项目的课程。教师通过调查学生的工作风格、技能和人口统计数据，利用这个工具形成团队；然后将这些标准配置为输入给分配团队的算法。我们调查学生（N = 277）的课程，以衡量他们的长处和短处的工具和想法，以改善它的看法。我们还采访了教师（N = 13）不同于那些谁教八门课程，了解他们的标准选择和工具的看法。学生们重视形成团队的理性基础，但他们希望在标准选择和解释上有更强的发言权，说明他们为什么被分配到某一特定团队。导师赞赏团队形成效率但想查看用于类似课程标准的典范。这项工作有助于在教育环境中部署团队形成工具，并更好地满足所有利益相关者的目标。 article link

277. Multimodal Classification of Moderated Online Pro-Eating Disorder Content

SESSION:Online Content

Social media sites are challenged by both the scale and variety of deviant behavior online. While algorithms can detect spam and obscenity, behaviors that break community guidelines on some sites are difficult because they have multimodal subtleties (images and/or text). Identifying these posts is often regulated to a few moderators. In this paper, we develop a deep learning classifier that jointly models textual and visual characteristics of pro-eating disorder content that violates community guidelines. Using a million Tumblr photo posts, our classifier discovers deviant content efficiently while also maintaining high recall (85%). Our approach uses human sensitivity throughout to guide the creation, curation, and understanding of this approach to challenging, deviant content. We discuss how automation might impact community moderation, and the ethical and social obligations of this area.

> 社交媒体网站受到在线越轨行为的规模和多样性的挑战。而算法能够检测垃圾邮件和淫秽行为，打破社区指南，一些网站是困难的因为他们有多微妙（图像和/或文本）。识别这些帖子通常是由几个版主来管理的。在本文中，我们开发了一个深度学习分类器，共同建模的文本和视觉特征的亲食障碍内容违反了社区的指导方针。一百万采用Tumblr照片的帖子，我们发现不良内容的有效分类器同时保持高召回率（85%）。我们的方法是使用人类的敏感性在指导创作，策展，了解这种方法的挑战，离经叛道的内容。我们将讨论自动化可能如何影响社区的适度性，以及该地区的伦理和社会义务。 article link

278. WritLarge: Ink Unleashed by Unified Scope, Action, & Zoom

SESSION:Pens, Ink, Input

WritLargeis a freeform canvas for early-stage design on electronic whiteboards with pen+touch input. The system aims to support a higher-level flow of interaction by 'chunking' the traditionally disjoint steps ofselectionandactioninto unifiedselection-actionphrases. This holistic goal led us to address two complementary aspects: SELECTION, for which we devise a new technique known as theZoom-Catcherthat integrates pinch-to-zoom and selection in a single gesture for fluidly selecting and acting on content; plus: ACTION, where we demonstrate how this addresses the combined issues of navigating, selecting, and manipulating content. In particular, the designer can transform select ink strokes in flexible and easily-reversible representations viasemantic, structural, andtemporalaxes of movement that are defined as conceptual 'moves' relative to the specified content.This approach dovetails zooming with lightweight specification of scope as well as the evocation of context-appropriate commands, at-hand, in a location-independent manner. This establishes powerful new primitives that can help to scaffold higher-level tasks, thereby unleashing the expressive power of ink in a compelling manner.

> writlargeis为笔+触摸输入电子白板早期设计自由曲面的画布。该系统旨在支持更高级别的流程交互的组块的传统分离的步骤ofselectionandactioninto unifiedselection actionphrases。这个整体目标使我们解决两个互补的方面：选择，为此我们设计了一种新的技术称为thezoom catcherthat集捏缩放和流体的选择在一个单一的姿态选择和表演内容；加上行动，我们演示了如何解决组合问题的导航，选择和操作内容。特别是，设计师可以变换选择水墨笔触在灵活和容易可逆表示viasemantic，结构，运动被定义为相对概念“动作”规定的内容andtemporalaxes相吻合。这种方法缩放范围轻规范以及在手的情况下适当的命令，召唤，在一个位置无关的方式。这建立了强大的新的原语，可以帮助脚手架更高层次的任务，从而释放油墨的表现力，以令人信服的方式。 article link

279. As We May Ink?: Learning from Everyday Analog Pen Use to Improve Digital Ink Experiences

SESSION:Pens, Ink, Input

This paper sheds light on gaps and discrepancies between the experiences afforded by analog pens and their digital counterparts. Despite the long history (and recent renaissance) of digital pens, the literature still lacks a comprehensive survey of what types of marks people make and what motivates them to use ink-both analog and digital in daily life. To capture the diversity of inking behaviors and tease out the unique affordances of pen-and ink, we conducted a diary study with 26 participants from diverse backgrounds. From analysis of 493 diary entries we identified 8 analog pen-and-ink activities, and 9 affordances of pens. We contextualized and contrasted these findings using a survey with 1,633 respondents and a follow-up diary study with 30 participants, observing digital pens. Our analysis reveals gaps and research opportunities based on pen affordances not yet fully explored in the literature.

> 本文揭示了模拟笔和数字笔所提供的经验之间的差距和差异。尽管数字笔有着悠久的历史（和最近的复兴），但文献仍然缺乏对人们所使用的标记的种类和日常生活中使用模拟和数字墨水的动机的全面调查。捕捉墨行为的多样性和梳理出笔墨的独特的启示，我们进行了日记研究的26名学员来自不同背景。从493日记分析我们确定了8个模拟笔墨的活动，和9个启示的笔。我们的语境和对比这些结果通过调查有1633的受访者和30的参与者随访日记研究，观察数码笔。我们的分析揭示了差距，研究基于笔的启示尚未在文献探讨的机会。 article link

280. Thumb + Pen Interaction on Tablets

SESSION:Pens, Ink, Input

Modern tablets support simultaneous pen and touch input, but it remains unclear how to best leverage this capability for bimanual input when the nonpreferred hand holds the tablet. We explore Thumb + Pen interactions that support simultaneous pen and touch interaction, with both hands, in such situations. Our approach engages the thumb of the device-holding hand, such that the thumb interacts with the touch screen in anindirectmanner, thereby complementing thedirectinput provided by the preferred hand. For instance, the thumb can determine how pen actions (articulated with the opposite hand) are interpreted. Alternatively, the pen can point at an object, while the thumb manipulates one or more of its parameters through indirect touch. Our techniques integrate concepts in a novel way that derive from marking menus, spring-loaded modes, indirect input, and multi-touch conventions. Our overall approach takes the form of a set of probes, each representing a meaningfully distinct class of application. They serve as an initial exploration of the design space at a level which will help determine the feasibility of supporting bimanual interaction in such contexts, and the viability of the Thumb + Pen techniques in so doing.

> 现代片同时支持笔和触摸输入，但它仍不清楚如何最好地利用这种能力时双手输入首选手持平板电脑。我们探索拇指+笔的互动，支持同时笔和触摸互动，双手，在这种情况下。我们的方法与装置，手拇指，使拇指与anindirectmanner触摸屏交互，从而补充的首选方面提供thedirectinput。例如，拇指可以决定钢笔动作是如何解释的。或者，笔可以指向一个对象，而拇指通过间接触摸操作一个或多个参数。我们的技术以一种新颖的方式集成概念，从标记菜单、弹簧模式、间接输入和多触摸约定中派生出来。我们的总体方法采用了一组探针，每一个代表一个有意义的不同类的应用程序。他们是在一个水平，将有助于确定支撑在这样的上下文中，双手交互的可行性空间设计的初步探索，和存活的拇指+笔技术这么做。 article link

281. Experimental Analysis of Mode Switching Techniques in Touch-based User Interfaces

SESSION:Pens, Ink, Input

This paper presents the results of a 36 participant empirical comparison of touch mode-switching. Six techniques are evaluated, spanning current and future techniques: long press, non-dominant hand, two-fingers, hard press, knuckle, and thumb-on-finger. Two poses are controlled for, seated with the tablet on a desk and standing with the tablet held on the forearm. Findings indicate pose has no effect on mode switching time and little effect on error rate; using two-fingers is fastest while long press is much slower; non-preferred hand and thumb-on-finger also rate highly in subjective scores. The experiment protocol is based on Li et al.'s pen mode-switching study, enabling a comparison of touch and pen mode switching. Among the common techniques, the non-dominant hand is faster than pressure with touch, whereas no significant difference had been found for pen. Our work addresses the lack of empirical evidence comparing touch mode-switching techniques and provides guidance to practitioners when choosing techniques and to researchers when designing new mode-switching methods.

> 本文介绍了36人参与的触摸模式切换的实证比较结果。六种技术进行了评估，包括当前和未来的技术：长按，非优势手，两个手指，硬按，指节和拇指在手指上。两个姿势被控制着，用写字板坐在桌子上，站在前臂上的写字板上。结果表明，姿势对模式转换时间没有影响，对错误率影响不大；两指最快，长按压慢得多；手指的非惯用手和拇指在主观评分上也很高。实验协议是基于李等人的笔模式切换研究，使触摸和笔模式切换比较。在常用技术中，非优势手的速度比触压快，而钢笔没有显著差异。我们的工作解决了缺乏经验证据比较触摸模式切换技术，并提供指导从业者选择技术和研究人员在设计新的模式切换方法。 article link

282. ForceEdge: Controlling Autoscroll on Both Desktop and Mobile Computers Using the Force

SESSION:Sensing and Input

Operating systems support autoscroll to allow users to scroll a view while in dragging mode: the user moves the pointer near the window's edge to trigger an "automatic" scrolling whose rate is typically proportional to the distance between the pointer and the window's edge. This approach suffers from several problems, especially when the window is maximized, resulting in a very limited space around it. Another problem is that for some operations, such as object drag-and-drop, the source and destination might be located in different windows, making it complicated for the computer to understand user's intention. In this paper, we present ForceEdge, a novel autoscroll technique relying on touch surfaces with force-sensing capabilities to alleviate the problems related to autoscroll. We report on the results of three controlled experiments showing that it improves over macOS and iOS systems baselines for top-to-bottom select and move tasks.

> 操作系统支持自动滚屏让用户滚动查看在拖动方式：用户移动靠近窗户的边缘指针触发自动滚动的速度通常是之间的距离成正比的指针和窗口的边缘。这种方法存在一些问题，特别是当窗口最大化时，它的周围空间非常有限。另一个问题是，对于某些操作，如对象拖放，源和目的地可能位于不同的窗口中，这使得计算机很难理解用户的意图。在本文中，我们提出一个新的forceedge，自动滚屏技术依托力传感能力，减轻相关的问题的滚动接触表面。我们报告的结果三对照试验表明，它提高了在MacOS和iOS系统的基线上下选择和移动任务。 article link

283. Finding Common Ground: A Survey of Capacitive Sensing in Human-Computer Interaction

SESSION:Sensing and Input

For more than two decades, capacitive sensing has played a prominent role in human-computer interaction research. Capacitive sensing has become ubiquitous on mobile, wearable, and stationary devices - enabling fundamentally new interaction techniques on, above, and around them. The research community has also enabled human position estimation and whole-body gestural interaction in instrumented environments. However, the broad field of capacitive sensing research has become fragmented by different approaches and terminology used across the various domains. This paper strives to unify the field by advocating consistent terminology and proposing a new taxonomy to classify capacitive sensing approaches. Our extensive survey provides an analysis and review of past research and identifies challenges for future work. We aim to create a common understanding within the field of human-computer interaction, for researchers and practitioners alike, and to stimulate and facilitate future research in capacitive sensing.

> 20多年来，电容传感在人机交互研究中起到了突出的作用。电容传感已成为无处不在的移动，可穿戴和固定设备-使根本上新的互动技术，上述及其周围。研究界也使仪表的环境人的位置估计和全身手势交互。然而，电容传感研究的广泛领域已经被不同领域使用的不同方法和术语割裂开来。本文试图通过提倡统一的术语和提出一种新的分类方法来分类电容传感方法来统一这个领域。我们广泛的调查提供了对过去研究的分析和回顾，并为今后的工作指明了挑战。我们的目标是在人机交互领域建立一个共同的理解，为研究人

> 员和从业者一样，刺激和促进电容传感未来的研究。 article link

284. bioSync: A Paired Wearable Device for Blending Kinesthetic Experience

SESSION:Sensing and Input

We present a novel, paired, wearable system for combining the kinesthetic experiences of two persons. These devices allow users to sense and combine muscle contraction and joint rigidity bi-directionally. This is achieved through kinesthetic channels based on electromyogram (EMG) measurement and electrical muscle stimulation (EMS). We developed a pair of wearable kinesthetic input-output (I/O) devices called bioSync that uses specially designed electrodes to perform biosignal measurement and stimulation simultaneously on the same electrodes.In a user study, participants successfully evaluated the strength of their partners' muscle contractions while exerting their own muscles. We confirmed that the pair of devices could help participants synchronize their hand movements through tapping, without visual and auditory feedback. The proposed interpersonal kinesthetic communication system can be used to enhance interactions such as clinical gait rehabilitation and sports training, and facilitate sharing of physical experiences with Parkinson's patients, thereby enhancing understanding of the physical challenges they face in daily life.

> 我们提出了一种新型的配对，将两人的动觉经验可穿戴式系统。这些设备允许用户感知和结合肌肉收缩和关节僵硬双向。这是通过动觉通道肌电图（EMG）的基础上，实现了测量和电子肌肉刺激（EMS）。我们开发了一个对可穿戴运动输入输出（I/O）设备称为biosync使用特别设计的电极进行生物信号测量和刺激，同时电极。在用户研究中，参与者成功地评估合作伙伴的肌肉收缩的强度而发挥自己的肌肉。我们确认，这对设备可以帮助参与者通过敲击来实现手部动作的同步，没有视觉和听觉反馈。提出的人际知觉的通信系统可用于增强的相互作用如临床步态康复和运动训练，并帮助帕金森病人共享物理经验，从而提高他们在日常生活中面对的挑战体能的认识。 article link

285. Modeling Cumulative Arm Fatigue in Mid-Air Interaction based on Perceived Exertion and Kinetics of Arm Motion

SESSION:Sensing and Input

Quantifying cumulative arm muscle fatigue is a critical factor in understanding, evaluating, and optimizing user experience during prolonged mid-air interaction. A reasonably accurate estimation of fatigue requires an estimate of an individual's strength. However, there is no easy-to-access method to measure individual strength to accommodate inter-individual differences. Furthermore, fatigue is influenced by both psychological and physiological factors, but no current HCI model provides good estimates of cumulative subjective fatigue. We present a new, simple method to estimate the maximum shoulder torque through a mid-air pointing task, which agrees with direct strength measurements. We then introduce a cumulative fatigue model informed by subjective and biomechanical measures. We evaluate the performance of the model in estimating cumulative subjective fatigue in mid-air interaction by performing multiple cross-validations and a comparison with an existing fatigue metric. Finally, we discuss the potential of our approach for real-time evaluation of subjective fatigue as well as future challenges.

> 量化累积肌肉疲劳是理解、评估和优化长时间空中交互过程中用户体验的一个关键因素。对疲劳程度的精确估计需要对个人力量的估计。然而，没有容易的方法来衡量个人的力量，以适应个体间的差异。此外，疲劳受心理和生理因素的影响，但目前的HCI模型没有对累积主观疲劳提供良好的估计。我们提出了一种新的简单方法，通过一个空中指向任务来估计最大肩力矩，这与直接强度测量相吻合。然后，我们介绍一个累积疲劳模型的主观和生物力学措施通知。我们评估的模型的性能估计累积的主观疲劳在空中交互执行多个交叉验证和现有的疲劳指标的比较。最后，我们讨论了我们评估主观疲劳和未来挑战的方法的潜力。 article link

286. Women's Safety in Public Spaces: Examining the Efficacy of Panic Buttons in New Delhi

SESSION:Social Justice

We present a qualitative inquiry through the lens of feminist Human-Computer Interaction (HCI) into women's perceptions of personal safety in New Delhi, India. Since a brutal gang-rape incident took place in Delhi in December 2012 and received global attention, women's safety has been the focus of much attention India-wide. In April 2016, the Indian government issued a mandate that all mobile phones sold in India 2017 onwards must include a panic button for women's safety. We draw on interview and survey data to examine women's responses to the mandate, also investigating what factors influence their perceptions of safety, positively and negatively. Our findings indicate that women's sense of safety may be deconstructed into a multitude of factors--personal, public, social, technological--that must align for this sense of safety to be preserved. We then discuss the implications these factors have for the success and (re-)design of the panic button and similar interventions.

> 我们通过女权主义人机交互（HCI）的镜头，对印度新德里的妇女对人身安全的看法进行了定性调查。自2012年12月在德令哈市发生一起轮奸案并引起全球关注以来，妇女安全问题一直是印度各界关注的焦点。今年2016年4月，印度政府发布了一项授权，要求所有在印度销售的手机2017必须包括妇女安全的恐慌按钮。我们利用访谈和调查数据审查妇女对任务的反应，并调查哪些因素影响她们对安全的积极和消极的看法。我们的研究结果表明，女性的安全感可以解构为众多的因素--个人、公众、社会、技术，必须对这种安全感被保存下来。然后，我们讨论这些因素对成功和（重新）设计恐慌按钮和类似干预措施的影响。 article link

287. Technologies and Social Justice Outcomes in Sex Work Charities: Fighting Stigma, Saving Lives

SESSION:Social Justice

Sex workers' rights are human rights, and as such are an issue inherently based in social, criminal, and political justice debates. As HCI continues to move towards feminist and social justice oriented research and design approaches, we argue that we need to take into consideration the difficulties faced by sex workers; and explore how technology can and does mediate social justice outcomes for them. We contribute directly to this challenge by providing an empirical account of a charity whose work is built on the underlying move towards social and criminal justice for sex workers in the UK. Through ethnographic fieldwork, meetings, interviews, surveys, and creative workshops we describe the different points of view associated with the charity from a variety of stakeholders. We discuss their service provision and the ways in which HCI is uniquely positioned to be able respond to the needs of and to support sex work support services.

> 性工作者的权利是人权，因此，这一问题本质上是基于社会、刑事和政治公正的辩论。随着HCI继续走向女权主义和社会正义导向的研究和设计方法，我们认为，我们需要考虑性工作者面临的困难；探讨技术如何和确实为他们调解社会正义结果。我们对这一挑战作出了直接贡献，提供了一个慈善机构的经验报告，该慈善机构的工作建立在对英国性工作者的社会和刑事司法的根本行动上。通过人种学田野调查、会议、访谈、调查和创造性讲习班，我们描述了不同利益相关者对慈善机构的不同看法。我们讨论了他们提供的服务，以及如何使HCI具有独特的地位，以便能够满足和支持性工作支助服务的需要。 article link

288. A Human-Centered Approach to Algorithmic Services: Considerations for Fair and Motivating Smart Community Service

Management that Allocates Donations to Non-Profit Organizations

SESSION:Social Justice

Algorithms are increasingly being incorporated into diverse services that orchestrate multiple stakeholders' needs and interests. How can we design these algorithmic services to make decisions that are not only efficient, but also fair and motivating? We take a human-centered approach to identify and address challenges in building human-centered algorithmic services. We are in the process of building an allocation algorithm for 412 Food Rescue, an organization that matches food donations with non-profit organizations. As part of this ongoing project, we conducted interviews with multiple stakeholders in the service-organization staff, donors, volunteers, recipient non-profits and their clients, and everyday citizens-in order to understand how the allocation algorithm, interfaces, and surrounding work practices should be designed. The findings suggest that we need to understand and account for varying fairness notions held by stakeholders; consider people, contexts, and interfaces for algorithms to work fairly in the real world; and preserve meaningfulness and social interaction in automation in order to build fair and motivating algorithmic services.

> 算法越来越多地被纳入各种服务，以协调多个利益相关者的需求和兴趣。我们如何设计这些算法服务，使决策不仅高效，而且公平和激励？我们采取以人为本的方法来识别和处理以人为中心的算法服务的挑战。我们正在为412个食品救援组织建立一个分配算法，这是一个将食物捐赠与非营利组织相匹配的组织。作为该项目的一部分，我们进行了在服务组织的工作人员，多个利益相关者的访谈者，志愿者，接受非营利组织和他们的客户，并为每个公民了解如何分配算法，接口，和周围的工作实践应设计。研究结果表明，我们需要了解不同的公平观念举行利益相关者考虑；考虑人、环境、和接口，在现实世界中相当的工作算法；并保存在自动化的意义和社会作用，建立公平、激励算法服务。 article link

289. Class Confessions: Restorative Properties in Online Experiences of Socioeconomic Stigma

SESSION:Social Justice

In this paper, we examine stigma related to class identity online through an empirical examination of Elite University Class Confessions (EUCC). EUCC is an online space that includes a Facebook page and a surrounding sociotechnical ecosystem. It is a community of, for, and about low-income and first generation students at an elite university. By bringing in a community that learns and engages with users' socioeconomic struggles, EUCC engenders unique restorative properties for students experiencing class stigma. EUCC's restorative properties foster new ways of understanding one's stigmatized identity through meaning- making interactions in a networked sociotechnical system. We discuss how EUCC's design shapes the nature of user interactions around class stigma, and explore in depth how people experience stigma differently through the restorative properties of EUCC.

> 在本文中，我们研究通过精英大学类告白实证检验类的网上身份相关的污名（eucc）。eucc是一个在线的空间，包括一个脸谱网网页和周围的社会技术系统。它是一所精英大学的低收入和第一代学生的社区。通过在一个社区，学习和从事与用户的经济斗争，eucc引发学生体验类柱头独特的恢复性能。eucc的恢复属性培育新的理解人的污名化的身份通过意义-在网络社会技术系统的交互方式。我们将讨论如何eucc的设计形状的用户交互类柱头周围的性质，并深入人们如何体验不同的eucc柱头通过恢复性能的探讨。 article link

290. Activity as the Ultimate Particular of Interaction Design

SESSION:Wild Methods

In the turn towards practice-oriented research in interaction design, one of the most important proposals has been the emphasis on the 'ultimate particulars' produced by design, as embodiments of design knowledge. In current HCI research, those particulars are almost always taken to be 'things' artefacts or singular systems. We argue that this emphasis may have come at a cost that can be described as a loss of identity; interaction design research was never primarily concerned with the design of artefacts, but with how humans act and interact with each other with and through artefacts. We propose a complementary perspective by looking at design projects and traditions where the 'ultimate particulars' can be considered to be activities rather than things. The article is concerned with how knowledge needs to be articulated in the scholarly engagement with such design practices. We argue that engagement with activity-centric design gets design research one step closer towards understanding salient contemporary design practices and what Buchanan calls 'environmental design'.

> 在交互设计的面向实践的研究中，最重要的建议之一是强调设计所产生的“最终细节”，作为设计知识的体现。在当前的人机交互研究中，这些细节几乎总是被视为“物”或“奇异系统”。我们认为，这种强调可能是以一种成本来描述的，这是一种身份的丧失；交互设计研究从来没有主要涉及人工制品的设计，而是涉及人类如何通过和通过人工制品相互作用和相互作用。我们提出了一个互补的观点，即着眼于设计项目和传统，其中“最终细节”可以被认为是活动而不是事物。这篇文章关注的是，知识需要如何与这种设计实践联系起来。我们认为，以活动为中心的设计的参与使设计研究更接近于理解当代显著的设计实践和卜婵安所说的“环境设计”。 article link

291. Intuition in Design: Reflections on the Iterative Aesthetics of Form

SESSION:Wild Methods

Curious to reflect on the factors contributing to the internal decision-making processes of intuitive design, a reflective study was established to systematically examine and document the practice of intuition while performing an iterative aesthetic task. Autoethnographic techniques were used to document the reflective practices that occurred over numerous iterations spanning several weeks of activity. Our analysis concludes with a summary of reflections on how intuition informs judgment in design cognition. We examine four dimensions of intuition in design - efficiency, inspiration, curiosity, and insight - and the reflective and sensory inputs that drive intuitive speculation and impulse.

> 为了反思直觉设计内部决策过程的因素，建立了一个反思性研究，系统地研究和记录了在执行迭代美学任务时的直觉实践。autoethnographic技术进行反思性实践，发生在无数次的迭代生成活动几周文件。我们的分析总结了对直觉如何在设计认知中判断判断的总结。我们考察了设计中直觉的四个维度——效率、灵感、好奇心和洞察力——以及反射和感官输入，它们驱动直觉的猜测和冲动。 article link

292. Understanding Public Evaluation: Quantifying Experimenter Intervention

SESSION:Wild Methods

Public evaluations are popular because some research questions can only be answered by turning "to the wild." Different approaches place experimenters in different roles during deployment, which has implications for the kinds of data that can be collected and the potential bias introduced by the experimenter. This paper expands our understanding of how

experimenter roles impact public evaluations and provides an empirical basis to consider different evaluation approaches. We completed an evaluation of a playful gesture-controlled display not to understand interaction at the display but to compare different evaluation approaches. The conditions placed the experimenter in three roles, steward observer, overt observer, and covert observer, to measure the effect of experimenter presence and analyse the strengths and weaknesses of each approach.

> 公众评价的流行是因为一些研究问题只能通过打开“野回答。“不同的方法将不同角色在实验者的部署，也可以收集的数据和潜在的偏见，由实验者的种类的影响。本文扩展了我们对实验者角色如何影响公众评价的理解，并提供了考虑不同评估方法的经验基础。我们完成了一个有趣的手势控制显示的评价，而不是在显示器上理解交互，而是比较不同的评估方法。这些条件将实验者置于三个角色：管家观察者、公开观察者和隐蔽观察者，以测量实验者在场的效果，并分析每种方法的优缺点。 article link

293. Challenges in Public Display Deployments: A Taxonomy of External Factors

SESSION:Wild Methods

Public display deployments are often subjected to various surprising and unwanted effects. These effects are frequently due to external factors properties and phenomena that are unrelated to the deployment. Therefore, we conducted a literature review within the public display domain to investigate the causes behind the reported issues. This work presents a taxonomy of external factors affecting deployments, consisting of six categories: weather, events, surroundings, space, inhabitants, and vandalism. Apart from a few positive examples, we predominantly found negative effects arising from these factors. We then identified four ways of addressing the effects: ignoring, adapting, solving, and embracing. Of these, ignoring and adapting are substantially more frequent responses than solving and embracing emphasizing the need for researchers to adapt. We present real-world examples and insights on how researchers and practitioners can address the effects to better manage their deployments.

> 公共显示器的部署常常会受到各种令人惊讶和不必要的影响。这些影响常常是由于与部署无关的外部因素、属性和现象。因此，我们在公共显示领域内进行了文献回顾，以调查报告问题背后的原因。这项工作对影响部署的外部因素进行了分类，包括六类：天气、事件、环境、空间、居民和破坏行为。除了几个积极的例子，我们主要发现这些因素产生的负面影响。然后，我们确定了四种解决这些影响的方法：忽视、适应、解决和拥抱。其中，忽视和适应是比解决和拥抱更为频繁的反应，强调研究人员适应的必要性。我们介绍了真实世界的例子和见解，研究人员和从业者如何处理这些影响，以更好地管理他们的部署。 article link

294. Typefaces and the Perception of Humanness in Natural Language Chatbots

SESSION:Chatbot Interfaces

How much do visual aspects influence the perception of users about whether they are conversing with a human being or a machine in a mobile-chat environment? This paper describes a study on the influence of typefaces using a blind Turing test-inspired approach. The study consisted of two user experiments. First, three different typefaces (OCR, Georgia, Helvetica) and three neutral dialogues between a human and a financial adviser were shown to participants. The second experiment applied the same study design but OCR font was substituted by Bradley font. For each of our two independent experiments, participants were shown three dialogue transcriptions and three typefaces counterbalanced. For each dialogue typeface pair, participants had to classify adviser conversations as human or chatbot-like. The results showed that machine-like typefaces biased users towards perceiving the adviser as machines but, unexpectedly, handwritten-like typefaces had not the opposite effect. Those effects were, however, influenced by the familiarity of the user to artificial intelligence and other participants' characteristics.

> 视觉方面对用户在移动聊天环境中是否与人或机器对话有多大影响？本文用盲图灵测试启发法研究字体的影响。这项研究包括两个用户实验。首先，三种不同的字体（OCR，格鲁吉亚，瑞士）和三中性对话人和财务顾问之间显示与会者。第二个实验采用相同的研究设计，但OCR字体被布拉德利字体替代。我们每两个独立的实验中，参与者看到了三对话转录三字体平衡。每个对话字体对参与者进行分类，顾问交谈人或聊天机器人。结果表明，类似机器的字体会使用户误以为顾问是机器，但出乎意料的是，手写字体并没有相反的效果。然而，这些影响是由用户对人工智能的熟悉程度和其他参与者的特性所决定的。 article link

295. "Could You Define That in Bot Terms"?: Requesting, Creating and Using Bots on Reddit

SESSION:Chatbot Interfaces

Bots are estimated to account for well over half of all web traffic, yet they remain an understudied topic in HCI. In this paper we present the findings of an analysis of 2284 submissions across three discussion groups dedicated to the request, creation and discussion of bots on Reddit. We set out to examine the qualities and functionalities of bots and the practical and social challenges surrounding their creation and use. Our findings highlight the prevalence of misunderstandings around the capabilities of bots, misalignments in discourse between novices who request and more expert members who create them, and the prevalence of requests that are deemed to be inappropriate for the Reddit community. In discussing our findings, we suggest future directions for the design and development of tools that support more carefully guided and reflective approaches to bot development for novices, and tools to support exploring the consequences of contextually-inappropriate bot ideas.

> 机器人估计占到所有Web流量的一半，但他们仍在人机交互中的话题。在本文中，我们提出的2284份意见书在三个讨论小组致力于请求的结果分析，在Reddit讨论机器人创作。我们着手研究机器人的质量和功能，以及它们的创建和使用所面临的实际和社会挑战。我们的研究结果表明在机器人的能力误解盛行，在新手的要求和更多的专家成员创建它们之间的话语错位，与流行的请求被认为是不恰当的Reddit社区。在讨论我们的研究结果，我们建议对设计和开发工具，支持更多的认真指导和反射方法BOT开发新手的未来方向，和工具支持探索内容不当的BOT的想法的后果。 article link

296. Response Times when Interpreting Artificial Subtle Expressions are Shorter than with Human-like Speech Sounds

SESSION:Chatbot Interfaces

Artificial subtle expressions (ASEs) are machine-like expressions used to convey a system's confidence level to users intuitively. In this paper, we focus on the cognitive loads of users in interpreting ASEs in this study. Specifically, we assume that a shorter response time indicates less cognitive load, and we hypothesize that users will show a shorter response time when interpreting ASEs compared with speech sounds. We succeeded in verifying our hypothesis in a web-based investigation done to comprehend participants' cognitive loads by measuring their response times in interpreting ASEs and speeches.

> 人工细微的表情（ASES）是机器般的表情，用来表达系统的信心水平用户直观。在本文中，我们重点在解释本研究作为用户的认知负荷。具体来说，我们假设一个更短的响应时间指较少的认知负荷，我们假设用户将显示一个更短的响应时间在解释作为与语音。我们成功地在一个网络调查来理解参与者的认知负荷的解释例和演讲测量响应时间的验证我们的假说。 article link

297. A New Chatbot for Customer Service on Social Media

SESSION:Chatbot Interfaces

Users are rapidly turning to social media to request and receive customer service; however, a majority of these requests were not addressed timely or even not addressed at all. To overcome the problem, we create a new conversational system to automatically generate responses for users requests on social media. Our system is integrated with state-of-the-art deep learning techniques and is trained by nearly 1M Twitter conversations between users and agents from over 60 brands. The evaluation reveals that over 40% of the requests are emotional, and the system is about as good as human agents in showing empathy to help users cope with emotional situations. Results also show our system outperforms information retrieval system based on both human judgments and an automatic evaluation metric.

> 用户正在迅速转向社交媒体来请求和接收客户服务；然而，大多数这些请求没有及时得到解决，甚至根本没有解决。为了克服这个问题，我们创建了一个新的会话系统，以自动响应用户对社交媒体的请求。我们的系统集成了最先进的深层学习技术，并接受了来自60多个品牌的用户和代理商之间近100万次Twitter对话的培训。评估结果显示，超过40%的请求是情绪化的，而且该系统与人类代理人一样，表现出同理心，以帮助用户应付情绪状况。结果还表明，我们的系统优于基于人类判断和自动评估指标的信息检索系统。 article link

298. CrowdVerge: Predicting If People Will Agree on the Answer to a Visual Question

SESSION:Collaborative Crowdwork

Visual question answering systems empower users to ask any question about any image and receive a valid answer. However, existing systems do not yet account for the fact that a visual question can lead to a single answer or multiple different answers. While a crowd often agrees, disagreements do arise for many reasons including that visual questions are ambiguous, subjective, or difficult. We propose a model, CrowdVerge, for automatically predicting from a visual question whether a crowd would agree on one answer. We then propose how to exploit these predictions in a novel application to efficiently collect all valid answers to visual questions. Specifically, we solicit fewer human responses when answer agreement is expected and more human responses otherwise. Experiments on 121,811 visual questions asked by sighted and blind people show that, compared to existing crowdsourcing systems, our system captures the same answer diversity with typically 14-23% less crowd involvement.

> 可视问答系统允许用户询问任何图像的任何问题，并得到有效的答案。然而，现有的系统还不能解释这样一个事实，即视觉问题可以导致单个答案或多个不同的答案。虽然很多人都同意，但也有许多不同的原因，包括视觉问题模棱两可，主观或困难。我们提出一个模型，crowdverge，自动预测从视觉问题的人群会有一个答案一致。然后，我们建议如何利用这些预测在一个新的应用程序，以有效地收集所有有效的视觉问题的答案。具体来说，我们希望在回答一致的情况下征求较少的人的反应，而其他人的反应则不然。的短视和盲目的人表明，要求在121811视觉问题的实验中，相比现有的众包系统，我们的系统通常14-23少群众参与相同的答案多样性捕捉。 article link

299. Flash Organizations: Crowdsourcing Complex Work by Structuring Crowds As Organizations

SESSION:Collaborative Crowdwork

This paper introduces flash organizations: crowds structured like organizations to achieve complex and open-ended goals. Microtask workflows, the dominant crowdsourcing structures today, only enable goals that are so simple and modular that their path can be entirely pre-defined. We present a system that organizes crowd workers into computationally-represented structures inspired by those used in organizations - roles, teams, and hierarchies - which support emergent and adaptive coordination toward open-ended goals. Our system introduces two technical contributions: 1) encoding the crowd's division of labor into de-individualized roles, much as movie crews or disaster response teams use roles to support coordination between on-demand workers who have not worked together before; and 2) reconfiguring these structures through a model inspired by version control, enabling continuous adaptation of the work and the division of labor. We report a deployment in which flash organizations successfully carried out open-ended and complex goals previously out of reach for crowdsourcing, including product design, software development, and game production. This research demonstrates digitally networked organizations that flexibly assemble and reassemble themselves from a globally distributed online workforce to accomplish complex work.

> 本文介绍了Flash组织：组织这样的群体来实现复杂和开放的目标。微任务的工作流程，主导的众包结构的今天，只有使目标是如此简单和模块化的，他们完全可以预先定义的路径。我们提出了一个系统，将人群工作者组织成由组织、角色、团队和层次结构所激励的计算式结构，这些结构支持对开放式目标的紧急和适应性协调。我们的系统采用了两种技术的贡献：1）编码的人群的分工到个性化的角色，就像电影船员或灾难反应小组使用角色来支持随需应变的工人谁没有一起工作过的协调；2）重新配置这些结构通过一个模型的启发，版本控制，使工作不断适应与分工。我们报告了一个部署，Flash组织成功地实现了以前无法实现的面向众包的开放式和复杂的目标，包括产品设计、软件开发和游戏生产。这项研究表明，数字网络化的组织，灵活的组装和组装自己的全球分布的在线员工来完成复杂的工作。 article link

300. Facilitating Pervasive Community Policing on the Road with Mobile Roadwatch

SESSION:Collaborative Crowdwork

We consider community policing on the road with pervasive recording technologies such as dashcams and smartphones where citizens are actively volunteering to capture and report various threats to traffic safety to the police via mobile apps. This kind of novel community policing has recently gained significant popularity in Korea and India. In this work, we identify people's general attitude and concerns toward community policing on the road through an online survey. We then address the major concerns by building a mobile app that supports easy event capture/access, context tagging, and privacy preservation. Our two-week user study (n = 23) showed Roadwatch effectively supported community policing activities on the road. Further, we found that the critical factors for reporting are personal involvement and seriousness of risks, and participants were mainly motivated by their contribution to traffic safety. Finally, we discuss several practical design implications to facilitate community policing on the road.

> 我们认为，社区警务的道路上用普遍的录音技术如智能手机dashcams和公民积极主动捕捉和报告交通安全通过移动应用程序的各种威胁的警察。这种新型的社区警务最近在韩国和印度获得了广泛的普及。在这项工作中，我们通过在线调查确定人们对社区警务的普遍态度和关注。然后，我们通过构建一个支持简单事件捕获/访问、上下文标注和隐私保护的移动应用程序来解决主要问题。我们两周的用户研究（n = 23）显示道路监察局有效地支持社区警务活动的道路上。此外，我们发现，报告的关键因素是个人参与和风险的严重性，参与者的动机主要是他们对交通安全的贡献。最后，我们讨论了几个实际的设计问题，以促进社区警务的道路上。 article link

301. ReTool: Interactive Microtask and Workflow Design through Demonstration

SESSION:Collaborative Crowdwork

In addition to simple form filling, there is an increasing need for crowdsourcing workers to perform freeform interactions directly on content in microtask crowdsourcing (e.g. proofreading articles or specifying object boundary in an image). Such microtasks are often organized within well-designed workflows to optimize task quality and workload distribution. However, designing and implementing the interface and workflow for such microtasks is challenging because it typically requires programming knowledge and tedious manual effort. We present ReTool, a web-based tool for requesters to design and publish interactive microtasks and workflows by demonstrating the microtasks for text and image content. We evaluated ReTool against a task-design tool from a popular crowdsourcing platform and showed the advantages of ReTool over the existing approach.

> 除了简单的表格填写，有众包工人进行自由的相互作用直接对内容的需求日益增加，微任务众包（例如校对文章或图像中的指定对象的边界）。这样的microtasks经常组织在精心设计的流程优化工作质量和工作量的分配。然而，设计和实施这样的microtasks接口和工作流具有挑战性，因为它通常需要编程知识和繁琐的手工工作。我们现在的装备，一个基于网络的工具为请求者设计并出版互动microtasks和工作流程的演示microtasks文本和图像内容。我们评估重组对任务的设计工具，从一个流行的众包平台和显示的优势重组，在现有的方法。 article link

302. Always On(line)?: User Experience of Smartwatches and their Role within Multi-Device Ecologies

SESSION:Contextual Smartwatch Use

Users have access to a growing ecosystem of devices (desktop, mobile and wearable) that can deliver notifications and help people to stay in contact. Smartwatches are gaining popularity, yet little is known about the user experience and their impact on our increasingly always online culture. We report on a qualitative study with existing users on their everyday use of smartwatches to understand both the added value and the challenges of being constantly connected at the wrist. Our findings show that users see a large benefit in receiving notifications on their wrist, especially in terms of helping manage expectations of availability. Moreover, we find that response rates after viewing a notification on a smartwatch change based on the other devices available: laptops prompt quicker replies than smartphones. Finally, there are still many costs associated with using smartwatches, thus we make a series of design recommendations to improve the user experience of smartwatches.

> 用户可以访问日益增长的设备（桌面、移动和可穿戴）系统，可以提供通知并帮助人们保持联系。手表的日益普及，关于用户体验以及他们对我们越来越经常在线文化影响非常少。我们报告的定性研究与现有用户的日常使用smartwatches理解的附加值，不断连接在手腕的挑战。我们的研究结果表明，用户在接收他们的手腕上的通知时看到了很大的好处，特别是在帮助管理对可用性的期望方面。此外，我们发现后的反应率在一个基于其他设备可用的SmartWatch变化看通知：笔记本电脑提示更快回复比智能手机。最后，还有很多相关的费用使用手表，因此我们制定了一系列的设计建议提高手表的用户体验。 article link

303. Quantifying Sources and Types of Smartwatch Usage Sessions

SESSION:Contextual Smartwatch Use

We seek to quantify smartwatch use, and establish differences and similarities to smartphone use. Our analysis considers use traces from 307 users that include over 2.8 million notifications and 800,000 screen usage events, and we compare our findings to previous work that quantifies smartphone use. The results show that smartwatches are used more briefly and more frequently throughout the day, with half the sessions lasting less than 5 seconds. Interaction with notifications is similar across both types of devices, both in terms of response times and preferred application types. We also analyse the differences between our smartwatch dataset and a dataset aggregated from four previously conducted smartphone studies. The similarities and differences between smartwatch and smartphone use suggest effect on usage that go beyond differences in form factor.

> 我们试图量化的SmartWatch的使用，并建立智能手机使用的异同。我们的分析考虑了307个用户使用的跟踪信息，其中包括超过280万个通知和800000个屏幕使用事件，并将我们的研究结果与以前量化智能手机使用的工作进行比较。结果表明，使用更简单的smartwatches和更频繁的整个一天，一半的时间小于5秒。在响应时间和首选应用程序类型方面，这两种类型的设备与通知的交互都类似。我们还分析了我们的数据集和数据汇总的SmartWatch四先前进行的智能手机研究之间的差异。智能手表和智能手机使用的异同，建议使用超越差异形成因素的影响。 article link

304. Situating Wearables: Smartwatch Use in Context

SESSION:Contextual Smartwatch Use

Drawing on 168 hours of video recordings of smartwatch use, this paper studies how context influences smartwatch use. We explore the effects of the presence of others, activity, location and time of day on 1,009 instances of use. Watch interaction is significantly shorter when in conversation than when alone. Activity also influences watch use with significantly longer use while eating than when socialising or performing domestic tasks. One surprising finding is that length of use is similar at home and work. We note that usage peaks around lunchtime, with an average of 5.3 watch uses per hour throughout a day. We supplement these findings with qualitative analysis of the videos, focusing on how use is modified by the presence of others, and the lack of impact of watch glances on conversation. Watch use is clearly a context-sensitive activity and in discussion we explore how smartwatches could be designed taking this into consideration.

> 在168小时的SmartWatch使用录像，研究如何利用语境影响的SmartWatch。我们探讨了其他人的存在，活动，地点和时间对1009个使用实例的影响。在交谈中观看互动比单独交谈要短得多。活动也影响显著不再使用而吃比在社交或执行国内任务表的使用。一个令人惊讶的发现是在家和工作中使用时间是相似的。我们注意到，午餐时间的使用高峰时间为一天，平均每小时5.3次。我们将这些发现与定性分析相结合，着重于如何使用他人的修改，以及观看对话的效果。手表显然是一个上下文敏感的活动，探讨如何smartwatches可以设计考虑到这。 article link

305. BreakSense: Combining Physiological and Location Sensing to Promote Mobility during Work-Breaks

SESSION:Contextual Smartwatch Use

Work breaks can play an important role in the mental and physical well-being of workers and contribute positively to productivity. In this paper we explore the use of activity-, physiological-, and indoor-location sensing to promote mobility during work-breaks. While the popularity of devices and applications to promote physical activity is growing, prior research highlights important constraints when designing for the workplace. With these constraints in mind, we developed BreakSense, a mobile application that uses a Bluetooth beacon infrastructure, a smartphone and a smartwatch to encourage mobility during breaks with a game-like design. We discuss constraints imposed by design for work and the workplace, and highlight challenges associated with the use of noisy sensors and methods to overcome them. We then describe a short deployment of BreakSense within our lab that examined bound vs. unbound augmented breaks and how they affect users' sense of completion and readiness to work.

> 工作间歇对工人的身心健康起着重要作用，对生产力有积极贡献。在本文中，我们探讨了使用活动，生理和室内位置传感，以促进工作休息期间的流动性。虽然促进体力活动的

> 设备和应用越来越普及，但以前的研究在设计工作场所时强调了重要的限制。记住这些约束，我们开发了breaksense，移动使用蓝牙信标基础设施中的应用，智能手机和智能手表来鼓励在这样的游戏设计突破移动。我们讨论了设计对工作和工作场所的限制，并强调了使用嘈杂的传感器和方法来克服这些挑战。我们描述一个短部署在我们的实验室检查breaksense绑定和未绑定增强断裂以及它们是如何影响用户的准备工作完成和感。 article link

306. Disempowered by Data: Nonprofits, Social Enterprises, and the Consequences of Data-Driven Work

SESSION:Data Culture

Organizations across many sectors are under intense pressure to become data-driven. Yet, for mission-driven organizations, the path to becoming and value of being data-driven is not always clear. We present results from an interview-based study of the role of data in the monitoring and evaluation practices of mission-driven organizations. Instead of leading to productive and empowering data-driven decision making, monitoring and evaluation work is characterized by theerosion of autonomy, data drift, anddata fragmentation. Together, these consequences of monitoring and evaluation practices play into a cycle of increasing disempowerment for the mission-driven organization. These findings suggest that the design of information systems should work towards empowering organizations in ways that make sense for their unique data needs and those of their constituents.

> 许多部门的组织都面临着成为数据驱动的巨大压力。然而，对于任务驱动的组织来说，成为数据驱动的途径和价值并不总是清晰的。我们提出了一项基于访谈的研究数据在任务驱动组织的监测和评估实践中的作用的结果。而导致生产和授权数据驱动的决策，监测和评价工作的特点是自主性、数据漂移的侵蚀，和碎片。在一起，这些后果的监测和评价活动为任务驱动型组织增加一个周期的权利被剥夺。这些发现表明，信息系统的设计应该致力于赋予组织以其独特的数据需求和其组成部分的意义。 article link

307. Scratch Community Blocks: Supporting Children as Data Scientists

SESSION:Data Culture

In this paper, we presentScratch Community Blocks, a new system that enables children to programmatically access, analyze, and visualize data about their participation in Scratch, an online community for learning computer programming. At its core, our approach involves a shift in who analyzes data: from adult data scientists to young learners themselves. We first introduce the goals and design of the system and then demonstrate it by describing example projects that illustrate its functionality. Next, we show through a series of case studies how the system engages children in not only representing data and answering questions with data but also in self-reflection about their own learning and participation.

> 在本文中，我们presentscratch社区块，一个新的系统，可以使孩子以编程方式访问，分析，和对他们参与临时数据可视化，学习计算机编程的一个在线社区。我们的方法的核心是世卫组织分析数据的转变：从成人数据科学家到青年学习者本身。我们首先介绍系统的目标和设计，然后通过描述示例项目来演示它的功能。接下来，我们将通过一系列的案例研究表明，该系统是如何让儿童参与不仅代表数据和回答问题的数据，而且还自我反思自己的学习和参与。 article link

308. Supporting the Use of User Generated Content in Journalistic Practice

SESSION:Data Culture

Social media and user-generated content (UGC) are increasingly important features of journalistic work in a number of different ways. However, their use presents major challenges, not least because information posted on social media is not always reliable and therefore its veracity needs to be checked before it can be considered as fit for use in the reporting of news. We report on the results of a series of in-depth ethnographic studies of journalist work practices undertaken as part of the requirements gathering for a prototype of a social media verification 'dashboard' and its subsequent evaluation. We conclude with some reflections upon the broader implications of our findings for the design of tools to support journalistic work.

> 社会媒体和用户生成内容（UGC）是新闻工作中越来越多的重要特征。然而，它们的使用带来了重大挑战，尤其是因为张贴在社会媒体上的信息并不总是可靠的，因此在它被认为适合用于新闻报道之前，需要对其准确性进行检查。我们报告了新闻工作者工作实践的一系列深入人种学研究的结果，作为社会媒体验证“仪表盘”原型的需求收集和后续评估的一部分。最后，我们对我们的发现对设计支持新闻工作的工具的更广泛影响作了一些思考。 article link

309. How Data Workers Cope with Uncertainty: A Task Characterisation Study

SESSION:Data Culture

Uncertainty plays an important and complex role in data analysis, where the goal is to find pertinent patterns, build robust models, and support decision making. While these endeavours are often associated with professional data scientists, many domain experts engage in such activities with varying skill levels. To understand how these domain experts (or "data workers") analyse uncertain data we conducted a qualitative user study with 12 participants from a variety of domains. In this paper, we describe their various coping strategies to understand, minmise, exploit or even ignore this uncertainty. The choice of the coping strategy is influenced by accepted domain practices, but appears to depend on the types and sources of uncertainty and whether participants have access to support tools. Based on these findings, we propose a new process model of how data workers analyse various types of uncertain data and conclude with design considerations for uncertainty-aware data analytics.

> 不确定性在数据分析中起着重要而复杂的作用，其目的是找到相关的模式，建立健壮的模型，并支持决策。虽然这些工作往往与专业数据科学家有关，但许多领域专家从事不同技能水平的此类活动。为了了解这些领域专家（或“数据工作者”）如何分析不确定的数据，我们对来自不同领域的12名参与者进行了定性的用户研究。在本文中，我们描述了各种应对策略的理解，minmise、利用甚至忽略这种不确定性。应对策略的选择受接受域实践的影响，但似乎取决于不确定性的类型和来源以及参与者是否能够获得支持工具。基于这些发现，我们提出了一种新的数据工作者如何分析各种不确定数据的过程模型，并总结了不确定数据分析的设计考虑。 article link

310. Cardboard Machine Kit: Modules for the Rapid Prototyping of Rapid Prototyping Machines

SESSION:Fabrication and DIY

Digital fabrication machines (such as laser cutters or 3D printers) can be instructed to produce any part geometry within their application space. However, machines' application spaces are not easily modified or extended. How can we enable the production of application-specific computer-controlled machines by machine building novices? How can we facilitate rapid prototyping of rapid prototyping tools? We propose a novel set of modules, the Cardboard Machine Kit, for the construction of digital fabrication machines. These open-source modules are implemented using cardboard frames, stepper motors, and networked electronics controlled through a Python library. We evaluated the kit both through

machine building workshops and by studying the usage of the kit in the wild. In the wild we observed more than 500 novice machine builders who built 125 different machines for 15 different application types. We argue that this breadth demonstrates the efficacy of this modular approach. Finally we discuss the limitations of the Cardboard Machine Kit and discuss how it could inform future machine building infrastructure.

> 数字制造机器（如激光切割机或3D打印机）可以被指示在其应用空间内产生任何零件几何形状。然而，机器的应用空间不容易修改或扩展。我们如何使机器制造新手生产应用程序特定的计算机控制的机器？我们如何促进快速原型工具的快速原型设计？我们提出了一套新的模块，纸板机，为数字制造机的建设。这些开放源码模块是通过使用Python库控制的硬纸板框架、步进电机和网络电子设备实现的。我们通过机器制造车间评估了工具包，并研究了野生动物工具箱的使用情况。在野生环境中，我们观察了500多名新手机器制造商，他们为15种不同的应用程序建立了125台不同的机器。我们认为，这种宽度表明这种模块化方法的有效性。最后，我们讨论了纸板箱的局限性，并讨论了它如何告知未来的机器制造基础设施。 article link

311. Printflatables: Printing Human-Scale, Functional and Dynamic Inflatable Objects

SESSION:Fabrication and DIY

Printflatables is a design and fabrication system for human-scale, functional and dynamic inflatable objects. We use inextensible thermoplastic fabric as the raw material with the key principle of introducing folds and thermal sealing. Upon inflation, the sealed object takes the expected three dimensional shape. The workflow begins with the user specifying an intended 3D model which is decomposed to two dimensional fabrication geometry. This forms the input for a numerically controlled thermal contact iron that seals layers of thermoplastic fabric. In this paper, we discuss the system design in detail, the pneumatic primitives that this technique enables and merits of being able to make large, functional and dynamic pneumatic artifacts. We demonstrate the design output through multiple objects which could motivate fabrication of inflatable media and pressure-based interfaces.

> printflatables是和人类尺度的制造系统的设计、功能和动态充气物体。我们用不可伸长的热塑性织物与引入的褶皱和热密封的关键原则的原料。当充气时，密封物体达到预期的三度形状。工作流始于用户指定一个预期的三维模型，该模型分解为二维制造几何。这就形成了一种数控热接触铁的输入，它密封了热塑性织物的层。在本文中，我们详细讨论了系统设计，气动原语，这种技术使其优点是能够制造大型，功能和动态气动工件。我们演示了设计输出通过多个对象，这可以刺激制造充气媒体和压力为基础的接口。 article link

312. Sketching CuddleBits: Coupled Prototyping of Body and Behaviour for an Affective Robot Pet

SESSION:Fabrication and DIY

Social robots that physically display emotion invite natural communication with their human interlocutors, enabling applications like robot-assisted therapy where a complex robot's breathing influences human emotional and physiological state. Using DIY fabrication and assembly, we explore how simple 1-DOF robots can express affect with economy and user customizability, leveraging open-source designs.We developed low-cost techniques for coupled iteration of a simple robot's body and behaviour, and evaluated its potential to display emotion. Through two user studies, we (1) validated these CuddleBits' ability to express emotions (N=20); (2) sourced a corpus of 72 robot emotion behaviours from participants (N=10); and (3) analyzed it to link underlying parameters to emotional perception (N=14).We found that CuddleBits can express arousal (activation), and to a lesser degree valence (pleasantness). We also show how a sketch-refine paradigm combined with DIY fabrication and novel input methods enable parametric design of physical emotion display, and discuss how mastering this parsimonious case can give insight into layering simple behaviours in more complex robots.

> 社交机器人身体展示情感邀请自然与孩子沟通的人谈话，使应用程序像机器人辅助治疗在一个复杂的机器人的呼吸影响人的情绪和生理状态。用DIY的制造和装配，我们探讨如何简单的单自由度的机器人可以表达影响经济和用户可定制性，利用开源的设计。我们开发了一个简单的机器人的身体和行为的耦合迭代的低成本技术，并评估其潜在的情感表现。通过两个用户研究，我们（1）验证这些cuddlebits”表达情绪的能力（n = 20）；（2）来源分析72个机器人的情感行为的参与者（n = 10）；和（3）分析其链接基本参数（n = 14）情绪感知。我们发现cuddlebits可以表达唤醒（激活），并在较小程度上价（愉快）。我们还展示了一个草图细化范式结合DIY制造和新的输入方法，使参数设计的物理情感显示，并讨论如何掌握这个吝啬的情况下，可以洞察分层简单的行为，在更复杂的机器人。 article link

313. WireDraw: 3D Wire Sculpturing Guided with Mixed Reality

SESSION:Fabrication and DIY

The availability of commodity 3D extruder pen allows direct drawing of 3D wire sculptures for novice users, enabling many novel applications such as intuitive spatial intelligence development for school students. However, the lack of spatial and structural cues among individual pen strokes makes the 3D drawing process challenging, which often leads to highly distorted and even incomplete wire sculptures. We present a mixed reality system, called `WireDraw', to immersively guide the 3D drawing for easy wire sculpturing. The system design is based on novel 3D drawing principles and the subsequent optimization, making the stroke sequence of the wire model drawable and easy to draw. On-the-fly edits on unsatisfactory strokes are also allowed for creative design. We demonstrate the effectiveness of our system by testing on a variety of wire models and a user study. The results show that the visual guidance provided by our system is extremely helpful for drawing high-quality wire sculptures.

> 商品三维挤压笔可供初学者直接绘制三维线雕塑，使许多新的应用，如直观的空间智力发展的学生。然而，由于缺乏单个笔画之间的空间和结构线索，使得3D绘图过程具有挑战性，常常导致高度扭曲甚至不完整的线雕塑。我们提出了一种混合现实系统，称为`拉长，以感导三维绘图线容易雕刻。本系统的设计是基于新的3D绘图的原理和后续的优化，使得导线模型冲和容易画的笔画顺序。对于创意设计，也可以在不满意的笔画上进行修改。我们通过测试各种有线模型和用户研究来证明我们的系统的有效性。结果表明，本系统所提供的视觉指导对于绘制高质量的金属丝雕塑非常有帮助。 article link

314. Sparkle: Hover Feedback with Touchable Electric Arcs

SESSION:Haptic Feedback

Many finger sensing input devices now support proximity input, enabling users to perform in-air gestures. While near-surface interactions increase the input vocabulary, they lack tactile feedback, making it hard for users to perform gestures or to know when the interaction takes place. Sparkle stimulates the fingertip with touchable electric arcs above a hover sensing device to give users in-air tactile or thermal feedback, sharper and more feelable than acoustic mid-air haptic devices. We present the design of a high voltage resonant transformer with a low-loss soft ferrite core and self-tuning driver circuit, with which we create electric arcs 6 mm in length, and combine this technology with infrared proximity sensing in two proof-of-concept devices with form factor and functionality similar to a button and a touchpad. We provide design guidelines for Sparkle devices and examples of stimuli in application scenarios, and report the results of a user study on the perceived sensations. Sparkle is the first step towards providing a new type of hover feedback, and it does not require users to wear tactile stimulators.

> 许多手指感应输入设备现在支持接近输入，允许用户执行空中手势。虽然近表面交互增加了输入词汇，他们缺乏触觉反馈，使用户很难执行手势或知道何时发生交互。闪光刺激指尖触摸电弧传感装置上方悬停在空中的触觉或热反馈给用户，更感受到声空中触觉设备。我们提出了一个低损耗软磁铁氧体芯和自驱动电路的高压谐振变压器的设计，并产生电弧的长度为6 mm，且该技术与红外接近两证明与外形和功能类似于一个按钮和一个触摸板概念设备检测的结合。我们提供了照明设备的设计准则和应用场景中刺激的例子，并报告了用户对感知感觉的研究结果。火花是走向提供了一个新的类型的悬停反馈的第一步，它不需要用户佩戴触觉刺激。 article link

315. Sparse Haptic Proxy: Touch Feedback in Virtual Environments Using a General Passive Prop

SESSION:Haptic Feedback

We propose a class of passive haptics that we call Sparse Haptic Proxy: a set of geometric primitives that simulate touch feedback in elaborate virtual reality scenes. Unlike previous passive haptics that replicate the virtual environment in physical space, a Sparse Haptic Proxy simulates a scene's detailed geometry by redirecting the user's hand to a matching primitive of the proxy. To bridge the divergence of the scene from the proxy, we augment an existing Haptic Retargeting technique with an on-the-fly target remapping: We predict users' intentions during interaction in the virtual space by analyzing their gaze and hand motions, and consequently redirect their hand to a matching part of the proxy. We conducted three user studies on haptic retargeting technique and implemented a system from three main results: 1) The maximum angle participants found acceptable for retargeting their hand is 40°, with an average rating of 4.6 out of 5. 2) Tracking participants' eye gaze reliably predicts their touch intentions (97.5%), even while simultaneously manipulating the user's hand-eye coordination for retargeting. 3) Participants preferred minimized retargeting distances over better-matching surfaces of our Sparse Haptic Proxy when receiving haptic feedback for single-finger touch input. We demonstrate our system with two virtual scenes: a flight cockpit and a room quest game. While their scene geometries differ substantially, both use the same sparse haptic proxy to provide haptic feedback to the user during task completion.

> 我们提出了一类被动触觉，我们称之为稀疏的触觉代理：一组几何图元，模拟触摸反馈精心制作的虚拟现实场景。不同于以往的被动触觉，复制在物理空间的虚拟环境，稀疏的触觉代理重定向用户的手到一个匹配的代理原始模拟场景的几何细节。桥从代理的场景的分歧，我们增加一个现有的触觉重定向技术和对飞行目标的映射：我们预测用户的意图，在互动中在虚拟空间中通过分析他们的目光和手的运动，从而使他们一方面对代理匹配部分。我们进行了三个用户研究触觉重定向技术实现了一个系统由三个主要结果：1）最大角度发现学员的接受他们的手是40°重定向，平均等级4.6 5。2）跟踪参与者的视线能可靠地预测他们接触的意图（97.5%），甚至同时操纵用户的手眼协调重定向。3）参与者优先最小化重定向距离超过更好的配合面稀疏触觉代理接收时的触觉反馈单手指触摸输入。我们演示了我们的系统有两个虚拟场景：飞行座舱和房间探索游戏。虽然他们的场景几何差异很大，两者都使用相同的稀疏触觉代理提供触觉反馈给用户在任务完成。 article link

316. HapticHead: A Spherical Vibrotactile Grid around the Head for 3D Guidance in Virtual and Augmented Reality

SESSION:Haptic Feedback

Current virtual and augmented reality head-mounted displays usually include no or only a single vibration motor for haptic feedback and do not use it for guidance. We present HapticHead, a system utilizing multiple vibrotactile actuators distributed in three concentric ellipses around the head for intuitive haptic guidance through moving tactile cues. We conducted three experiments, which indicate that HapticHead vibrotactile feedback is both faster (2.6 s vs. 6.9 s) and more precise (96.4% vs. 54.2% success rate) than spatial audio (generic head-related transfer function) for finding visible virtual objects in 3D space around the user. The baseline of visual feedback is as expected more precise (99.7% success rate) and faster (1.3 s) in comparison, but there are many applications in which visual feedback is not desirable or available due to lighting conditions, visual overload, or visual impairments. Mean final precision with HapticHead feedback on invisible targets is 2.3° compared to 0.8° with visual feedback. We successfully navigated blindfolded users to real household items at different heights using HapticHead vibrotactile feedback independently of a head-mounted display.

> 目前的虚拟和增强现实的头戴显示器通常包括没有或只有一个单一的振动电机的触觉反馈，不使用它的指导。我们目前的haptichead，系统利用多个感觉器分布在三个同心椭圆绕头通过直观的触觉指导运动的触觉。我们进行了三个实验，表明haptichead振动触觉反馈是更快（2.6 vs. 6.9）和更精确的（96.4%与54.2%的成功率）比空间音频（通用头相关传输函数）发现在三维空间中的虚拟对象在用户可见的。相比之下，视觉反馈的基线更精确（99.7%的成功率）和更快（1.3秒），但有许多应用中，由于照明条件、视觉过载或视觉障碍，视觉反馈不可取或不可用。最终的平均精度haptichead反馈对隐形的目标是2.3°相比0.8°视觉反馈。我们成功地通过了被蒙住眼睛的用户房家居用品使用haptichead触觉反馈不同高度独立的头戴式显示器。 article link

317. Passive yet Expressive TouchTokens

SESSION:Haptic Feedback

TouchTokens are passive tokens that can be recognized on any capacitive surface based on the spatial configuration of the fingers that hold them. However, interaction with these tokens is confined to the basic two-state model of touch interaction as the system only knows the tokens' position and cannot detect tokens that are not touched. We increase the expressive power of TouchTokens by introducing laser-cut lattice hinges in their design, so as to make them flexible. A new recognizer, that analyzes the micro-movements of the fingers that hold the tokens, enables the system to detect when a token is left on the surface rather than taken off it. It can also detect bend events that can be mapped to command triggers, and a squeezed state that can be used for quasi-modal interaction.

> touchtokens被动标记，可以在任何电容表面基于持有它们的手指的空间配置的认可。然而，与这些令牌的交互仅限于基本的两态触摸交互模型，因为系统只知道令牌的位置，无法检测未被触摸的令牌。我们增加touchtokens表达能力在他们的设计中引入激光切割格铰链，使其灵活。一种新的识别器，它分析了持有令牌的手指的微小运动，使系统能够检测令牌何时留在表面而不是将其取下来。它还可以检测到可以映射到命令触发器的弯曲事件，以及可用于准模态交互的压缩状态。 article link

318. Enhancing Pen-based Interaction using Electrovibration and Vibration Haptic Feedback

SESSION:Haptic Feedback

This paper presents theEV2-Penwhich leverageselectrovibrationtechnology andvibrationtechnology in pen interaction. Electrovibration technology can produce multisensory feedback when the pen is in motion (sliding/moving on the screen), and vibration technology can provide vibrative feedback when the pen is stationary (pointing/resting on the screen). We conducted an experiment to investigate user performance with the EV2-Pen. The results indicated that the EV2-Pen outperformed the EV-Pen [18, 19] in pointing-steering tasks. Finally, we discuss the characteristics of the EV2-Pen, and explore some possible applications and scenarios.

> 本文介绍了笔式交互theev2钢笔leverageselectrovibrationtechnology andvibrationtechnology。电振动技术可生产多种反馈当笔在运动（滑动/移动屏幕上的），和振动技术可以提供振动反馈笔时是静止的（指向搁在屏幕）。我们进行了一项实验研究与Ev2笔用户性能。结果表明，Ev2笔比EV笔[18, 19]指出方向的任务。最后，我们讨论了Ev2笔的特点，并探讨了一些可能的应用场景。 article link

319. Stay Cool! Understanding Thermal Attacks on Mobile-based User Authentication

SESSION:Passwords and Authentication

PINs and patterns remain among the most widely used knowledge-based authentication schemes. As thermal cameras become ubiquitous and affordable, we foresee a new form of threat to user privacy on mobile devices. Thermal cameras allow performing thermal attacks, where heat traces, resulting from authentication, can be used to reconstruct passwords. In this work we investigate in details the viability of exploiting thermal imaging to infer PINs and patterns on mobile devices. We present a study (N=18) where we evaluated how properties of PINs and patterns influence their thermal attacks resistance. We found that thermal attacks are indeed viable on mobile devices; overlapping patterns significantly decrease successful thermal attack rate from 100% to 16.67%, while PINs remain vulnerable (>72% success rate) even with duplicate digits. We conclude by recommendations for users and designers of authentication schemes on how to resist thermal attacks.

> 引脚和模式仍然是最广泛使用的基于知识的认证方案。随着热相机变得无处不在和负担得起，我们预见到一种新形式的威胁，用户的隐私在移动设备上。热相机允许执行热攻击，热痕迹，从认证产生的，可以用来重建密码。在这项工作中，我们详细调查的可行性，利用热成像推断引脚和模式在移动设备上。我们提出了一个研究（N = 18），我们评估了引脚和图案的性能如何影响他们的抗热攻击性。我们发现热攻击在移动设备上确实是可行的；重叠模式显著地降低了100%到16.67%的成功热攻击率，而即使是重复的数字，引脚仍然是脆弱的（72%成功率）。最后，我们就如何抵抗热攻击的认证方案向用户和设计者提出建议。 article link

320. Thumprint: Socially-Inclusive Local Group Authentication Through Shared Secret Knocks

SESSION:Passwords and Authentication

Small, local groups who share protected resources (e.g., families, work teams, student organizations) have unmet authentication needs. For these groups, existing authentication strategies either create unnecessary social divisions (e.g., biometrics), do not identify individuals (e.g., shared passwords), do not equitably distribute security responsibility (e.g., individual passwords), or make it difficult to share or revoke access (e.g., physical keys). To explore an alternative, we designed Thumprint: inclusive group authentication with a shared secret knock. All group members share one secret knock, but individual expressions of the secret are discernible. We evaluated the usability and security of our concept through two user studies with 30 participants. Our results suggest that (1) individuals who enter the same shared thumprint are distinguishable from one another, (2) that people can enter thumprints consistently over time, and (3) that thumprints are resilient to casual adversaries.

> 共享受保护资源的小团体（例如家庭、工作队、学生组织）没有满足身份验证的需要。对于这些群体，现有的认证策略，造成不必要的社会分化（例如，生物），不确定的个人（例如，共享密码），不公平地分配安全责任（例如，个人密码），或使其难以分享或撤销访问（例如，物理按键）。探索替代方案，我们设计了thumprint：包容组认证与共享秘密敲。所有组成员共享一个秘密的敲门声，但秘密的个别表达是可辨别的。我们通过两个用户研究评估了我们的概念的可用性和安全性，共有30名参与者。我们的研究结果表明：（1）个人进入同一个共享thumprint区别于彼此，（2），人们可以进入thumprints始终随着时间的推移，和（3），thumprints适应休闲的对手。 article link

321. Design and Evaluation of a Data-Driven Password Meter

SESSION:Passwords and Authentication

Despite their ubiquity, many password meters provide inaccurate strength estimates. Furthermore, they do not explain to users what is wrong with their password or how to improve it. We describe the development and evaluation of a data-driven password meter that provides accurate strength measurement and actionable, detailed feedback to users. This meter combines neural networks and numerous carefully combined heuristics to score passwords and generate data-driven text feedback about the user's password. We describe the meter's iterative development and final design. We detail the security and usability impact of the meter's design dimensions, examined through a 4,509-participant online study. Under the more common password-composition policy we tested, we found that the data-driven meter with detailed feedback led users to create more secure, and no less memorable, passwords than a meter with only a bar as a strength indicator.

> 尽管它们无处不在，但许多密码表提供了不精确的强度估计。此外，他们没有向用户解释他们的密码有什么问题，或者如何改进它。我们描述了一个数据驱动的密码表的开发和评估，提供精确的强度测量和可操作的，详细的反馈给用户。该表结合了神经网络和许多精心组合的启发式方法来获取密码，并生成有关用户密码的数据驱动文本反馈。我们描述了仪表的迭代开发和最终设计。我们详细介绍了仪表设计尺寸的安全性和可用性影响，并通过4509名参与者在线研究进行了检查。在我们所测试的更为常用的密码组合策略下，我们发现带有详细反馈的数据驱动仪表能使用户创建比仅使用bar作为强度指示器的更安全、更令人难忘的密码。 article link

322. Can Unicorns Help Users Compare Crypto Key Fingerprints?

SESSION:Passwords and Authentication

Many authentication schemes ask users to manually compare compact representations of cryptographic keys, known as fingerprints. If the fingerprints do not match, that may signal a man-in-the-middle attack. An adversary performing an attack may use a fingerprint that is similar to the target fingerprint, but not an exact match, to try to fool inattentive users. Fingerprint representations should thus be both usable and secure. We tested the usability and security of eight fingerprint representations under different configurations. In a 661-participant between-subjects experiment, participants compared fingerprints under realistic conditions and were subjected to a simulated attack. The best configuration allowed attacks to succeed 6% of the time; the worst 72%. We find the seemingly effective compare-and-select approach performs poorly for key fingerprints and that graphical fingerprint representations, while intuitive and fast, vary in performance. We identify some fingerprint representations as particularly promising.

> 许多认证方案要求用户手动比较加密密钥的紧凑表示，称为指纹。如果指纹不匹配，那可能是中间人攻击的信号。执行攻击的对手可能会使用类似于目标指纹的指纹，而不是精确匹配，试图愚弄不注意的用户。因此，指纹表示应该既可用又安全。我们测试了八种指纹表示在不同配置下的可用性和安全性。在661人参与的受试者实验中，参与者比较真实情况下的指纹，并进行模拟攻击。最好的配置允许攻击成功6%的时间；最坏的72%。我们发现，看似有效的比较和选择方法对关键指纹表现不佳，而图形指纹表示则直观而快速，表现各异。我们确定一些指纹表示特别有前途。 article link

323. FDVT: Data Valuation Tool for Facebook Users

SESSION:Social Media Privacy

The OECD, the European Union and other public and private initiatives are claiming for the necessity of tools that create awareness among Internet users about the monetary value associated to the commercial exploitation of their online personal information. This paper presents the first tool addressing this challenge, the Facebook Data Valuation Tool

(FDVT). The FDVT provides Facebook users with a personalized and real-time estimation of the revenue they generate for Facebook. Relying on the FDVT, we are able to shed light into several relevant HCI research questions that require a data valuation tool in place. The obtained results reveal that (i) there exists a deep lack of awareness among Internet users regarding the monetary value of personal information, (ii) data valuation tools such as the FDVT are useful means to reduce such knowledge gap, (iii) 1/3 of the users testing the FDVT show a substantial engagement with the tool.

> 经合组织、欧洲联盟和其他公共和私人倡议声称有必要使用工具，使互联网用户认识到与其在线个人资料商业利用有关的货币价值。本文提出的第一个工具应对这一挑战，脸谱网数据的评估工具（fdvt）。的fdvt提供脸谱网用户提供个性化、实时利润脸谱网估计。依托fdvt，我们能够揭示成几个相关的人机交互研究的问题，需要一个数据的评估工具到位。结果表明，（我）存在互联网用户对个人信息的货币价值之间的严重缺乏认识，（ii）数据的评估工具，如fdvt是减少这样的知识差距的有效手段，（iii）1 / 3测试fdvt用户显示一个工具实质性参与。 article link

324. Characterizing Social Insider Attacks on Facebook

SESSION:Social Media Privacy

Facebook accounts are secured against unauthorized access through passwords and device-level security. Those defenses, however, may not be sufficient to prevent social insider attacks, where attackers know their victims, and gain access to a victim's account by interacting directly with their device. To characterize these attacks, we ran two MTurk studies. In the first (n = 1,308), using the list experiment method, we estimated that 24% of participants had perpetrated social insider attacks and that 21% had been victims (and knew about it). In the second study (n = 45), participants wrote stories detailing personal experiences with such attacks. Using thematic analysis, we typified attacks around five motivations (fun, curiosity, jealousy, animosity, and utility), and explored dimensions associated with each type. Our combined findings indicate that social insider attacks are common, often have serious emotional consequences, and have no simple mitigation.

> 脸谱网帐户通过密码和设备级安全来防止未经授权的访问。然而，这些防御可能不足以防止社会内部攻击，攻击者知道受害者，并通过与他们的设备直接交互获得受害者的帐户。表征这些攻击，我们跑了两MTurk研究。在第一（N = 1308），使用列表实验方法，我们估计有24%的参与者犯了社会内部攻击，21%的人是受害者（并且知道）。在第二项研究（N = 45）中，参与者写了一些故事，详细描述了这些攻击的个人经历。利用专题分析，我们以攻击五左右的动机（好玩，好奇，嫉妒，仇恨，和实用），并探讨各类型相关尺寸。我们的联合调查结果表明，社会内部的攻击是常见的，往往有严重的情感后果，并没有简单的缓解。 article link

325. Photo Privacy Conflicts in Social Media: A Large-scale Empirical Study

SESSION:Social Media Privacy

Items in social media such as photos may be co-owned by multiple users, i.e., the sharing decisions of the ones who upload them have the potential to harm the privacy of the others. Previous works uncovered coping strategies by co-owners to manage their privacy, but mainly focused on general practices and experiences. We establish an empirical base for the prevalence, context and severity of privacy conflicts over co-owned photos. To this aim, a parallel survey of pre-screened 496 uploaders and 537 co-owners collected occurrences and type of conflicts over co-owned photos, and any actions taken towards resolving them. We uncover nuances and complexities not known before, including co-ownership types, and divergences in the assessment of photo audiences. We also find that an all-or-nothing approach seems to dominate conflict resolution, even when parties actually interact and talk about the conflict. Finally, we derive key insights for designing systems to mitigate these divergences and facilitate consensus.

> 像照片这样的社会媒体中的项目可能由多个用户共同拥有，即上传者的共享决定有可能损害其他人的隐私。以前的作品揭露了共同业主处理隐私的应对策略，但主要集中在一般做法和经验上。我们建立了一个关于共有照片隐私冲突的普遍性、上下文和严重性的实证基础。为了这个目的，一个预调查筛选出的496和537并行上传共收集事件和类型的冲突，共同拥有的照片，和任何采取行动解决他们。我们发现以前不知道的细微差别和复杂性，包括共有类型，以及对照片观众评估的分歧。我们还发现，一个全或全无的办法似乎主宰冲突解决，即使当事方实际上相互交流并谈论冲突时。最后，我们得出了设计系统的关键见解，以减轻这些分歧，促进共识。 article link

326. Towards Understanding Differential Privacy: When Do People Trust Randomized Response Technique?

SESSION:Social Media Privacy

As a consequence of living in a data ecosystem, we often relinquish personal information to be used in contexts in which we have no control. In this paper, we begin to examine the usability of differential privacy, a mechanism that proposes to promise privacy with a mathematical "proof" to the data donor. Do people trust this promise and adjust their privacy decisions if the interfaces through which they interact make differential privacy less opaque? In a study with 228 participants, we measured comfort, understanding, and trust using a variant of differential privacy known as Randomized Response Technique (RRT). We found that allowing individuals to see the amount of obfuscation applied to their responses increased their trust in the privacy-protecting mechanism. However, participants who associated obfuscating privacy mechanisms with deception did not make the "safest" privacy decisions, even as they demonstrated an understanding of RRT. We demonstrate that prudent privacy-related decisions can be cultivated with simple explanations of usable privacy.

> 作为一个生活在数据生态系统中的结果，我们经常放弃个人信息，在我们无法控制的环境中使用。在本文中，我们开始研究差分隐私的可用性，一种机制，提出了承诺的数学证明“隐私”的数据捐赠者。人们是否相信这个承诺，并调整他们的隐私决定，如果他们通过互动的接口使差别隐私不那么不透明？在一项研究中228名参与者，我们测得的安慰，理解，并利用微分隐私被称为随机应答技术的一个变种信托（RRT）。我们发现，允许个人看到对他们的回答应用混淆的数量增加了他们对隐私保护机制的信任。然而，那些相关的混淆隐私机制与欺骗参与者并没有使“安全”的隐私的决定，即使他们表明RRT的理解。我们证明了谨慎的隐私相关决策可以通过对可用隐私的简单解释来培养。 article link

327. Was my message read?: Privacy and Signaling on Facebook Messenger

SESSION:Social Media Privacy

Major online messaging services such as Facebook Messenger and WhatsApp are starting to provide users with real-time information about when people read their messages, while useful, the feature has the potential to negatively impact privacy as well as cause concern over access to self. We report on two surveys using Mechanical Turk which looked at senders' (N=402} use of and reactions to the `message seen' feature, and recipients' (N=316) privacy and signaling behaviors in the face of such visibility. Our findings indicate that senders experience a range of emotions when their message is not read, or is read but not answered immediately. Recipients also engage in various signaling behaviors in the face of visibility by both replying or not replying immediately.

> 主要的在线信息服务，如脸谱网信使和WhatsApp开始向用户提供实时信息，当人们阅读他们的信息时，虽然有用，但这一功能有可能对隐私产生负面影响，也会引起人们对自我的关注。我们报告两项调查使用机械土耳其人查看发送者（N = 402 }使用和反应的'消息看到'的功能，和收件人（N = 316）的隐私和信令行为，面对这样的能见度。我们的研究结果表明，发送者在他们的信息不被阅读或被阅读而没有立即回答时经历了一系列的情绪。接收者在面对可见性时也会通过应答或不立即应答来参与各种信令行为。 article link

328. The Effects of Artificial Landmarks on Learning and Performance in Spatial-Memory Interfaces

SESSION:Technology & Spatial Landmarks

Spatial memory is a powerful way for users to become expert with an interface, because remembering item locations means that users do not have to carry out slow visual search. Spatial learning in the real world benefits greatly from landmarks in the environment, but user interfaces often provide very few visual landmarks. In this paper we explore the use ofartificiallandmarks as a way to improve people's spatial memory in spatially-stable grid menus called CommandMaps. We carried out three studies to test the effects of three types of artificial landmarks (standard grid, simple anchor marks, and a transparent image) on spatial learning. We found that for small grid menus, the artificial landmarks had little impact on performance, whereas for medium and large grids, the simple anchor marks significantly improved performance. The simple visual anchors were faster and less error-prone than the visually richer transparent image. Our studies show that artificial landmarks can be a valuable addition to spatial interfaces.

> 空间内存是用户成为接口专家的一种强大方式，因为记住项目位置意味着用户不必进行缓慢的视觉搜索。现实世界中的空间学习很大程度上得益于环境中的地标，但用户界面通常很少提供视觉地标。本文探讨采用ofartificiallandmarks作为一种提高空间稳定的网格菜单叫commandmaps人的空间记忆。我们进行了三项研究，以测试三种人工地标（标准网格、简单锚点标记和透明图像）对空间学习的影响。我们发现，对于小型网格菜单，人工地标对性能影响不大，而对于中型和大型网格，简单的锚点标记显著地提高了性能。简单的视觉锚比视觉丰富的透明图像更快，更容易出错。我们的研究表明，人工地标可以成为空间接口的一个有价值的补充。 article link

329. Studying Space Use: Bringing HCI Tools to Architectural Projects

SESSION:Technology & Spatial Landmarks

Understanding how people use different spaces in a building can inform design interventions aimed at improving the utility of that building, but can also inform the design of future buildings. We studied space use in an office building following a method we have designed to reveal the occupancy rate and navigational patterns. Our method involves two key components:1) a pervasive sensing system that is scalable for large buildings, and high number of occupants, and2) participatory data analysis engaging stakeholders including interior architects and building performance engineers, to refine the questions and define the needs for further analyses through multiple iterations.In this paper, we describe our method in detail, and exemplify how HCI methods and approaches can contribute to professional building design projects.

> 了解人们如何使用建筑物中不同的空间可以告知设计干预措施，以提高该建筑的实用性，但也可以告知未来建筑物的设计。我们研究了办公建筑中的空间使用，我们设计了一种方法来揭示占用率和导航模式。我们的方法包括两个关键组件：1）无处不在的传感系统，用于大型建筑物是可扩展的，高居住人数，2）参与数据分析与利益相关者包括室内建筑师和建筑性能工程师，提炼问题和定义作进一步分析，通过多次迭代的需求。在本文中，我们描述的方法的详细介绍，以及如何通过人机交互的方法和途径，有助于专业的建筑设计项目。 article link

330. Locating the Internet in the Parks of Havana

SESSION:Technology & Spatial Landmarks

Since March 2015, the public squares of Havana have been transformed from places where people stroll and children play to places where crowds gather to try to connect to the internet at all hours of the day and night. We present a field investigation of public WiFi hotspots in Havana, Cuba, and examine the possibilities of internet access these limited and expensive hotspots present to individuals, many of who are experiencing the internet for the first time. Drawing on fieldwork conducted in 2015-2016, we underscore the reconfigurations that have resulted from this access, as evolving internet users reconfigure their interactions with place, time, and individuals in their efforts to locate the internet. We also discuss the implications our findings have for the design of internet access interventions in Cuba and in other low-resource environments across the world, as well as the broader implications for social computing across diverse geographies.

> 自2015年3月以来，哈瓦那的公共广场已从地方散步的人们和孩子们玩的地方，人群聚集要在日以继夜的连接到互联网的转变。我们提出了一个在哈瓦那，古巴的公共WiFi热点，现场调查，并检查互联网的可能性访问这些有限的和昂贵的热点目前的个人，许多人正在经历第一次互联网。借鉴了2015-2016年实地考察，我们强调的是，导致这种访问配置，为不断发展的互联网用户配置他们的相互作用的地点，时间，和他们的努力找到Internet个人。我们还讨论了我们的研究结果对设计互联网接入干预在古巴和其他低资源环境在世界各地的影响，以及更广泛的影响，在不同地区的社会计算。 article link

331. TriTap: Identifying Finger Touches on Smartwatches

SESSION:Wearable Technology

The small screens of smartwatches provide limited space for input tasks. Finger identification is a promising technique to address this problem by associating different functions with different fingers. However, current technologies for finger identification are unavailable or unsuitable for smartwatches. To address this problem, this paper observes that normal smartwatch use takes places with a relatively static pose between the two hands. In this situation, we argue that the touch and angle profiles generated by different fingers on a standard smartwatch touch screen will differ sufficiently to support reliable identification. The viability of this idea is explored in two studies that capture touches in natural and exaggerated poses during tapping and swiping tasks. Machine learning models report accuracies of up to 93% and 98% respectively, figures that are sufficient for many common interaction tasks. Furthermore, the exaggerated poses show modest costs (in terms of time/errors) compared to the natural touches. We conclude by presenting examples and discussing how interaction designs using finger identification can be adapted to the smartwatch form factor.

> 智能手表的小屏幕上输入任务提供有限的空间。手指识别是一个很有前途的技术来解决这个问题，通过关联不同的功能与不同的手指。然而，对于指纹识别是目前技术对于smartwatches可用或不适合。为了解决这个问题，本文认为，正常的SmartWatch的使用需要的地方的两只手之间的相对静态的姿势。在这种情况下，我们认为触摸和角分布所产生的不同的手指在一个标准的SmartWatch的触摸屏将足以支持可靠的识别不同。这一思想的活力在两项研究中，捕捉自然和夸张的姿势摸出钢刷任务探讨。机器学习模型报告的精度分别高达93%和98%，这些数字足以满足许多共同的交互任务。此外，夸张的姿势与自然接触相比，表现出了适度的成本（时间/错误）。我们的结论提出的例子和讨论互动的设计采用指纹识别可适应的SmartWatch的形式因素。 article link

332. WatchSense: On- and Above-Skin Input Sensing through a Wearable Depth Sensor

SESSION:Wearable Technology

This paper contributes a novel sensing approach to support on- and above-skin finger input for interaction on the move. WatchSense uses a depth sensor embedded in a wearable device to expand the input space to neighboring areas of skin and the space above it. Our approach addresses challenging camera-based tracking conditions, such as oblique viewing angles and occlusions. It can accurately detect fingertips, their locations, and whether they are touching the skin or hovering above it. It extends previous work that supported either mid-air or multitouch input by simultaneously supporting both. We demonstrate feasibility with a compact, wearable prototype attached to a user's forearm (simulating an integrated depth sensor). Our prototype---which runs in real-time on consumer mobile devices---enables a 3D input space on the back of the hand. We evaluated the accuracy and robustness of the approach in a user study. We also show how WatchSense increases the expressiveness of input by interweaving mid-air and multitouch for several interactive applications.

> 本文提出了一种新的传感方法来支持上下皮肤手指输入的移动交互。watchsense采用深度传感器嵌入在可穿戴设备扩展输入空间到邻近地区的皮肤和空间上面。我们的方法涉及具有挑战性的基于摄像机的跟踪条件，如斜视角和遮挡。它能准确地检测指尖、它们的位置，以及它们是否触到皮肤或在上面盘旋。它扩展了以前的工作，支持空中或多点触控输入同时支持。我们演示了一个紧凑的，可穿戴的原型连接到用户的前臂（模拟集成深度传感器）的可行性。我们的原型——在消费者移动设备上实时运行——可以在手的背面实现3D输入空间。我们评估了该方法在用户研究中的准确性和鲁棒性。我们还展示了如何watchsense增加投入的表现，交织在空中，触摸了几个交互应用。 article link

333. Supporting Everyday Function in Chronic Pain Using Wearable Technology

SESSION:Wearable Technology

While most rehabilitation technologies target situated exercise sessions and associated performance metrics, physiotherapists recommend physical activities that are integrated with everyday functioning. We conducted a 1-2 week home study to explore how people with chronic pain use wearable technology that senses and sonifies movement (i.e., movement mapped to sound in real-time) to do functional activity (e.g., loading the dishwasher). Our results show that real-time movement sonification led to an increased sense of control during challenging everyday tasks. Sonification calibrated to functional activity facilitated application of pain management techniques such as pacing. When calibrated to individual needs, sonification enabled serendipitous discovery of physical capabilities otherwise obscured by a focus on pain or a dysfunctional proprioceptive system. A physiotherapist was invited to comment on the implications of our findings. We conclude by discussing opportunities provided by wearable sensing technology to enable better functioning, the ultimate goal of physical rehabilitation.

> 虽然大多数康复技术目标情境训练和相关的性能指标，物理治疗师推荐体力活动与日常功能集成。我们进行了1-2周家探讨慢性疼痛的人使用可穿戴技术，感官和sonifies运动（即运动映射到声音实时）做功能活动（例如，加载洗碗机）。我们的研究结果表明，实时运动发声导致增加意识的控制中具有挑战性的日常任务。可听化校准功能活动促进了疼痛管理技术如起搏中的应用。校准时的个性化需求，使体育能力的可听化疼痛或不正常的本体感觉系统的焦点否则遮蔽的意外发现。物理治疗师应邀评论我们的研究结果的影响。最后，我们将讨论穿戴式传感技术提供的机会，以使机能更好地发挥作用，这是物理康复的最终目标。 article link

334. SoPhy: A Wearable Technology for Lower Limb Assessment in Video Consultations of Physiotherapy

SESSION:Wearable Technology

Physiotherapists are increasingly using video conferencing tools for their teleconsultations. Yet, the assessment of subtle differences in body movements remains a challenge. To support lower limb assessment in video consultations, we presentSoPhy, a wearable technology consisting of a pair of socks with embedded sensors for patients to wear; and a web interface that displays information about range of weight distribution, foot movement, and foot orientation for physiotherapists in real-time. We conducted a laboratory study of 40 video consultations, in which postgraduate physiotherapy students assessed lower limb function. We compare assessment with and withoutSoPhy. Findings show thatSoPhyincreased the confidence in assessing squats exercise and fewer repetitions were required to assess patients when usingSoPhy. We discuss the significance ofSoPhyto address the challenges of assessing bodily information over video, and present considerations for its integration with clinical practices and tools.

> 物理治疗师越来越多地使用视频会议工具为teleconsultations。然而，对身体运动细微差别的评估仍然是一个挑战。支持视频磋商，下肢评估我们presentsophy，可穿戴技术由一对患者穿嵌入式传感器袜子；和一个Web界面，显示的重量分布、方位信息和脚的运动，物理治疗师在实时脚的方向。我们进行了40项视频咨询的实验研究，研究生的物理治疗学生评估下肢功能。我们比较评估和withoutsophy。结果显示thatsophyincreased评估信心蹲练习和重复次数少，需要评估患者时，usingsophy。我们讨论的意义ofsophyto地址评估身体信息在视频的挑战，并对其与临床实践结合目前考虑的工具。 article link

335. EagleSense: Tracking People and Devices in Interactive Spaces using Real-Time Top-View Depth-Sensing

SESSION:Camera-based Tracking

Real-time tracking of people's location, orientation and activities is increasingly important for designing novel ubiquitous computing applications. Top-view camera-based tracking avoids occlusion when tracking people while collaborating, but often requires complex tracking systems and advanced computer vision algorithms. To facilitate the prototyping of ubiquitous computing applications for interactive spaces, we developedEagleSense, a real-time human posture and activity recognition system with a single top-view depth-sensing camera. We contribute our novel algorithm and processing pipeline, including details for calculating silhouette-extremities features and applying gradient tree boosting classifiers for activity recognition optimized for top-view depth sensing.EagleSenseprovides easy access to the real-time tracking data and includes tools for facilitating the integration into custom applications. We report the results of a technical evaluation with 12 participants and demonstrate the capabilities ofEagleSensewith application case studies.

> 实时跟踪人们的位置、方向和活动对于设计新的普适计算应用越来越重要。基于摄像头的跟踪避免了在协作时跟踪人的遮挡，但往往需要复杂的跟踪系统和先进的计算机视觉算法。方便的互动空间，无处不在的计算应用的原型，我们developedeaglesense，实时人体姿态和行为识别系统与一个单一的视图深度感应相机。我们贡献我们的算法和处理管道，包括计算轮廓四肢的特点及应用梯度树提高活动识别顶部的视图的深度sensing.eaglesenseprovides易于访问的实时跟踪数据，包括便于集成到自定义应用程序工具的优化分类器的细节。我们报告的技术评估结果与12的参与者和展示能力ofeaglesensewith应用案例研究。 article link

336. Interactive Visual Calibration of Volumetric Head-Tracked 3D Displays

SESSION:Camera-based Tracking

Head-tracked 3D displays can provide a compelling 3D effect, but even small inaccuracies in the calibration of the participant's viewpoint to the display can disrupt the 3D illusion. We propose a novel interactive procedure for a participant to easily and accurately calibrate a head-tracked display by visually aligning patterns across a multi-screen display. Head-tracker measurements are then calibrated to these known viewpoints. We conducted a user study to evaluate the effectiveness of different visual patterns and different display shapes. We found that the easiest to align shape was the spherical display and the best calibration pattern was the combination of circles and lines. We performed a quantitative camera-based calibration of a cubic display and found visual calibration outperformed manual tuning and generated viewpoint calibrations accurate to within a degree. Our work removes the usual, burdensome step of manual calibration when using head-tracked displays and paves the way for wider adoption of this inexpensive and effective 3D display technology.

> 头部跟踪3D显示器可以提供令人信服的3D效果，但即使是在参与者的观点到显示器的校准小的不准确也可以扰乱三维错觉。我们提出了一种新的交互程序，让参与者通过屏幕显示的视觉对齐方式，轻松、准确地校准头部显示器。头跟踪器测量然后校准这些已知的观点。我们进行了一项用户研究，以评估不同视觉模式和不同显示形状的效果。我们发现，最容易对齐的形状是球形显示器，最好的校准模式是圆和线的组合。我们进行了一个定量的基于摄像机的立方体显示器的校准，发现视觉校准优于手动调整，生成的视点校准精确到一定程度。我们的工作在使用头戴式显示器时消除了通常繁琐的手工校准步骤，为更广泛地采用这种廉价而有效的三维显示技术铺平了道路。 article link

337. Changing the Appearance of Real-World Objects By Modifying Their Surroundings

SESSION:Camera-based Tracking

We present an approach to alter the perceived appearance of physical objects by controlling their surrounding space. Many real-world objects cannot easily be equipped with displays or actuators in order to change their shape. While common approaches such as projection mapping enable changing the appearance of objects without modifying them, certain surface properties (e.g. highly reflective or transparent surfaces) can make employing these techniques difficult. In this work, we present a conceptual design exploration on how the appearance of an object can be changed by solely altering the space around it, rather than the object itself. In a proof-of-concept implementation, we place objects onto a tabletop display and track them together with users to display perspective-corrected 3D graphics for augmentation. This enables controlling properties such as the perceived size, color, or shape of objects. We characterize the design space of our approach and demonstrate potential applications. For example, we change the contour of a wallet to notify users when their bank account is debited. We envision our approach to gain in importance with increasing ubiquity of display surfaces.

> 我们提出了一种通过控制周围空间来改变物理物体外观的方法。许多现实世界的物体不能轻易地装上显示器或执行器来改变形状。虽然常用的方法如投影映射可以改变对象的外观而不修改它们，但某些表面特性（例如高反射或透明的表面）可以使这些技术难以使用。在这项工作中，我们提出了一个概念设计探索如何通过改变对象周围的空间，而不是物体本身的外观可以改变的对象。在一个概念验证实现中，我们将对象放在桌面显示器上，并与用户一起跟踪它们，以显示透视校正的3D图形用于增强。这允许控制对象的大小、颜色或形状等属性。我们描述了我们的方法的设计空间，并展示了潜在的应用。例如，我们改变一个钱包的轮廓来通知用户，当他们的银行账户中扣除。我们设想随着越来越多的显示表面的普及，我们的方法变得越来越重要。 article link

338. HeadPhones: Ad Hoc Mobile Multi-Display Environments through Head Tracking

SESSION:Camera-based Tracking

We present HeadPhones (Headtracking + smartPhones), a novel approach for the spatial registration of multiple mobile devices into an ad hoc multi-display environment. We propose to employ the user's head as external reference frame for the registration of multiple mobile devices into a common coordinate system. Our approach allows for dynamic repositioning of devices during runtime without the need for external infrastructure such as separate cameras or fiducials. Specifically, our only requirements are local network connections and mobile devices with built-in front facing cameras. This way, HeadPhones enables spatially-aware multi-display applications in mobile contexts. A user study and accuracy evaluation indicate the feasibility of our approach.

> 我们目前的耳机（头部跟踪+智能手机），一种新的方法，为多个移动设备的空间配准到Ad Hoc多显示器环境。我们建议使用用户的头部作为外部参考帧的多个移动设备注册到一个共同的坐标系统。我们的方法允许在运行时动态定位装置无需外部基础设施如单独的相机或基准点的需要。具体来说，我们唯一的要求是本地网络连接和内置前置摄像头的移动设备。通过这种方式，耳机可以在移动环境中实现空间感知的多显示应用。用户研究和精度评估表明我们的方法的可行性。 article link

339. Zensei: Embedded, Multi-electrode Bioimpedance Sensing for Implicit, Ubiquitous User Recognition

SESSION:Ubiquitous Sensing

Interactions and connectivity is increasingly expanding to shared objects and environments, such as furniture, vehicles, lighting, and entertainment systems. For transparent personalization in such contexts, we see an opportunity for embedded recognition, to complement traditional, explicit authentication. We introduce Zensei, an implicit sensing system that leverages bio-sensing, signal processing and machine learning to classify uninstrumented users by their body's electrical properties. Zensei could allow many objects to recognize users. E.g., phones that unlock when held, cars that automatically adjust mirrors and seats, or power tools that restore user settings. We introduce wide-spectrum bioimpedance hardware that measures both amplitude and phase. It extends previous approaches through multi-electrode sensing and high-speed wireless data collection for embedded devices. We implement the sensing in devices and furniture, where unique electrode configurations generate characteristic profiles based on user's unique electrical properties. Finally, we discuss results from a comprehensive longitudinal 22-day data collection experiment with 46 subjects. Our analysis shows promising classification accuracy and low false acceptance rate.

> 交互和连通性越来越多地扩展到共享对象和环境，如家具、车辆、照明和娱乐系统。在这样的上下文中，为了透明的个性化，我们看到了一个嵌入式识别的机会，以补充传统的、显式的身份验证。我们介绍zensei，隐式传感系统，利用生物传感、信号处理和机器学习分类摆锤的使用者身体的电性能。zensei可以让很多物体识别用户。例如，打开时解锁的手机，自动调整镜子和座椅的汽车，或者恢复用户设置的电动工具。我们介绍了广谱生物阻抗的幅值和相位的硬件措施。它扩展了以前的方法通过多电极传感和高速无线数据采集的嵌入式设备。我们实现传感设备和家具，其中独特的电极配置产生的特征曲线，根据用户的独特的电气性能。最后，我们讨论了一个46天的综合纵向22天数据收集实验的结果。我们的分析表明有很好的分类准确率和低误接受率。 article link

340. Synthetic Sensors: Towards General-Purpose Sensing

SESSION:Ubiquitous Sensing

The promise of smart environments and the Internet of Things (IoT) relies on robust sensing of diverse environmental facets. Traditional approaches rely on direct and distributed sensing, most often by measuring one particular aspect of an environment with a special purpose sensor. This approach can be costly to deploy, hard to maintain, and aesthetically

and socially obtrusive. In this work, we explore the notion ofgeneral purpose sensing, wherein a single enhanced sensor can indirectly monitor a large context, without direct instrumentation of objects. Further, through what we callSynthetic Sensors, we can virtualize raw sensor data into actionable feeds, whilst simultaneously mitigating immediate privacy issues. A series of structured, formative studies informed the development of our new sensor hardware and accompanying information architecture. We deployed our system across many months and environments, the results of which show the versatility, accuracy and potential utility of our approach.

> 智能环境和物联网的承诺依赖于对不同环境方面的鲁棒感知。传统的方法依赖于直接和分布式传感，通常是通过使用特殊用途传感器测量环境的某个特定方面。这种方法可以是昂贵的部署，努力维护和美学和社会突兀。在这项工作中，我们探索的概念，通用传感器，其中一个增强的传感器可以间接监测大背景下，没有对目标的直接测量。此外，通过我们callsynthetic传感器，我们可以加入传感器原始数据转化为可操作的饲料，同时减轻直接的隐私问题。一系列结构化、形成性的研究揭示了我们新的传感器硬件和伴随的信息体系结构的发展。我们在多个月和环境中部署了我们的系统，结果显示了我们的方法的通用性、准确性和潜在的实用性。 article link

341. Deus EM Machina: On-Touch Contextual Functionality for Smart IoT Appliances

SESSION:Ubiquitous Sensing

Homes, offices and many other environments will be increasingly saturated with connected, computational appliances, forming the "Internet of Things" (IoT). At present, most of these devices rely on mechanical inputs, webpages, or smartphone apps for control. However, as IoT devices proliferate, these existing interaction methods will become increasingly cumbersome. Will future smart-home owners have to scroll though pages of apps to select and dim their lights? We propose an approach where users simply tap a smartphone to an appliance to discover and rapidly utilize contextual functionality. To achieve this, our prototype smartphone recognizes physical contact with uninstrumented appliances, and summons appliance-specific interfaces. Our user study suggests high accuracy 98.8% recognition accuracy among 17 appliances. Finally, to underscore the immediate feasibility and utility of our system, we built twelve example applications, including six fully functional end-to-end demonstrations.

> 家庭、办公室和许多其他环境将越来越多地被连接的计算设备饱和，形成“物联网”（物联网）。目前，大多数这些设备依靠机械输入、网页或智能手机应用程序进行控制。然而，随着物联网设备的激增，这些现有的交互方法将变得越来越繁琐。未来的智能家居业主必须滚动的应用程序页面，选择和昏暗的灯光？我们提出了一种方法，用户可以简单地将智能手机接入到设备上，以发现并快速利用上下文功能。要做到这一点，我们的智能手机原型识别与非器械器具的身体接触，并召唤特定设备接口。我们的用户研究表明，17种设备的识别准确率高达98.8%。最后，为了强调我们系统的即时可行性和实用性，我们构建了十二个示例应用程序，包括六个完全功能的端到端演示。 article link

342. Seeing, Sensing and Recognizing Laban Movement Qualities

SESSION:Ubiquitous Sensing

Human movement has historically been approached as a functional component of interaction within human computer interaction. Yet movement is not only functional, it is also highly expressive. In our research, we explore how movement expertise as articulated in Laban Movement Analysis (LMA) can contribute to the design of computational models of movement's expressive qualities as defined in the framework of Laban Efforts. We include experts in LMA in our design process, in order to select a set of suitable multimodal sensors as well as to compute features that closely correlate to the definitions of Efforts in LMA. Evaluation of our model shows that multimodal data combining positional, dynamic and physiological information allows for a better characterization of Laban Efforts. We conclude with implications for design that illustrate how our methodology and our approach to multimodal capture and recognition of Effort qualities can be integrated to design interactive applications.

> 人类运动在历史上被认为是人机交互中的一个功能部件。然而，运动不仅是功能性的，而且具有高度的表现力。在我们的研究中，我们探讨了运动技能拉邦动作分析铰接（LMA）有助于运动的表现特征计算模型的设计在拉班努力下定义。我们包括在罩在我们的设计过程的专家，为了选择一套合适的多模态传感器以及计算密切相关的努力在LMA的定义特征。我们的模型的评估表明，多式联运数据结合位置，动态和生理信息，可以更好地刻画拉班的努力。我们的结论与设计的影响，说明我们的方法和我们的方法，多模式捕获和识别的努力质量可以被集成到设计交互式应用程序。 article link

343. ShareVR: Enabling Co-Located Experiences for Virtual Reality between HMD and Non-HMD Users

SESSION:Experiences with Virtual Reality

Virtual reality (VR) head-mounted displays (HMD) allow for a highly immersive experience and are currently becoming part of the living room entertainment. Current VR systems focus mainly on increasing the immersion and enjoyment for the user wearing the HMD (HMD user), resulting in all the bystanders (Non-HMD users) being excluded from the experience. We propose ShareVR, a proof-of-concept prototype using floor projection and mobile displays in combination with positional tracking to visualize the virtual world for the Non-HMD user, enabling them to interact with the HMD user and become part of the VR experience. We designed and implemented ShareVR based on the insights of an initial online survey (n=48) with early adopters of VR HMDs. We ran a user study (n=16) comparing ShareVRto a baseline condition showing how the interaction using ShareVR led to an increase of enjoyment, presence and social interaction. In a last step we implemented several experiences for ShareVR, exploring its design space and giving insights for designers of co-located asymmetric VR experiences.

> 虚拟现实（VR）的头戴式显示器（HMD）允许一个高度身临其境的体验，并正在成为客厅娱乐的一部分。目前虚拟现实系统主要集中在增加着头盔用户沉浸和享受（HMD的用户），导致所有的旁观者（非HMD用户）被排除的经验。我们提出了ShareVR，在可视化的虚拟世界非HMD用户位置跟踪组合使用地面投影和移动显示一个概念验证原型，使他们能够与HMD用户交互和成为虚拟现实体验的一部分。我们设计和实现了ShareVR基于初始网络调查（N = 48）的见解与VR HMD尝鲜。我们跑了一个用户研究（n = 16）相比sharevrto基线条件显示如何使用sharevr导致享受增加的相互作用，存在与社会的互动。在最后一步中我们实施了一些经验的ShareVR，探索设计空间为共同位于非对称虚拟现实的经验的设计师的见解。 article link

344. CarVR: Enabling In-Car Virtual Reality Entertainment

SESSION:Experiences with Virtual Reality

Mobile virtual reality (VR) head-mounted displays (HMDs) allow users to experience highly immersive entertainment whilst being in a mobile scenario. Long commute times make casual gaming in public transports and cars a common occupation. However, VR HMDs can currently not be used in moving vehicles since the car's rotation affects the HMD's sensors and simulator sickness occurs when the visual and vestibular system are stimulated with incongruent information. We present CarVR, a solution to enable VR in moving vehicles by subtracting the car's rotation and mapping vehicular movements with the visual information. This allows the user to actually feel correct kinesthetic forces during the VR experience. In a user study (n = 21), we compared CarVR inside a moving vehicle with the baseline of using VR without vehicle movements. We show that the perceived kinesthetic forces caused by CarVR increase enjoyment and immersion significantly while simulator sickness is reduced compared to a stationary VR experience. Finally, we

explore the design space of in-car VR entertainment applications using real kinesthetic forces and derive design considerations for practitioners.

> 移动虚拟现实（VR）的头戴式显示器（HMD）允许用户体验高度身临其境的娱乐虽然在移动的情况下。漫长的通勤时间使公共交通工具和汽车的休闲游戏成为共同的职业。然而，VR HMDs目前不用于移动车辆自车的旋转影响HMD的传感器和模拟疾病发生时，视觉和前庭系统不一致的信息刺激。我们目前的carvr，解决使VR在行驶的车辆上减去汽车的旋转和映射与视觉信息的车辆的运动。这让用户真正感受到正确的运动力在VR的经验。在用户研究（n = 21），与我们相比carvr无车辆的运动，采用VR基线移动车辆内。我们表明，感知运动的力量造成的carvr增加享受和沉浸在模拟疾病明显比静止的VR体验减少。最后，我们探索设计空间的汽车虚拟娱乐应用，使用真正的运动力和得到医生的设计考虑。 article link

345. Effects of Sharing Physiological States of Players in a Collaborative Virtual Reality Gameplay

SESSION:Experiences with Virtual Reality

Interfaces for collaborative tasks, such as multiplayer games can enable more effective and enjoyable collaboration. However, in these systems, the emotional states of the users are often not communicated properly due to their remoteness from one another. In this paper, we investigate the effects of showing emotional states of one collaborator to the other during an immersive Virtual Reality (VR) gameplay experience. We created two collaborative immersive VR games that display the real-time heart-rate of one player to the other. The two different games elicited different emotions, one joyous and the other scary. We tested the effects of visualizing heart-rate feedback in comparison with conditions where such a feedback was absent. The games had significant main effects on the overall emotional experience.

> 协作任务的接口，如多人游戏，可以使协作更有效、更愉快。然而，在这些系统中，由于彼此距离太远，用户的情感状态常常没有得到适当的沟通。在本文中，我们研究了在沉浸式虚拟现实（VR）游戏体验中，显示一个合作者的情绪状态对另一个合作伙伴的影响。我们创建了两个协作式沉浸式VR游戏，将一个玩家的实时心率显示给另一个玩家。这两种不同的游戏引起了不同的情绪，一种是快乐的，另一种是可怕的。我们测试了心率反馈的可视化效果，并与没有反馈的情况进行了比较。奥运会对整体情绪体验有着重要的影响。 article link

346. VRRRRoom: Virtual Reality for Radiologists in the Reading Room

SESSION:Experiences with Virtual Reality

Reading room conditions such as illumination, ambient light, human factors and display luminance, play an important role on how radiologists analyze and interpret images. Indeed, serious diagnostic errors can appear when observing images through everyday monitors. Typically, these occur whenever professionals are ill-positioned with respect to the display or visualize images under improper light and luminance conditions. In this work, we show that virtual reality can assist radiodiagnostics by considerably diminishing or cancel out the effects of unsuitable ambient conditions. Our approach combines immersive head-mounted displays with interactive surfaces to support professional radiologists in analyzing medical images and formulating diagnostics. We evaluated our prototype with two senior medical doctors and four seasoned radiology fellows. Results indicate that our approach constitutes a viable, flexible, portable and cost-efficient option to traditional radiology reading rooms.

> 阅览室条件，如照明，环境光，人的因素和显示亮度，对放射科医生如何分析和解释图像起着重要的作用。事实上，通过日常监视器观察图像时会出现严重的诊断错误。通常情况下，当专业人员在显示屏上显示出不恰当的位置时，就会出现这种情况。在这项工作中，我们发现，虚拟现实技术可以大大减少或取消不适宜的环境条件影响的协助。我们的方法结合了身临其境的头戴式显示器与互动的表面，以支持专业放射科医生在分析医学图像和制定诊断。我们评估了我们的原型与两个高级医生和四个经验丰富的放射研究员。结果表明，我们的方法是一个可行的，灵活的，可移植的和成本效益的选择，传统的放射学阅览室。 article link

347. Handsfree Omnidirectional VR Navigation using Head Tilt

SESSION:Experiences with Virtual Reality

Navigating mobile virtual reality (VR) is a challenge due to limited input options and/or a requirement for handsfree interaction. Walking-in-place (WIP) is considered to offer a higher presence than controller input but only allows unidirectional navigation in the direction of the user's gaze--which impedes navigation efficiency. Leaning input enables omnidirectional navigation but currently relies on bulky controllers, which aren't feasible in mobile VR contexts. This note evaluates the use of head-tilt - implemented using inertial sensing - to allow for handsfree omnidirectional VR navigation on mobile VR platforms. A user study with 24 subjects compared three input methods using an obstacle avoidance navigation task: (1) head-tilt alone (TILT) (2) a hybrid method (WIP-TILT) that uses head tilting for direction and WIP to control speed; and (3) traditional controller input. TILT was significantly faster than WIP-TILT and joystick input, while WIP-TILT and TILT offered the highest presence. There was no difference in cybersickness between input methods.

> 在虚拟现实（VR）的移动是由于有限的输入选项和/或一个免提互动需求的挑战。步行到位（WIP）被认为是提供比控制器输入更高的存在，但只允许单向导航在用户的视线方向-这妨碍了导航效率。倾斜输入使全方位导航，但目前依赖于笨重的控制器，这在移动虚拟现实环境中是不可行的。本文对头部倾斜的使用惯性传感-允许免提全向VR导航在移动开发平台实现。24名用户研究比较三种输入法使用避障导航任务：（1）头部倾斜（倾斜）（2）混合法（wip-tilt）使用头倾斜方向和在制品的控制速度；和（3）传统控制器的输入。倾斜的比wip-tilt和操纵杆输入的速度明显加快，而wip-tilt和倾斜提供了最高的存在。在输入法之间cybersickness没有差异。 article link

348. Rice Today, Roti Tomorrow: Diets and Diabetes in Urban Indian Households

SESSION:Food & Nutrition

In India, where diabetes is a growing concern and approximately 69 million are affected, we investigate the factors that influence diet management, a critical component of living with the disease. Taking the middle-income diabetes-affected household as our unit of analysis, we use a combination of semi-structured interviews and a design probe to understand if and how diets are monitored, tailored, and balanced. We research the various information-seeking behaviors of our participants and their culturally situated approaches to food and eating. Our findings illuminate how contextual nuances shape individuals' beliefs around dealing with diabetes and the ways in which family, friends, and broader social networks influence dietary decisions. We conclude by offering a framework ofLearning-Being-Doingto inform the holistic design of technologies for managing diets and diabetes.

> 在印度，糖尿病越来越受到关注，大约6900万受影响，我们研究影响饮食管理的因素，这是与疾病共存的重要组成部分。以中等收入糖尿病影响的家庭为分析单位，我们采用半结构式访谈和设计调查相结合的方法来了解饮食的监控方式、饮食方式和饮食均衡。我们研究了参与者的各种信息寻求行为和他们在食物和饮食上的文化定位方法。我们的发现阐明了上下文细微差别是如何塑造个人对糖尿病的信念以及家庭、朋友和更广泛的社会网络影响饮食决策的方式。我们的结论提供了一个框架来学习被通知技术的整体设计管理饮食与糖尿病。 article link

349. Monster Appetite: Effects of Subversive Framing on Nutritional Choices in a Digital Game Environment

SESSION:Food & Nutrition

Americans' health has reached a dangerous obesity epidemic from overconsumption and unhealthy food choices. In response, persuasive games for health encourage healthier lifestyles typically by providing positive reinforcement for the desired behaviors. However, positive reinforcement is only one of the many possibly effective approaches. We explore two types of message framing in a nutrition game, Monster Appetite (MA). In MA, players' choices of high or low calorie snacks impact visual appearance of their monster avatar. MA utilizes two types of health messages: subversive, which encourages players to make unhealthy choices and focuses on costs, and inoculation, which encourages players to eventually defend healthy choices and focuses on benefits. We test message framing's effect by tracking users' purchasing behavior in our online snack shop, Snackazon. The study showed that when positive messages were embedded in MA mixed with negative visuals through the monster avatars, participants exhibited better snack choices post-gameplay.

> 美国人的健康已从过度消费和不健康的食物选择一个危险的肥胖流行。作为回应，有说服力的健康游戏鼓励健康的生活方式，通常是对所希望的行为给予积极的强化。然而，积极强化只是许多可能有效的方法之一。我们探索营养游戏中的两种信息框架：怪物胃口（MA）。在MA中，玩家选择高热量或低热量的零食会影响怪物化身的视觉效果。马利用了两种健康信息：颠覆性的，鼓励玩家做出不健康的选择，关注成本和接种，鼓励玩家最终捍卫健康的选择，关注利益。我们的测试信息框架的影响通过跟踪用户的购买行为在我们的网上快餐店，Snackazon。这项研究表明，当正面信息被嵌入在带有怪物化身的负面视觉效果的MA中时，参与者在游戏后会表现出更好的零食选择。 article link

350. The Role of Explanations in Casual Observational Learning about Nutrition

SESSION:Food & Nutrition

The ubiquity of internet-based nutrition information sharing indicates an opportunity to use social computing platforms to promote nutrition literacy and healthy nutritional choices. We conducted a series of experiments with unpaid volunteers using an online Nutrition Knowledge Test. The test asked participants to examine pairs of photographed meals and identify meals higher in a specific macronutrient (e.g., carbohydrate). After each answer, participants received no feedback on the accuracy of their answers, viewed proportions of peers choosing each response, received correctness feedback from an expert dietitian with or without expert-generated explanations, or received correctness feedback with crowd-generated explanations. The results showed that neither viewing peer responses nor correctness feedback alone improved learning. However, correctness feedback with explanations (i.e., modeling) led to significant learning gains, with no significant difference between explanations generated by experts or peers. This suggests the importance of explanations in social computing-based casual learning about nutrition and the potential for scaling this approach via crowdsourcing.

> 以互联网为基础的营养信息共享无处不在，表明利用社会计算平台促进营养知识和健康营养选择的机会。我们使用在线营养知识测试对无偿志愿者进行了一系列的实验。测试要求参与者进行拍照餐对和确定在一个特定的元素（例如，高膳食碳水化合物）。之后的每一个答案，参与者没有收到反馈对他们的答案的准确性，看比例的同行选择每个响应，收到正确的反馈从一个营养师或专家没有专家产生的解释，或收到正确的反馈与人群产生的解释。结果表明，既不看同行的反应，也不正确的反馈单独改善学习。然而，正确的反馈与解释（即建模）导致了显著的学习收益，在专家或同行之间的解释之间没有显著差异。这表明在基于社会计算的营养学基础上进行解释的重要性，以及通过大众化扩展这种方法的潜力。 article link

351. Audible Beacons and Wearables in Schools: Helping Young Visually Impaired Children Play and Move Independently

SESSION:Impaired Vision and Navigation

Young children with visual impairments tend to engage less with their surroundings, limiting the benefits from activities at school. We investigated novel ways of using sound from a bracelet, such as speech or familiar noises, to tell children about nearby people, places and activities, to encourage them to engage more during play and help them move independently. We present a series of studies, the first two involving visual impairment educators, that give insight into challenges faced by visually impaired children at school and how sound might help them. We then present a focus group with visually impaired children that gives further insight into the effective use of sound. Our findings reveal novel ways of combining sounds from wearables with sounds from the environment, motivating audible beacons, devices for audio output and proximity estimation. We present scenarios, findings and a design space that show the novel ways such devices could be used alongside wearables to help visually impaired children at school.

> 视障儿童往往较少接触周围环境，限制学校活动带来的好处。我们研究了从手镯中使用声音的新方法，例如讲话或熟悉的噪音，告诉孩子附近的人、地方和活动，鼓励他们在玩耍中多参与，帮助他们独立移动。我们提出了一系列的研究，前两个涉及视障教育工作者，深入了解视障儿童在学校面临的挑战，以及声音如何可能帮助他们。然后，我们提出一个重点小组与视障儿童，进一步了解有效地使用声音。我们的研究结果揭示将声音从身打扮与声音从环境的新方法，激励声信标，用于音频输出和接近估计装置。我们目前的情况下，研究和设计空间，这样的设备可以一起使用可穿戴设备在学校帮助视障儿童的新方法。 article link

352. Embracing Errors: Examining How Context of Use Impacts Blind Individuals' Acceptance of Navigation Aid Errors

SESSION:Impaired Vision and Navigation

Prevention of errors has been an orienting goal within the field of Human-Computer Interaction since its inception, with particular focus on minimizinghumanerrors through appropriate technology design. However, there has been relatively little exploration into how designers can best support users oftechnologiesthat will inevitably make errors. We present a mixed-methods study in the domain of navigation technology for visually impaired individuals. We examined how users respond to device errors made in realistic scenarios of use. Contrary to conventional wisdom that usable systems must be error-free, we found that 42% of errors were acceptable to users. Acceptance of errors depends on error type, building feature, and environmental context. Further, even when a technical error is acceptable to the user, the misguided social responses of others nearby can negatively impact user experience. We conclude with design recommendations that embrace errors while also supporting user management of errors in technical systems.

> 预防错误一直是一个目标定向在人机交互领域的自成立以来，通过适当的工艺设计对minimizinghumanerrors特别关注。然而，很少有探讨设计师如何能够最好地支持用户oftechnologiesthat难免会犯错误。我们在视障人士的导航技术领域提出了一种混合方法研究。我们研究了用户如何在实际使用场景中对设备错误作出响应。与传统的观点相反，可用的系统必须是无错误的，我们发现42%的错误是可以接受的用户。错误的接受取决于错误类型、构建特征和环境上下文。此外，即使用户可以接受技术错误，附近的其他人的错误的社会反应也会对用户体验产生负面影响。我们的结论是，设计建议包含错误，同时也支持用户对技术系统中错误的管理。 article link

353. Understanding Low Vision People's Visual Perception on Commercial Augmented Reality Glasses

SESSION:Impaired Vision and Navigation

People with low vision have a visual impairment that affects their ability to perform daily activities. Unlike blind people, low vision people have functional vision and can potentially benefit from smart glasses that provide dynamic, always-available visual information. We sought to determine what low vision people could see on mainstream commercial augmented reality (AR) glasses, despite their visual limitations and the device's constraints. We conducted a study with 20 low vision participants and 18 sighted controls, asking them to identify virtual shapes and text in different sizes, colors, and thicknesses. We also evaluated their ability to see the virtual elements while walking. We found that low vision participants were able to identify basic shapes and read short phrases on the glasses while sitting and walking. Identifying virtual elements had a similar effect on low vision and sighted people's walking speed, slowing it down slightly. Our study yielded preliminary evidence that mainstream AR glasses can be powerful accessibility tools. We derive guidelines for presenting visual output for low vision people and discuss opportunities for accessibility applications on this platform.

> 视力低下的人有视力障碍，影响他们进行日常活动的能力。与盲人不同的是，低视力的人具有功能性视力，并能从提供动态的、随时可用的视觉信息的智能眼镜中获益。我们试图确定人们在主流商业增强现实（AR）眼镜上能看到什么低视力，尽管他们的视觉限制和设备的限制。我们对20名低视力参与者和18名视力控制者进行了一项研究，要求他们识别不同尺寸、颜色和厚度的虚拟形状和文字。我们还评估了他们在行走时看到虚拟元素的能力。我们发现低视力的参与者在坐着和走路时能够识别眼镜的基本形状和阅读短句。识别虚拟元素对低视力和视力正常人的行走速度也有相似的影响，减慢速度。我们的研究得出初步证据，主流AR眼镜可以是强大的辅助工具。我们推导了低视力人群视觉输出的指导原则，并讨论了在这个平台上的可访问性应用程序的机会。 article link

354. Synthesizing Stroke Gestures Across User Populations: A Case for Users with Visual Impairments

SESSION:Impaired Vision and Navigation

We introduce a new principled method grounded in the Kinematic Theory of Rapid Human Movements to automatically generate synthetic stroke gesturesacross user populationsin order to support ability-based design of gesture user interfaces. Our method is especially useful when the target user population is difficult to sample adequately and, consequently, when there is not enough data to train gesture recognizers to deliver high levels of accuracy. To showcase the relevance and usefulness of our method, we collected gestures from peoplewithoutvisual impairments and successfully synthesized gestures with the articulation characteristics of peoplewithvisual impairments. We also show that gesture recognition accuracy improves significantly when using our synthetic gesture samples for training. Our contributions will benefit researchers and practitioners that wish to design gesture user interfaces for people with various abilities by helping them prototype, evaluate, and predict gesture recognition performance without having to expressly recruit and involve people with disabilities in long, time-consuming gesture collection experiments.

> 我们引入一个新的原则性的方法以快速的动作来自动生成综合卒中gesturesacross用户人口以支持基于手势的用户界面设计能力的运动理论。我们的方法是特别有用当目标用户群体是很难充分品尝，因此，当没有足够的数据来训练手势识别提供高水平的精度。展示我们的方法的相关性和有用性，我们从peoplewithoutvisual障碍成功地合成了收集的手势和手势与peoplewithvisual障碍的发音特点。我们还表明，当我们使用合成手势样本进行训练时，手势识别的准确率显著提高。我们的贡献将有利于研究人员和从业者，希望设计与各种能力的人的手势的用户界面，帮助他们的原型，评估和预测的手势识别性能，而无需明确招聘和涉及残疾人长人，耗时的手势采集实验。 article link

355. Investigating Tilt-based Gesture Keyboard Entry for Single-Handed Text Entry on Large Devices

SESSION:Innovative Text Entry Systems

The popularity of mobile devices with large screens is making single-handed interaction difficult. We propose and evaluate a novel design point around a tilt-based text entry technique which supports single handed usage. Our technique is based on the gesture keyboard (shape writing). However, instead of drawing gestures with a finger or stylus, users articulate a gesture by tilting the device. This can be especially useful when the user's other hand is otherwise encumbered or unavailable. We show that novice users achieve an entry rate of 15 words-per-minute (wpm) after minimal practice. A pilot longitudinal study reveals that a single participant achieved an entry rate of 32 wpm after approximate 90 minutes of practice. Our data indicate that tilt-based gesture keyboard entry enables walk-up use and provides a suitable text entry rate for occasional use and can act as a promising alternative to single-handed typing in certain situations.

> 大屏幕移动设备的普及使得单手交互变得困难。我们建议和评估一个新的设计点周围倾斜为基础的文本输入技术，支持单手使用。我们的技术是基于手势键盘（形状写）。然而，用户用手指或手写笔代替手势，通过倾斜装置来表达手势。这是特别有用当用户的另一方面是其他妨碍或不可用。我们发现，新手用户达到每分钟15字的输入速度（每分钟）后最小的实践。一个飞行员的纵向研究揭示了一个单一的参与者达到每分钟32字的输入速度约90分钟练习后。我们的数据表明，基于倾斜的手势键盘输入可以提高使用率，并为偶尔使用提供了合适的文本输入率，在某些情况下可以作为一种很有前途的单手打字替代方案。 article link

356. Modelling Learning of New Keyboard Layouts

SESSION:Innovative Text Entry Systems

Predicting how users learn new or changed interfaces is a long-standing objective in HCI research. This paper contributes to understanding of visual search and learning in text entry. With a goal of explaining variance in novices' typing performance that is attributable to visual search, a model was designed to predict how users learn to locate keys on a keyboard: initially relying on visual short-term memory but then transitioning to recall-based search. This allows predicting search times and visual search patterns for completely and partially new layouts. The model complements models of motor performance and learning in text entry by predicting change in visual search patterns over time. Practitioners can use it for estimating how long it takes to reach the desired level of performance with a given layout.

> 预测用户如何学习新的或更改的接口是HCI研究的一个长期目标。本文有助于理解文本输入中的视觉搜索和学习。有一个目标是解释由于视觉搜索而导致的初学者打字表现的差异，设计了一个模型来预测用户如何学习键盘上的键：最初依靠视觉短时记忆，然后转换到基于回忆的搜索。这允许为完全和部分新布局预测搜索时间和视觉搜索模式。该模型通过预测视觉搜索模式随时间的变化来补充文本输入中运动性能和学习的模型。从业者可以使用它来估计需要多长时间才能达到给定的布局所需的性能水平。 article link

357. Word Clarity as a Metric in Sampling Keyboard Test Sets

SESSION:Innovative Text Entry Systems

Test sets play an essential role in evaluating text entry techniques. In this paper, we argue that in addition to the widely adopted metric of bigram representativeness and memorability, word clarity should also be considered as a metric when creating test sets from the target dataset. Word clarity quantifies the extent to which a word is likely to confuse with other words on a keyboard. We formally define word clarity, derive equations calculating it, and both theoretically and empirically show that word clarity has a significant effect on text entry performance: it can yield up to 26.4% difference in error rate, and 25% difference in input speed. We later propose a Pareto optimization method for sampling test sets with different sizes, which optimizes the word clarity and bigram representativeness, and memorability of the test set. The obtained test sets are published on the

Internet.

> 测试集在评估文本输入技术中起着至关重要的作用。在本文中，我们认为，除了广泛采用的两字组的代表性和记忆性度量，字的清晰度也应被视为一个度量时创建测试集的目标数据集。单词清晰度可以量化一个单词与键盘上其他单词混淆的程度。我们对词的清晰度进行了形式化定义，推导出了计算词汇清晰度的公式，理论和实证结果表明，词汇清晰度对文本输入性能有显著影响：错误率高达26.4%，输入速度相差25%。后来我们提出了一个抽样测试集的大小不同的帕累托优化方法，优化和二字清晰的代表性，并对测试集的记忆。所获得的测试集在因特网上发布。 article link

358. Quantifying Aversion to Costly Typing Errors in Expert Mobile Text Entry

SESSION:Innovative Text Entry Systems

Text entry is an increasingly important activity for mobile device users. As a result, increasing text entry speed of expert typists is an important design goal for physical and soft keyboards. Mathematical models that predict text entry speed can help with keyboard design and optimization. Making typing errors when entering text is inevitable. However, current models do not consider how typists themselves reduce the risk of making typing errors (and lower error frequency) by typing more slowly. We demonstrate that users respond to costly typing errors by reducing their typing speed to minimize typing errors. We present a model that estimates the effects of risk aversion to errors on typing speed. We estimate the magnitude of this speed change, and show that disregarding the adjustments to typing speed that expert typists use to reduce typing errors leads to overly optimistic estimates of maximum errorless expert typing speeds.

> 对于移动设备用户来说，文本输入是一项越来越重要的活动。因此，提高专业打字员文字录入速度是物理和软键盘设计的一个重要目标。预测文本输入速度的数学模型有助于键盘的设计和优化。输入文本时键入错误是不可避免的。然而，目前的模型没有考虑如何使自己减少打字员打字错误的风险（和较低的错误频率）打字更慢。我们演示了用户通过降低打字速度以减少打字错误来应对昂贵的打字错误。我们提出了一个模型来估计风险厌恶对打字速度上的错误的影响。我们估计这速度变化的幅度，表明无论调整专业打字员打字速度，使用减少打字错误导致的最大无差错专家打字速度估计过于乐观。 article link

359. High Costs and Small Benefits: A Field Study of How Users Experience Operating System Upgrades

SESSION:Models of Use and Gestures

Users must manage frequent software and operating system upgrades across multiple computing devices. While current research focuses primarily on the security aspect, we investigate the user's perspective of upgrading software. Our first study (n=65) found that users delay major upgrades by an average of 80 days. We then ran a field study (n=14), beginning with in-depth observations during an operating system upgrade, followed by a four-week diary study. Very few participants prepared for upgrades (e.g., backing up files), and over half had negative reactions to the upgrade process and other changes (e.g., bugs, lost settings, unwanted features). During the upgrade process, waiting times were too long, feedback was confusing or misleading, and few had clear mental models of what was happening. Users almost never mentioned security as a concern or reason for upgrading. By contrast, interviews (n=3) with technical staff responsible for one organization's upgrades focused only on security and licensing, not user interface changes. We conclude with recommendations to improve the user's upgrade experience.

> 用户必须在多个计算设备上管理频繁的软件和操作系统升级。虽然目前的研究主要集中在安全方面，我们研究了用户对软件升级的看法。我们的第一项研究（N = 65）发现，用户延迟升级的平均时间为80天。然后，我们进行了一项实地研究（N＝14），从操作系统升级过程中的深入观察开始，接着进行了为期四周的日记研究。很少有参与者准备升级（例如备份文件），超过一半的人对升级过程和其他更改（如bug、丢失设置、不需要的功能）产生负面反应。在升级过程中，等待时间太长，反馈令人困惑或误导，很少有清晰的心理模型。用户几乎从来没有提到安全性是升级的原因或原因。相比之下，负责一个组织升级的技术人员的访谈（N＝3）只关注安全性和许可性，而不是用户界面的变化。最后，我们提出改进用户升级体验的建议。 article link

360. Understanding Shoulder Surfing in the Wild: Stories from Users and Observers

SESSION:Models of Use and Gestures

Research has brought forth a variety of authentication systems to mitigate observation attacks. However, there is little work about shoulder surfing situations in the real world. We present the results of a user survey (N=174) in which we investigate actual stories about shoulder surfing on mobile devices from both users and observers. Our analysis indicates that shoulder surfing mainly occurs in an opportunistic, non-malicious way. It usually does not have serious consequences, but evokes negative feelings for both parties, resulting in a variety of coping strategies. Observed data was personal in most cases and ranged from information about interests and hobbies to login data and intimate details about third persons and relationships. Thus, our work contributes evidence for shoulder surfing in the real world and informs implications for the design of privacy protection mechanisms.

> 研究提出了多种认证系统，以减轻观察攻击。然而，在现实世界中很少有关于肩上冲浪的工作。我们提出了一个用户调查的结果（N = 174），我们调查从用户和观察员在移动设备上的肩膀冲浪的实际故事。我们的分析表明，肩冲浪主要发生在机会主义，非恶意的方式。它通常不会产生严重的后果，但会引起双方的消极情绪，导致各种应对策略。在大多数情况下观察到的数据是个人的，从兴趣和爱好的信息到登录数据和第三个人和关系的亲密细节。因此，我们的工作提供了证据，在现实世界中的肩膀冲浪，并通知隐私保护机制的设计的影响。 article link

361. Fieldward and Pathward: Dynamic Guides for Defining Your Own Gestures

SESSION:Models of Use and Gestures

Although users accomplish ever more tasks on touch-enabled mobile devices, gesture-based interaction remains limited and almost never customizable by users. Our goal is to help users create gestures that are both personally memorable and reliably recognized by a touch-enabled mobile device. We address these competing requirements with two dynamic guides that use progressive feedforward to interactively visualize the "negative space" of unused gestures: the Pathward technique suggests four possible completions to the current gesture, and the Fieldward technique uses color gradients to reveal optimal directions for creating recognizable gestures. We ran a two-part experiment in which 27 participants each created 42 personal gesture shortcuts on a smartphone, using Pathward, Fieldward or No Feedforward. The Fieldward technique best supported the most common user strategy, i.e. to create a memorable gesture first and then adapt it to be recognized by the system. Users preferred the Fieldward technique to Pathward or No Feedforward, and remembered gestures more easily when using the technique. Dynamic guides can help developers design novel gesture vocabularies and support users as they design custom gestures for mobile applications.

> 尽管用户在触摸功能的移动设备上完成了越来越多的任务，但基于手势的交互仍然有限，几乎从不被用户定制。我们的目标是帮助用户创建由触摸功能的移动设备所带来的个人

> 难忘和可靠识别的手势。我们应对这些竞争的要求与动态的指南，使用渐进式前馈交互式可视化“负空间”未使用的手势：pathward技术建议目前的手势四可能的完成，并向原野地技术使用颜色渐变显示最优方向识别的手势。我们跑了其中27参与者之间创造了42个人的手势快捷方式在智能手机上，使用pathward两部分实验，向原野地或无前馈。最好的支持，最常见的用户策略向原野地技术，即创造一个难忘的手势先适应它被系统识别。用户会选择向原野地技术pathward或没有前馈，记得手势更容易使用的技术。动态指南可以帮助开发人员设计新的手势词汇表，并支持用户为移动应用程序设计自定义手势。 article link

362. Gesture Interfaces: Minor Change in Effort, Major Impact on Appeal

SESSION:Models of Use and Gestures

Making gestures easy for imaging systems to reliably recognize often comes at the expense of user effort. But what is the impact of increasing a gesture's effort, even slightly, on user preference? We investigate physical effort, system reliability, and user satisfaction in two experiments. The first explores eight basic command gestures. Participants preferred the less effortful gestures in two of the three easy-difficult gesture pairs when they perceived the difference in effort to be significantly different. The second experiment explores two separate three-dimensional pointing and selection conditions that differ only in the movement distance required to finish the task. In both experiments, there is a significant negative correlation between a gesture's effort and its appeal. The results show the great impact that effort has on a user's willingness to utilize the system. The findings provide evidence that the trade-off between user effort and system reliability must be carefully considered to build an effective gesture interface.

> 使手势易于成像系统可靠地识别往往是以牺牲用户的努力为代价的。但是，增加一个手势的努力，甚至是轻微的对用户偏好的影响是什么？在两个实验中，我们研究了物理努力、系统可靠性和用户满意度。第一部分探讨了八种基本的命令手势。参与者倾向于少受手势的三个容易的手势对他们感知的努力是显着不同的差异。第二个实验探索了两个单独的三维指向和选择条件，它们只在完成任务所需的运动距离上有所不同。在两个实验中，手势的努力和它的吸引力之间存在着显著的负相关关系。结果表明，努力对用户使用系统的意愿有很大的影响。研究结果表明，必须仔细考虑用户努力和系统可靠性之间的权衡，以建立有效的手势界面。 article link

363. MoveMeant: Anonymously Building Community Through Shared Location Histories

SESSION:Models of Use and Gestures

Awareness of and connections to a local community are important for building social capital, sharing resources, and providing physical support, but have been elusive to create in dense urban environments. We describe the design and implementation of MoveMeant, a system aimed to increase local community awareness through shared location traces. MoveMeant securely uses anonymized location data generated automatically by mobile devices to display aggregate, community-level location data. We report findings from interviews with residents in the Bronx, New York City who participated in a deployment of MoveMeant over a 6-week period. Our findings show that people use the anonymous information to make judgments about the people and places in their community, while opting to reveal their identity for third places where there is an opportunity to connect socially.

> 对当地社区的认识和联系对于建立社会资本、分享资源和提供物质支持是非常重要的，但在密集的城市环境中难以创造。我们描述和实现movemeant设计，系统通过共享位置的痕迹，增加当地的社区意识。movemeant安全使用匿名的位置数据自动生成的移动设备显示汇总，社区一级的位置数据。我们的报告发现在布朗克斯居民访谈、纽约参加部署movemeant超过6周的时间。我们的调查结果表明，人们使用匿名信息来判断他们所在社区的人和地点，而选择在有社交机会的第三个地方揭示他们的身份。 article link

364. MuEns: A Multimodal Human-Machine Music Ensemble for Live Concert Performance

SESSION:Sound of Music

Musical ensemble between human musicians and computers is a challenging task. We achieve this with a concert-quality synchronization using machine learning. Our system recognizes the position in a given song from the human performance using the microphone and camera inputs, and responds in real-time with audio and visual feedback as a music ensemble. We address three crucial requirements in a musical ensemble system. First, our system interacts with human players through both audio and visual cues, the conventional modes of coordination for musicians. Second, our system synchronizes with human performances while retaining its intended musical expression. Third, our system prevents failures during a concert due to bad tracking, by displaying an internal confidence measure and allowing a backstage human operator to "intervene" if the system is unconfident. We show the feasibility of the system with several experiments, including a professional concert.

> 人类音乐家和计算机之间的音乐合奏是一项具有挑战性的任务。我们使用机器学习实现音乐会质量同步。我们的系统识别在给定的歌曲中的位置，从人的表现，使用麦克风和摄像机输入，并响应实时与音频和视觉反馈作为一个音乐合奏。我们解决了音乐合奏系统中的三个关键要求。首先，我们的系统通过音频和视觉信号与人类玩家互动，传统的音乐家协调模式。第二，我们的系统与人类的表现同步，同时保留了它的音乐表达。第三，我们的系统可以防止因不良跟踪一个演唱会的过程中，通过显示内部的置信度和允许后台操作员“如果系统是不自信的干预”。我们展示了系统的可行性与几个实验，包括专业音乐会。 article link

365. Playing Fast and Loose with Music Recognition

SESSION:Sound of Music

We report lessons from iteratively developing a music recognition system to enable a wide range of musicians to embed musical codes into their typical performance practice. The musician composes fragments of music that can be played back with varying levels of embellishment, disguise and looseness to trigger digital interactions. We collaborated with twenty-three musicians, spanning professionals to amateurs and working with a variety of instruments. We chart the rapid evolution of the system to meet their needs as they strove to integrate music recognition technology into their performance practice, introducing multiple features to enable them to trade-off reliability with musical expression. Collectively, these support the idea of deliberately introducing "looseness" into interactive systems by addressing the three key challenges of control, feedback and attunement, and highlight the potential role for written notations in other recognition-based systems.

> 我们报告的教训，迭代开发一个音乐识别系统，使广大音乐家嵌入到他们的典型表演实践的音乐代码。音乐家作曲的音乐片段，可以播放不同层次的点缀，伪装和松散，以触发数字互动。我们与二十三位音乐家合作，跨越专业人士和业余爱好者，并与各种乐器合作。我们绘制系统的快速发展，以满足他们的需要，因为他们努力把音乐识别技术融入他们的演奏实践中，引入多种特性，使他们能够用音乐表达来权衡可靠性。总的来说，这些支持故意引入“松动”的互动系统的寻址控制的三个关键挑战的想法、反馈和协调，并强调在其他识别系统的书面符号的潜在作用。 article link

366. Holographic Whisper: Rendering Audible Sound Spots in Three-dimensional Space by Focusing Ultrasonic Waves

SESSION:Sound of Music

We propose a novel method of spatial audio rendering using ultrasound. An ultrasonic phased array generates one or more focal points in air, and they act as point sources of audible sound when the ultrasound waves are modulated. Our sound-point loudspeaker has two major advantages over conventional ultrasound-based sound-beam (superdirectional) loudspeakers. The higher audience selectivity means that our sound-point loudspeaker can deliver sound to the ears of the target person, whereas a sound-beam loudspeaker delivers sound to not only the target person but also other persons standing in the same direction. The other advantage is lower exposure to ultrasound; while an audible sound beam travels along an ultrasonic beam in a soundbeam loudspeaker, audible sound can be heard along the direction perpendicular to the ultrasonic beam in our soundpoint loudspeaker. This paper reports the principles of our sound-point loudspeaker, prototype construction, evaluation, and applications.

> 提出了一种利用超声进行空间音频再现的新方法。超声波相控阵在空气中产生一个或多个焦点，当超声波被调制时，它们充当可听见声音的点源。我们的声音一点扬声器具有比传统的基于超声声束的两大优势（superdirectional）扬声器。较高的观众选择性意味着，我们的声音点扬声器可以向目标人的耳朵发出声音，而声音波束扬声器不仅向目标人发出声音，而且向同一方向的其他人发出声音。另一个优势是较低的超声照射；当声束沿超声波束在soundbeam扬声器，声音可以听到沿着垂直于我们的SoundPoint扬声器的声束方向。本文介绍了我国声点扬声器的原理、样机的结构、性能及应用。 article link

367. EnseWing: Creating an Instrumental Ensemble Playing Experience for Children with Limited Music Training

SESSION:Sound of Music

While instrumental ensemble playing can benefit children's music education and collaboration skill development, it requires extensive training on music and instruments, which many school children lack. To help children with limited music training experience instrumental ensemble playing, we created EnseWing, an interactive system that offers such an experience. In this paper, we report the design of the EnseWing experience and a two-month field study. Our results show that EnseWing preserves the music and ensemble skills from traditional instrumental ensemble and provides more collaboration opportunities for children.

> 器乐合奏有利于儿童音乐教育和协作技能的发展，但对许多儿童缺乏音乐和乐器的训练要求广泛。帮助孩子在有限的音乐训练经验的器乐合奏，我们创造了ensewing，交互式系统提供这样的经验。在本文中，我们报告的ensewing经验和两个月的研究设计。我们的研究结果表明，ensewing保留传统器乐合奏音乐和合奏能力和为孩子提供更多的合作机会。 article link

368. Market Design for HCI: Successes and Failures of Peer-to-Peer Exchange Platforms

SESSION:Technology Enabled Commerce

This paper explores an HCI approach to designing markets, with a primary focus on peer-to peer exchange platforms. We draw on recent work in economics that has documented how markets function, how they can be evaluated, and what can be done to fix them when they fail. We introduce five key concepts from market design: thickness, congestion, stability, safety, and repugnance. These lend HCI an analytic vocabulary for understanding why markets may succeed or struggle. Building on prior empirical work, we apply these concepts to compare two well-known network hospitality platforms, Couchsurfing and Airbnb. As a second illustrative case, we use market design to shed light on the challenges experienced by smaller-scale peer-to-peer marketplaces for lending, renting, and selling physical goods. To conclude, we discuss how this kind of analysis can make conceptual, evaluative, and generative contributions to the study and design of exchange platforms and other socio-technical systems.

> 本文探讨了人机交互设计市场的方法，主要集中在点对点交换平台上。我们从 近年来的工作，证明了市场经济的作用，如何评价，我们可以做些什么来解决他们的失败。我们介绍的五个关键概念：从市场设计厚度，拥塞，稳定，安全，和厌恶。这为了解市场为什么会成功或奋斗提供了一个分析词汇。在实证工作之前，我们将这些概念应用到比较知名的网络服务平台，网站Airbnb。作为第二个说明性案例，我们利用市场设计来揭示规模较小的对等市场在贷款、租赁和销售实物商品方面所遇到的挑战。最后，我们将讨论这种分析如何能对交换平台和其他社会技术系统的研究和设计作出概念性、评价性和生成性贡献。 article link

369. Community Commerce: Facilitating Trust in Mom-to-Mom Sale Groups on Facebook

SESSION:Technology Enabled Commerce

Consumers are turning to Facebook Groups to buy and sell with strangers in their local communities. This trend is counter-intuitive given Facebook's lack of conventional e-commerce features, such as sophisticated search engines and reputation systems. We interviewed 18 members of two Mom-to-Mom Facebook sale groups. Despite a lack of commerce tools, members perceived sale groups as an easy-to-use way to quickly and conveniently buy and sell. Most important to members was that the groups felt safe and trustworthy. Drawing on these insights, we contribute a novel framing,community commerce, which explains the trust mechanisms that enable transactions between strangers in some groups. Community commerce fosters trust through (a) exclusive membership to a closed group, (b) regulation and sanctioning of behavior at the admin, member, and group level, and (c) a shared group identity or perceived similarity (though, surprisingly, not through social bonding). We discuss how community commerce affords unique and sometimes superior trust assurances and propose design implications for platforms hoping to foster trust between members who buy, sell, or share amongst themselves.

> 消费者转向脸谱网集团，在当地社区与陌生人进行买卖。考虑到脸谱网缺乏传统的电子商务功能，如复杂的搜索引擎和声誉系统，这种趋势是反直觉的。我们采访了两个妈妈到脸谱网销售集团的18个成员。尽管缺乏商业工具，会员们还是认为销售集团是一种方便快捷的买卖方式。对会员来说最重要的是，这些团体感到安全可靠。基于这些见解，我们提供了一种新的框架，即社区商业，它解释了一些群体中陌生人之间进行交易的信任机制。社区商业促进信任通过（一）一个封闭的集团专属会员，（b）监管和制裁的行为管理，成员，和组的水平，和（c）一组共享的身份或感知相似性（但令人惊讶的是，不通过社会联系）。我们将讨论社区商业如何提供独特的，有时甚至是优越的信任保证，并为希望在他们之间购买、销售或共享的成员之间建立信任的平台提供设计建议。 article link

370. No Such Thing as Too Much Chocolate: Evidence Against Choice Overload in E-Commerce

SESSION:Technology Enabled Commerce

E-commerce designers must decide how many products to display at one time. Choice overload research has demonstrated the surprising finding that more choice is not necessarily better?selecting from larger choice sets can be more cognitively demanding and can result in lower levels of choice satisfaction. This research tests the choice overload effect in an e-commerce context and explores how the choice overload effect is influenced by an individual's tendency to maximize or satisfice decisions. We conducted an online experiment with 611 participants randomly assigned to select a gourmet chocolate bar from either 12, 24, 40, 50, 60, or 72 different options. Consistent with prior work, we find that maximizers are less satisfied with their product choice than satisficers. However, using Bayesian analysis, we find that it's unlikely that choice set size affects choice satisfaction by much, if at all. We discuss why the decision-making process may be different in e-commerce contexts than the physical settings used in previous choice overload experiments.

> 电子商务设计者必须决定一次展示多少产品。选择超载的研究已经证明了令人惊讶的发现，更多的选择并不一定更好。从较大的选择集中选择可能会产生更多的认知要求，并导致选择满意度的降低。本研究试验选择超载的影响电子商务环境下，探讨如何选择过载效应是由一个人的倾向最大化或满意决策的影响。我们进行了一项在线实验，随机抽取611名参与者，从12, 24, 40个、50, 60个或72个不同的选项中选择一个美食巧克力棒。与以前的工作相一致，我们发现完美主义者不满意他们的产品选择，满足。然而，使用贝叶斯分析，我们发现选择集合大小不太可能影响选择的满意程度，如果是这样的话。我们讨论了为什么在电子商务环境中决策过程可能比以前选择过载实验中使用的物理设置不同。 article link

371. Why Users Disintermediate Peer-to-Peer Marketplaces

SESSION:Technology Enabled Commerce

This paper reports on a study of the prevalence of and possible reasons for peer-to-peer transaction marketplace (P2PM) users turning to out-of-market (OOM) transactions after finding transaction partners within a P2P system. We surveyed 97 P2PM users and interviewed 22 of 58 who reported going OOM. We did not find any evidence of predisposing personality factors for OOM activity; instead, it seems to be a rational response to circumstances, with a variety of situationally rational motivations at play, such as liking the transaction partner and trusting that good quality repeat transactions will occur in the future.

> 本文报道的患病率和对等交易市场可能的原因的研究（p2pm）用户转向了市场（OOM）的交易后，P2P系统内寻找交易伙伴。我们调查了97 p2pm用户和访问22 58人去OOM。我们没有发现任何证据表明倾向的人格因素对OOM活动；相反，它似乎是对环境的理性反应，与各种情境理性动机在起作用，比如喜欢的交易伙伴，相信质量好的重复交易将发生在未来。 article link

372. MistForm: Adaptive Shape Changing Fog Screens

SESSION:Unusual Displays

We present MistForm, a shape changing fog display that can support one or two users interacting with either 2D or 3D content. Mistform combines affordances from both shape changing interfaces and mid-air displays. For example, a concave display can maintain content in comfortable reach for a single user, while a convex shape can support several users engaged on individual tasks. MistForm also enables unique interaction possibilities by exploiting the synergies between shape changing interfaces and mid-air fog displays. For instance, moving the screen will affect the brightness and blurriness of the screen at specific locations around the display, creating spaces with similar (collaboration) or different visibility (personalized content). We describe the design of MistForm and analyse its inherent challenges, such as image distortion and uneven brightness on dynamic curved surfaces. We provide a machine learning approach to characterize the shape of the screen and a rendering algorithm to remove aberrations. We finally explore novel interactive possibilities and reflect on their potential and limitations.

> 我们目前的{形状改变，雾显示可以支持一个或两个用户交互的2D或3D内容。{结合形状改变接口和空中的启示显示。例如，凹显示可以保持单个用户舒适的内容，而凸形可以支持多个用户从事单个任务。{也使独特的互动的可能性，利用形状改变接口和空中雾之间的协同效应发挥。例如，移动屏幕将在显示特定的位置会影响屏幕的亮度和模糊，类似的创造空间（合作）或不同的可见性（个性化内容）。我们描述的{设计和分析其固有的挑战，如图像失真和亮度不均匀的动态曲面。我们提供了一种机器学习方法来描述屏幕的形状和消除像差的渲染算法。最后，我们探索新的互动可能性，并反思它们的潜力和局限性。 article link

373. The Object Inside: Assessing 3D Examination with a Spherical Handheld Perspective-Corrected Display

SESSION:Unusual Displays

Handheld Perspective Corrected Displays (HPCDs) can create the feeling of holding a virtual 3D object. They offer a direct interaction that is isomorphic to the manipulation of physical objects. This illusion depends on the ability to provide a natural visuomotor coupling. High performances systems are thus required to evaluate the fundamental merits of HPCDs. We built a spherical HPCD using external projection. The system offers a lightweight wireless seamless display with head-coupled stereo, robust tracking, and low latency. We compared users' performances with this HPCD and two other interactions that used a fixed planar display and either a touchpad or the spherical display as an indirect input. The task involved the inspection of complex virtual 3D puzzles. Physical puzzles were also tested as references. Contrary to expectations, all virtual interactions were found to be more efficient than a more "natural" physical puzzle. The HPCD yielded lower performances than the touchpad. This study indicates that the object examination task did not benefit from the accurate and precise rotations offered by the HPCD, but benefited from the high C/D gain of the touchpad.

> 手持透视校正显示器（HPCD）可以创建一个虚拟的三维物体的感觉持。它们提供了与物理对象操作同构的直接交互。这种错觉取决于提供一个自然的视觉运动耦合的能力。高性能的系统，因此需要评估影响的基本特点。我们建立了一个球形HPCD使用外部投影。该系统提供了一个轻量级无线无缝显示与头部耦合立体声，强大的跟踪和低延迟。我们比较了用户的性能，这HPCD使用固定的平面显示器和触摸板或球面显示器作为间接输入两其他相互作用。这项任务涉及到对复杂虚拟3D拼图的检查。物理谜题也被测试作为参考。与预期相反，所有虚拟交互都比“自然”物理难题更有效。HPCD得到比触摸板下的性能。这项研究表明，目标考核任务没有由HPCD提供准确和精确的旋转中受益，但受益于高C / D增益的触摸板。 article link

374. Visual Composition of Graphical Elements on Non-Rectangular Displays

SESSION:Unusual Displays

Graphical user interfaces are composed of varying elements (text, images, etc.) whose visual arrangement has been relatively well established in the context of rectangular interfaces. The advent of non-rectangular displays questions this knowledge. In this paper we study how traditional content layouts can be adapted to fit different non-rectangular displays. We performed a first qualitative study where graphic designers fitted text and images into different non-rectangular displays. From the analysis of their output we generalize and adapt ten composition principles that have been proposed in the literature for rectangular displays. We evaluate the revised principles through a paired comparison questionnaire where 57 participants compared pairs of layouts. Using the Bradley-Terry-Luce model to analyze our data we show that some results contradict current conventions on visual design for rectangular displays. We then extracted the most interesting cases and conducted a follow up study with additional shapes to investigate how the principles generalize. From these results we propose a set of guidelines for designing visual content for non-rectangular displays.

> 图形用户界面由不同的元素（文本、图像等）组成，它们的视觉安排在矩形接口的上下文中得到了很好的确立。非矩形显示器的出现质疑了这一认识。在本文中，我们研究如何适应传统的内容布局，以适应不同的非矩形显示器。我们进行了第一次定性研究，平面设计师将文本和图像安装到不同的非矩形显示器中。从对它们输出的分析中，我们概括和适应了矩形显示器中已经提出的十种组合原理。我们通过配对比较问卷对修订原则进行评估，其中57名参与者比较了布局对。利用Bradley Terry Luce模型分析我们的数据，我们发现一些结果与当前矩形显示视觉设计规范。然后，我们提取最有趣的病例，并进行了后续的研究，用更多的形状来研究这些原则是如何概括的。从这些结果中，我们提出了

> 一套非矩形显示器视觉内容设计准则。 article link

375. Effects of Tactile Feedback on the Perception of Virtual Shapes on Non-Planar DisplayObjects

SESSION:Unusual Displays

In this paper, we report on a study investigating a novel haptic illusion for altering the perception of 3D shapes using a non-planar screen and vibrotactile friction. In our study, we presented an image of a rectangular prism on a cylindrical and a flat display. Participants were asked to move their index finger horizontally along the surface of the displays towards the edge of the rectangular prism. Participants were asked whether they were experiencing a flat, cylindrical or rectangular shape. In one condition, a vibrotactile stimulus simulated increasing friction towards the visible edge of the rectangular prism, with a sudden drop-off when this edge was crossed by the finger. Results suggest that presenting an image of a rectangular prism, and applying vibrotactile friction, particularly on a cylindrical display, significantly increased participant ratings stating that they were experiencing a physical rectangular shape.

> 在本文中，我们报告一个研究改变三维感知形状使用非平面的屏幕和振动摩擦研究一种新型的触觉错觉。在我们的研究中，我们提出了圆柱和平面显示器上的矩形棱镜的图像。参与者被要求将食指沿着显示器的表面水平移动到矩形棱镜的边缘。参与者被问及他们是否经历了扁平、圆柱形或长方形。在一种情况下，一个振动触觉刺激模拟增加摩擦对直角棱镜可见边缘，与突然下降时，这种边缘交叉的手指。结果表明，呈直角棱镜的图像，应用振动摩擦，特别是在一个柱状显示，显著提高参与者的评级说明他们正在经历一个物理的矩形形状。 article link

376. BreathScreen: Design and Evaluation of an Ephemeral UI

SESSION:Unusual Displays

We present BreathScreen, a concept where clouds created by breathing are used as a projection surface for a picoprojector, creating an ephemeral user interface. In cold weather conditions the clouds are created naturally by warm breath condensing, but in other conditions an electric vaporizer may be used. We present an initial evaluation of the concept in a user study (n = 8), utilising a vaporizer-based BreathScreen prototype. The concept was positively received by study participants as a natural, hands-free interface and considered magical and aesthetically beautiful. Additionally, we provide guidance on the quantity of content that may be displayed on a BreathScreen, which is limited both by the length of a human breath and the contrast of the system.

> 我们现在的BreathScreen，一个概念，由呼吸云作为一个picoprojector投影面，创造了一个短暂的用户界面。在寒冷的天气条件下，通过温暖的呼吸冷凝自然形成云，但在其他条件下，可以使用电汽化器。我们提出的概念，初步评估在用户研究（n = 8），利用一个汽化器的基础breathscreen原型。研究参与者积极地接受这个概念，认为它是一种自然的免提接口，被认为是神奇而美观的。此外，我们提供的内容，可以显示在breathscreen数量的指导，这是有限的，一个人的呼吸的长度和系统的对比。 article link

377. Foreign-language Reviews: Help or Hindrance?

SESSION:User Perceptions in Sociotechnical Systems

The number and quality of user reviews greatly affects consumer purchasing decisions. While reviews in all languages are increasing, it is still often the case (especially for non-English speakers) that there are only a few reviews in a person's first language. Using an online experiment, we examine the value that potential purchasers receive from interfaces showing additional reviews in a second language. The results paint a complicated picture with both positive and negative reactions to the inclusion of foreign-language reviews. Roughly 26-28% of subjects clicked to see translations of the foreign-language content when given the opportunity, and those who did so were more likely to select the product with foreign-language reviews than those who did not.

> 用户评论的数量和质量极大地影响消费者的购买决策。虽然所有语言的评论都在增加，但通常情况下（尤其是对非英语国家），只有一个人的第一语言的评论很少。通过在线实验，我们研究了潜在购买者从第二语言中显示额外评论的界面获得的价值。这一结果描绘了一幅复杂的画面，包含了对外语评论的正反两方面的评价。大约26-28%科目点击看外文内容翻译时给予的机会，和那些更可能选择产品与外国语言的评论比那些没有。 article link

378. Getting Something for Nothing?: A User-Centric Perspective on Loyalty Card Schemes

SESSION:User Perceptions in Sociotechnical Systems

Loyalty cards are a form of tracking and recording technology (TRT) that enables retailers to collect data about their customers' demographic and purchase behaviours. As recompense for sharing their data consumers receive 'loyalty points' which they can redeem for exclusive discounts and rewards. The design of loyalty schemes, and TRTs more generally, plays a key role in defining the economic terms of that exchange, and ultimately the economic value of personal data. In this paper we present findings from an interview study with 12 loyalty cardholders in the UK explicating the ways in which they create (and lose) value through the everyday practice of shopping with loyalty cards and the orientations associated with them. Based on our findings we suggest cardholders are less concerned with the protection of their privacy than with leveraging its value, only some of which was economic. We provide design guidelines for TRTs that may enable consumers to derive greater value from the data they produce and share.

> 会员卡是一种形式的跟踪和记录技术（TRT），使零售商收集有关客户的人口统计和购买行为数据。作为分享他们的数据的回报，消费者得到“忠诚点”，他们可以赎回独家折扣和奖励。忠诚计划的设计，和台北捷运更普遍的是，在确定汇率的经济方面起着关键的作用，最终实现个人数据的经济价值。在本文中我们提出一项访谈研究在英国明确的方式创造出12的忠诚的持卡人（失去）通过忠诚卡和与之相关的日常实践价值取向的购物。根据我们的调查结果，我们建议持卡人不关心保护他们的隐私，而不是利用其价值，其中只有一些是经济的。我们提供TRTS可能使消费者获得更大的价值，它们所产生的数据和共享设计指南。 article link

379. Online Feedback Exchange: A Framework for Understanding the Socio-Psychological Factors

SESSION:User Perceptions in Sociotechnical Systems

To meet the demand for authentic, timely, and affordable feedback, researchers have explored technologies to connect designers with feedback providers online. While researchers have implemented mechanisms to improve the content of feedback, most systems for online feedback exchange do not support an end-to-end cycle, from help-seeking to sense-making to action. Building on extant literature in learning sciences, design, organizational behavior, and online communities, we propose a conceptual framework to highlight critical processes that affect online feedback exchange. We contribute research questions for future feedback systems and argue that online feedback systems must be able to support

designers through five activities that happen before, during, and after the feedback exchange. Our framework suggests that systems should address broader socio-psychological factors, such as how intent should be communicated online, how dialogue can support the interpretation of feedback, and how to balance the tradeoffs of anonymizing feedback providers.

> 为了满足对真实、及时和负担得起的反馈的需求，研究人员探索了将设计者与反馈提供者联机的技术。虽然研究人员已经实施了改善反馈内容的机制，但是大多数在线反馈交换系统不支持从求助到理解到行动的端到端循环。在现存的学习科学、设计、组织行为和在线社区的文献基础上，我们提出了一个概念框架来强调影响在线反馈交换的关键过程。我们为未来的反馈系统提供研究问题，并认为在线反馈系统必须能够通过反馈反馈之前、期间和之后发生的五项活动来支持设计者。我们的框架表明，系统应解决更广泛的社会心理因素，如有意向要网上交流对话，如何能支持反馈的解释，以及如何平衡匿名反馈供应商的权衡。 article link

380. The Geometry of Storytelling: Theatrical Use of Space for 360-degree Videos and Virtual Reality

SESSION:360 Video

360-degree filming and head-mounted displays (HMDs) give recorded media a new sense of space. Theatre practitioners' expertise in manipulating spatial interactions has much to contribute to immersive recorded content. Four theatre directors led teams of three actors to stage the same scene for both immersive theatre and for 360-degree filming. Each team was recorded performing the scene at least six times, three in each condition, to extract actors' coordinates. This study establishes how to quantify theatre practitioners' use of spatial interactions and examines the spatial adaptations made when transferring these relationships to 360-degree filming.Staging for a 360-degree camera compared to staging for an audience member had shorter distances from the camera and between performers, along with fewer instances of the camera being in the middle of the action. Across all groups, interpersonal distance between characters and between the audience/camera dropped at the end of the scene when the characters come together as a team, suggesting that elements of Proxemics may be applicable to narrative performance.

> 360度拍摄和头戴式显示器（HMD）给记录媒体新的空间感。戏剧从业者在处理空间交互方面的专长对沉浸式录制内容有很大贡献。四位戏剧导演带领三个演员团队，为身临其境的剧院和360度拍摄舞台。每一组被记录的场景至少有六次，每种情况下有三个，以提取演员的坐标。本研究建立了如何量化戏剧从业者使用空间相互作用并探讨了这些关系时，转移到360度空间的改编拍摄的360度摄像头相对于观众分期分期具有更短的距离从相机和演奏者之间，随着摄像机在行动中的实例少。在所有群体中，人际之间的距离，演员和观众之间/相机掉在现场结束时的文字组合在一起作为一个团队，表明元素的行为可能适用于叙事表现。 article link

381. Tap, Dwell or Gesture?: Exploring Head-Based Text Entry Techniques for HMDs

SESSION:360 Video

Despite the increasing popularity of head mounted displays (HMDs), development of efficient text entry methods on these devices has remained under explored. In this paper, we investigate the feasibility of head-based text entry for HMDs, by which, the user controls a pointer on a virtual keyboard using head rotation. Specifically, we investigate three techniques: TapType, DwellType, and GestureType. Users of TapType select a letter by pointing to it and tapping a button. Users of DwellType select a letter by pointing to it and dwelling over it for a period of time. Users of GestureType perform word-level input using a gesture typing style. Two lab studies were conducted. In the first study, users typed 10.59 WPM, 15.58 WPM, and 19.04 WPM with DwellType, TapType, and GestureType, respectively. Users subjectively felt that all three of the techniques were easy to learn and considered the induced fatigue to be acceptable. In the second study, we further investigated GestureType. We improved its gesture-word recognition algorithm by incorporating the head movement pattern obtained from the first study. This resulted in users reaching 24.73 WPM after 60 minutes of training. Based on these results, we argue that head-based text entry is feasible and practical on HMDs, and deserves more attention.

> 尽管头头盔显示器（HMD）的日益普及，高效的文字输入方法对这些器件的发展一直在探索。在本文中，我们探讨的可行性基于文本输入的头HMDs，由用户控制使用头指针旋转一个虚拟键盘。具体来说，我们研究三技术：TapType，dwelltype，和gesturetype。用户选择一个字母taptype指着它，点击一个按钮。用户选择一个字母dwelltype指出它和居住过一段时间。用户使用手势输入方式进行gesturetype字级的输入。进行了两项实验室研究。在第一项研究中，用户输入的10.59字，15.58字，19.04字与DwellType，TapType，和gesturetype，分别。用户主观上认为这三种技术都易于学习，并认为诱导疲劳是可以接受的。在第二项研究中，我们进一步研究GestureType。通过对第一次学习得到的头部运动模式的改进，改进了手势词识别算法。这导致了用户在60分钟的训练达到每分钟24.73个字。基于这些结果，我们认为，从文本输入在HMD中的可行性和实用性，值得更多的关注。 article link

382. Videos of Things: Speculating on, Anticipating and Synthesizing Technological Mediations

SESSION:360 Video

In this paper we present Videos of Things: videos that portray the mediated, lived world of computational artifacts informed by postphenomenology. In a post-phenomenological understanding, things and us are interdependent in that they mutually shape each other. And as a whole, technology or designed things mediate the relations between our world and us. This can be a challenge for designers. Through the making of design videos, we explored narrative strategies for creating stories featuring technological mediation. These include humanness, patterns in time, and non-human ensembles. We reflect on how the videos at different stages of the design process have helped to a) speculate on technological mediated relationships, b) synthesize and reflect on qualitative data on technological mediation and c) anticipate technological mediation. The paper contributes different narrative strategies for design videos and the role these videos can play within a design process aimed at elaborating the mediated qualities of technologies.

> 本文介绍了视频的事情：影片描绘的介导，生活世界postphenomenology计算工件的通知。在后现象学理解中，事物与我们是相互依存的，因为它们相互塑造。整体而言，技术或设计事物调解着我们与世界之间的关系。这对设计师来说是一个挑战。通过设计录像的制作，探索以科技中介创作故事的叙事策略。这些包括人性，时间模式，以及非人类的合奏。我们思考如何在设计过程的不同阶段的视频有助于（推测技术中介关系，B）综合和反思技术中介的定性数据和C）预期技术中介。本文为设计视频提供了不同的叙述策略，以及这些视频在设计过程中可以发挥的作用，旨在阐述技术的中介品质。 article link

383. Watching 360° Videos Together

SESSION:360 Video

360° videos are made using omnidirectional cameras that capture a sphere around the camera. Viewers get an immersive experience by freely changing their field of view around the sphere. The problem is that current interfaces are designed for a single user, and we do not know what challenges groups of people will have when viewing these videos together. We report on the findings of a study where 16 pairs of participants watched 360° videos together in a "guided tour" scenario. Our findings indicate that while participants enjoyed the ability to view the scene independently, this caused challenges establishing joint references, leading to breakdowns in conversation. We conclude by discussing how

gaze awareness widgets and gesturing mechanisms may support smoother collaborative interaction around collaborative viewing of 360° videos.

> 360度的视频是用全方位照相机捕捉到相机周围的球体。观众可以自由地改变自己在球体周围的视野，从而获得身临其境的体验。问题是目前的界面是为单个用户设计的，我们不知道人们在观看这些视频时会遇到什么样的挑战。我们报告了一项研究的结果，其中16对参与者在一个“导游”场景中观看了360°的视频。我们的研究结果表明，虽然参与者具有独立观察场景的能力，但这导致了建立联合引用的挑战，导致会话中断。我们的结论是讨论如何凝视感知部件和手势机制可以支持平滑的协同作用在协同浏览360°视频。 article link

384. Revisiting The American Voter on Twitter

SESSION:Civic Engagement

The American Voter- a seminal work in political science - uncovered the multifaceted nature of voting behavior which has been corroborated in electoral research for decades since. In this paper, we leverageThe American Voteras an analysis framework in the realm of computational political science, employing the factors ofparty, personality, andpolicyto structure the analysis of public discourse on online social media during the 2016 U.S. presidential primaries. Our analysis of 50 million tweets reveals the continuing importance of these three factors; our understanding is also enriched by the application of sentiment analysis techniques. The overwhelmingly negative sentiment of conversations surrounding 10 major presidential candidates reveals more "crosstalk" from Democratic leaning users towards Republican candidates, and less vice-versa. We uncover the lack ofmoderationas the most discussed personality dimension during this campaign season, as the political field becomes more extreme - Clinton and Rubio are perceived as moderate, while Trump, Sanders, and Cruz are not. While the most discussed issues areforeign policyandimmigration, Republicans tweet more aboutabortionthan Democrats who tweet more aboutgay rightsthan Republicans. Finally, we illustrate the importance of multifaceted political discourse analysis by applying regression to quantify the impact of party, personality, and policy on national polls.

> 美国选民——政治科学中的一项开创性工作——揭示了投票行为的多面性，这在选举研究中得到了几十年的证实。在本文中，我们利用美国voteras在计算政治科学领域的分析框架，运用因素此外，个性，andpolicyto结构分析的公共话语对在线社交媒体在2016美国总统初选。我们对5000万条推文的分析揭示了这三个因素的持续重要性；我们的理解也由于情绪分析技术的应用而得到了丰富。围绕10位主要总统候选人的谈话中，绝大多数负面情绪显示，民主党倾向的网民对共和党候选人的“串扰”更大，反之亦然。我们发现，缺乏ofmoderationas讨论最多的人格维度在竞选期间，作为政治领域变得更加极端，克林顿和Rubio被认为是温和的，而特朗普、妮其·桑德斯和克鲁兹都没有。而讨论最多的问题areforeign policyandimmigration，共和党人更aboutabortionthan鸣叫鸣叫更aboutgay rightsthan共和党民主党人。最后，我们用多元回归来量化政党、人格和政策对国家民意调查的影响，说明了多方面政治话语分析的重要性。 article link

385. Managing Uncertainty: Using Social Media for Risk Assessment during a Public Health Crisis

SESSION:Civic Engagement

Recently, diseases like H1N1 influenza, Ebola, and Zika virus have created severe crises, requiring public resources and personal behavior adaptation. Crisis Informatics literature examines interconnections of people, organizations, and IT during crisis events. However, how people use technology to cope with disease crises (outbreaks, epidemics, and pandemics) remains understudied. We investigate how individuals used social media in response to the outbreak of Zika, focusing on travel-related decisions. We found that extreme uncertainty and ambiguity characterized the Zika virus crisis. To cope, people turned to social media for information gathering and social learning geared towards personal risk assessment and modifying decisions when dealing with partial and conflicting information about Zika. In particular, individuals sought local information and used socially informed logical reasoning to deduce the risk at a specific locale. We conclude with implications for designing information systems to support individual risk assessment and decision-making when faced with uncertainty and ambiguity during public health crises.

> 最近，疾病如甲型H1N1流感、埃博拉病毒和齐卡病毒创造了严重的危机，需要公共资源与个人行为适应。危机信息学研究危机事件中人、组织和IT的相互联系。然而，人们如何使用技术来应对危机（疾病爆发，传染病和流行病）仍然是不足的。我们研究个人如何使用社会媒体在应对病毒爆发，专注于旅游相关的决定。我们发现，极端的不确定性和模糊性特点的齐卡病毒危机。为了应付，人们转向社交媒体信息的采集和社会学习面向个人风险评估和修改的决定在处理部分和相互矛盾的关于Zika的信息。特别是，个人寻求当地信息，并使用社会知情逻辑推理推断特定地点的风险。我们的结论是设计信息系统，以支持个人风险评估和决策时面临的公共卫生危机的不确定性和模糊性。 article link

386. Theory-Driven Collocated CMC: A Study of Collocated Mediated Interaction as a Public Sphere

SESSION:Civic Engagement

Computer-mediated communication (CMC) tools are used to increase social interaction in collocated settings. Recent research has been primarily constructive (oriented to building of systems) or phenomenon-driven (serving attempts to understand interactions in collocated CMC). The paper contributes a theory-driven approach and examines collocated CMC as a Habermasean "public sphere": a space that supports inclusive, civil, and rational discussion. An in-the-wild experimental study comparing CMC with face-to-face (F2F) communication enabled ascertaining that CMC is more inclusive than F2F communication. Respectfulness levels did not differ but were established differently: via collective construction of a common narrative in F2F and through quick reactions in CMC. Similarly, while rationality figures were on a par, F2F communication allowed participants to justify their claims better. The article discusses how a theory-based approach can strengthen phenomenon-driven research with new conceptual frames and measurement tools, and steer constructive research with a normative framework.

> 计算机中介通信（CMC）工具用于增加并置设置中的社会交互。最近的研究主要是建设性的（面向系统的构建）或现象驱动（试图理解并置CMC中的相互作用）。本文的理论方法和研究habermasean配置CMC作为“公共领域”：一个支持包容、民用航天、和理性的讨论。一个在野外实验研究比较CMC与面对面（F2F）通信功能的确定CMC比F2F沟通更具包容性。尊敬的水平没有差异，但分别建立不同：通过在F2F和通过CMC快速反应的共同叙事集体建设。同样的，而理性的数字不相上下，面对面沟通让参与者更好地证明自己的主张。本文讨论了如何以理论为基础的方法，以新的概念框架和测量工具加强现象驱动的研究，并以规范的框架指导建设性的研究。 article link

387. Is Two Enough?: ! Studying Benefits, Barriers, and Biases of Multi-Tablet Use for Collaborative Visualization

SESSION:Cross Device Interaction

A sizable part of HCI research on cross-device interaction is driven by the vision of users conducting complex knowledge work seamlessly across multiple mobile devices. This is based on the Weiserian assumption that people will be inclined to distribute their work across multiple
`pads' if such are available. We observed that this is not the reality today, even when devices were in abundance. We present a study wit`
bias' that introduced barriers for using more tablets and reduced the overall benefit of multi-device visualization.

> 跨设备交互的相当大一部分HCI研究是由用户在多个移动设备上无缝地进行复杂知识的愿景驱动的。这是基于weiserian假设人们会倾向于将他们的工作在多个 垫如果这样可。我们观察到，即使设备充裕，这也不是今天的现实。我们提出了一项研究，24的参与者在12对完成协同可视化任务多达六片。他们可以选择三种不同的可视化类型来回答有关经济数据的问题。任务的设计是为了同时使用平板电脑，无论是链接的还是独立的视图。我们发现用户通常每个用户只使用一块平板电脑。定量和定性分析揭示了一个“遗留偏倚”，它引入了使用更多平板电脑的障碍，降低了多设备可视化的总体效益。 article link

388. LetsPic: Supporting In-situ Collaborative Photography over a Large Physical Space

SESSION:Cross Device Interaction

Recent advances in mobile computing technology have made it increasingly common for collocated users to perform collaborative photography over a large physical space in various group activity scenarios such as field trips, site surveys, and group tours. Unlike traditional collocated interactions in a shared physical space, we find that mobility and group dynamics make awareness of group activities over a large physical space very challenging. In this work, we design LetsPic, a group photoware that supports group awareness for in-situ collaborative photography over the large physical space. We have iteratively built the app and performed user studies in site survey and group tour scenarios (n = 31, n = 24). Our results confirmed that LetsPic effectively promotes group awareness, facilitates group coordination, and encourages collaboration in both scenarios. We discuss practical design implications based on our findings.

> 移动计算技术的最新进展，使得越来越多的用户在不同的群体活动场景（如实地考察、现场调查和团体旅游）中，在一个大的物理空间上进行协作摄影。不同于传统的并置交互在一个共享的物理空间，我们发现，流动性和群体动态使群体活动的认识在一个大的物理空间非常具有挑战性。在这项工作中，我们设计了一个letspic，支持现场协同摄影在大的物理空间组组Photoware意识。我们反复构建应用程序，并在现场调查和团体旅游场景中进行用户研究（N＝31，N＝24）。我们的研究结果证实，letspic有效促进群体意识，促进组协调，并鼓励员工之间的合作，在这两种情况下。根据我们的研究结果，我们讨论了实际设计的含义。 article link

389. XDBrowser 2.0: Semi-Automatic Generation of Cross-Device Interfaces

SESSION:Cross Device Interaction

Several recent studies have highlighted the need to support parallel usage of multiple devices for cross-device use. Yet, most interfaces today are still designed for single-device use and require re-authoring to enable cross-device interaction. This paper presents two studies to inform the design of a new web browser with support for semi-automatic generation of cross-device interfaces. Based on the results of a recent study in which users manually customized web pages for cross-device use, our first study elicits from users how they might want to trigger popular cross-device patterns to transform single-device designs with relatively little effort. Our second study then examines how the emerging design patterns could be applied to the Alexa top 50 sites from 10 different genres. Based on these studies, we design semi-automatic techniques for page segmentation and distribution between multiple devices that can work on many existing web sites and require only minimal user input to switch between different cross-device designs. Finally, we discuss possible extensions to the Chrome web browser to make the techniques available for a wide range of desktop, mobile, and wearable devices, and successfully test them on popular web sites.

> 最近的几项研究强调了支持并行使用多个设备进行跨设备使用的必要性。然而，今天大多数接口仍然设计为单个设备使用，需要重新编写以启用跨设备交互。本文介绍了两项研究，旨在设计一种支持半自动生成跨设备接口的新Web浏览器。根据最近的一项研究结果，用户可以手动定制跨设备使用的Web页面，我们的第一项研究从用户那里引出了他们可能希望触发流行的跨设备模式，以相对较小的努力来改变单个设备的设计。然后，我们的第二个研究探讨了新兴的设计模式如何应用于10种不同类型的Alexa的前50个站点。基于这些研究，我们设计了用于多个设备之间的页面分割和分发的半自动技术，这种方法可以在许多现有Web站点上工作，并且只需要最少的用户输入来在不同的跨设备设计之间进行切换。最后，我们讨论了Chrome浏览器的可能扩展，使这些技术适用于各种桌面、移动和可穿戴设备，并成功地在流行的Web站点上测试它们。 article link

390. Low-Wage Precarious Workers' Sociotechnical Practices Working Towards Addressing Wage Theft

SESSION:Crowdwork

Nearly 40 million workers in the USA, a third of the working population, are low-wage, meaning they make less than $11.65 per hour. These workers face the pervasive and detrimental challenge of wage violations, also known as wage theft, which is any illegal activity by an employer that denies benefits or wages to employees. We interviewed 24 low-wage workers who experienced wage theft and sought justice about their work practices, challenges, and information technology usage. Based on these interviews, we identify three key sociotechnical practices these workers engaged in to address their wage theft: 1)identifying wage and payment discrepancies; 2)tracking and documenting work; and 3)pursuing wage claims. Seeking to leverage HCI research to interrupt uneven social, economic, and information relations in the low-wage workplace, we ultimately reflect on the possibility and limits of several key design recommendations.

> 美国近4000万名工人是工人的第三，他们的工资很低，这意味着他们每小时挣不到11.65美元。这些工人面临着普遍的和有害的违反工资的挑战，也称为工资盗窃，这是雇主否认雇员福利或工资的任何非法活动。我们采访了24名工资低的工人，他们经历了工资盗窃，并就他们的工作做法、挑战和信息技术使用寻求公正。基于这些访谈，我们确定了三个关键的技术实践这些工人从事解决他们的工资盗窃：1）确定工资支付的差异；2）跟踪和记录工作；3）追求的工资要求。为了利用HCI研究来打破低工资工作场所的社会、经济和信息的不平衡，我们最终考虑了几个关键设计建议的可能性和局限性。 article link

391. Examining Crowd Work and Gig Work Through The Historical Lens of Piecework

SESSION:Crowdwork

The internet is empowering the rise of crowd work, gig work, and other forms of on-demand labor. A large and growing body of scholarship has attempted to predict the socio-technical outcomes of this shift, especially addressing three questions: 1) What are the complexity limits of on-demand work?, 2) How far can work be decomposed into smaller microtasks?, and 3) What will work and the place of work look like for workers? In this paper, we look to the historical scholarship on piecework — a similar trend of work decomposition, distribution, and payment that was popular at the turn of the 20th century — to understand how these questions might play out with modern on-demand work. We identify the mechanisms that enabled and limited piecework historically, and identify whether on-demand work faces the same pitfalls or might differentiate itself. This approach introduces theoretical grounding that can help address some of the most persistent questions in crowd work, and suggests design interventions that learn from history rather than repeat it.

> 互联网赋予了群众工作、工作和其他形式的按需劳动的兴起。一个庞大和不断增长的学术团体试图预测这一转变的社会技术成果，特别是解决三个问题：1）按需工作的复杂性限制是什么？2），多少可以被分解成更小的microtasks？3）工人的工作和工作地点是什么样的？在本文中，我们期待在计件的工作分解，类似趋势的历史奖学金分配，支付在

> 第二十世纪之交是很了解这些问题可能会与现代需求的工作。我们确定的机制，使有限的工作历史上，并确定是否按需工作面临着同样的陷阱或可能脱颖而出。这种方法引入了理论基础，有助于解决人群工作中一些最持久的问题，并建议从历史中学习而非重复的设计干预措施。 article link

392. Leveraging Complementary Contributions of Different Workers for Efficient Crowdsourcing of Video Captions

SESSION:Crowdwork

Hearing-impaired people and non-native speakers rely on captions for access to video content, yet most videos remain uncaptioned or have machine-generated captions with high error rates. In this paper, we present the design, implementation and evaluation of BandCaption, a system that combines automatic speech recognition with input from crowd workers to provide a cost-efficient captioning solution for accessible online videos. We consider four stakeholder groups as our source of crowd workers: (i) individuals with hearing impairments, (ii) second-language speakers with low proficiency, (iii) second-language speakers with high proficiency, and (iv) native speakers. Each group has different abilities and incentives, which our workflow leverages. Our findings show that BandCaption enables crowd workers who have different needs and strengths to accomplish micro-tasks and make complementary contributions. Based on our results, we outline opportunities for future research and provide design suggestions to deliver cost-efficient captioning solutions.

> 听力受损的人和非英语母语的人依靠接入视频内容的标题，但大多数视频保持uncaptioned或机器生成的高错误率的标题。在本文中，我们提出的设计，实施和评价的系统bandcaption，结合人群工人输入自动语音识别提供一个符合成本效益的解决方案访问在线视频字幕。我们认为四个利益相关者群体是我们人群工作者的来源：（一）有听力障碍的个人；（二）熟练程度低的第二语言者；（三）熟练掌握第二语言的人；（四）母语为英语的人。每个团队都有不同的能力和激励机制，我们的工作流程利用了这些能力。我们的研究结果表明，人群bandcaption使工人有不同的需要和优势来完成微任务并使互补的贡献。根据我们的结果，我们勾勒出未来的研究机会和提供成本有效的字幕解决方案提供设计建议。 article link

393. Critique Style Guide: Improving Crowdsourced Design Feedback with a Natural Language Model

SESSION:Crowdwork

Designers are increasingly leveraging online crowds; yet, online contributors may lack the expertise, context, and sensitivity to provide effective critique. Rubrics help feedback providers but require domain experts to write them and may not generalize across design domains. This paper introduces and tests a novel semi-automated method to support feedback providers by analyzing feedback language. In our first study, 52 students from two design courses created design solutions and received feedback from 176 online providers. Instructors, students, and crowd contributors rated the helpfulness of each feedback response. From this data, an algorithm extracted a set of natural language features (e.g., specificity, sentiment etc.) that correlated with the ratings. The features accurately predicted the ratings and remained stable across different raters and design solutions. Based on these features, we produced a critique style guide with feedback examples - automatically selected for each feature - to help providers revise their feedback through self-assessment. In a second study, we tested the validity of the guide through a between-subjects experiment (n=50). Providers wrote feedback on design solutions with or without the guide. Providers generated feedback with higher perceived helpfulness when using our style-based guidance.

> 设计师们越来越多地利用网络人群；然而，在线投稿人可能缺乏提供有效批评的专业知识、上下文和敏感度。量规帮助反馈供应商但需要领域专家写的，不能概括整个设计领域。本文介绍并测试了一种通过反馈语言分析来支持反馈提供者的半自动方法。在我们的第一项研究中，来自两个设计课程的52名学生创建了设计解决方案，并收到了176家在线提供商的反馈。教师，学生，和人群贡献额定每个反馈的响应性。从这些数据中，算法提取了一组与评分相关的自然语言特征（例如，特异性、情感等）。的特点，准确预测了收视率和保持稳定在不同的评级机构和设计解决方案。基于这些特性，我们制作了一个评论风格指南，反馈示例-自动选择每个功能——帮助提供者通过自我评估修改反馈。在第二项研究中，我们通过一个受试者实验（N＝50）测试了该指南的有效性。提供商写了关于设计解决方案的反馈。供应商生成的反馈具有较高的感知乐于助人，用我们的风格为基础的指导。 article link

394. ProbUI: Generalising Touch Target Representations to Enable Declarative Gesture Definition for Probabilistic GUIs

SESSION:Improving Touch Interfaces

We presentProbUI, a mobile touch GUI framework that merges ease of use of declarative gesture definition with the benefits of probabilistic reasoning. It helps developers to handle uncertain input and implement feedback and GUI adaptations.ProbUIreplaces today's static target models (bounding boxes) with probabilistic gestures ("bounding behaviours"). It is the first touch GUI framework to unite concepts from three areas of related work: 1) Developersdeclaratively definetouch behaviours for GUI targets. As a key insight, the declarations imply simple probabilistic models (HMMs with 2D Gaussian emissions). 2)ProbUIderives these models automatically toevaluateusers' touch sequences. 3) It theninfersintended behaviour and target. Developers bind callbacks to gesture progress, completion, and other conditions. We showProbUI's value by implementing existing and novel widgets, and report developer feedback from a survey and a lab study.

> 我们presentprobui，移动触摸的GUI框架，融合与概率推理的好处陈述手势定义易用。它可以帮助开发人员处理不确定的输入和执行反馈和GUI adaptations.probuireplaces今天的静态目标模型（盒）与概率的手势（“包围”行为）。这是第一次接触GUI框架的统一概念从相关工作三个方面：1）developersdeclaratively definetouch GUI对象的行为。作为一个关键的洞察力，声明意味着简单的概率模型（二维高斯排放HMM）。2）probuiderives这些模型自动toevaluateusers触摸序列。3）它theninfersintended行为和目标。开发商绑定回调的姿态发展，完成，和其他条件。我们showprobui价值实现现有的和新的部件，和开发商的反馈报告和实验室研究。 article link

395. BackXPress: Using Back-of-Device Finger Pressure to Augment Touchscreen Input on Smartphones

SESSION:Improving Touch Interfaces

When people hold their smartphone in landscape orientation, they use their thumbs for input on the frontal touchscreen, while their remaining fingers rest on the back of the device (BoD) to stabilize the grip. We presentBackXPress, a new interaction technique that lets users create BoD pressure input with these remaining fingers to augment their interaction with the touchscreen on the front: Users can apply various pressure levels with each of these fingers to enter different temporary "quasi-modes" that are only active as long as that pressure is applied. Both thumbs can then interact with the frontal screen in that mode. We illustrate the practicality of BackXPress with several sample applications, and report our results from three user studies: Study 1 investigated which fingers can be used to exert BoD pressure and found index, middle, and ring finger from both hands to be practical. Study 2 revealed how pressure touches from these six fingers are distributed across the BoD. Study 3 examined user performance for applying BoD pressure (a) during single touches at the front and (b) for 20 seconds while touching multiple consecutive frontal targets. Participants achieved up to 92% pressure accuracy for three separate pressure levels above normal resting pressure, with the middle fingers providing the highest accuracy. BoD pressure did not affect frontal touch accuracy. We conclude with design guidelines for BoD pressure input.

> 当人们手持智能手机时，他们会用拇指在正面触摸屏上输入信息，而剩下的手指则停留在设备的后部，以稳定手柄。我们presentbackxpress，一个新的互动技术，可以让用户创建BOD压力输入这些剩余的手指来增强其作用与前面的触摸屏：用户可以应用不同的压力水平与这些手指进入不同的临时"准模式"，只有主动只要是施加的压力。然后，拇指可以在这种模式下与正面屏幕交互。我们用几个简单的应用backxpress的实用性，并报告我们的结果从三个用户研究：研究1研究手指可以施加压力，发现指标BOD，中间，和无名指从双手是可行的。研究2揭示了如何从这六个手指接触压力分布在BOD。研究3考察了用户在单点触摸时应用BOD压力（A）时的性能，以及在接触多个连续的正面目标时的20秒（b）。参与者在三个单独的压力水平上达到了92%的压力精确度，而中指提供了最高的精确度。BOD压力不影响正面接触准确性。我们的结论与BOD输入压力的设计准则。 article link

396. Improving Gesture Recognition Accuracy on Touch Screens for Users with Low Vision

SESSION:Improving Touch Interfaces

We contribute in this work on gesture recognition to improve the accessibility of touch screens for people with low vision. We examine the accuracy of popular recognizers for gestures produced by people with and without visual impairments, and we show that the user-independent accuracy of $P, the best recognizer among those evaluated, is small for people with low vision (83.8%), despite $P being very effective for gestures produced by people without visual impairments (95.9%). By carefully analyzing the gesture articulations produced by people with low vision, we inform key algorithmic revisions for the P recognizer, which we call P+. We show significant accuracy improvements of $P+ for gestures produced by people with low vision, from 83.8% to 94.7% on average and up to 98.2%, and 3x faster execution times compared to P.

> 我们在这项工作中进行手势识别，以改善低视力人群触摸屏的可及性。我们研究人的手势识别的精度产生的流行和无视觉障碍，我们表明，P用户独立的准确性，在这些评估的最佳识别器，小与低视力的人（83.8%），尽管P能很有效的无视觉障碍的人产生的手势（95.9%）。通过仔细分析与低视力的人产生的手势表达，我们通知关键算法修改为P系统，我们称之为P +。我们的视力低下的人产生手势$ P +显著的准确性的改善，从83.8%到94.7%，平均高达98.2%，和3倍更快的执行时间相比，P. article link

397. Understanding Grip Shifts: How Form Factors Impact Hand Movements on Mobile Phones

SESSION:Improving Touch Interfaces

In this paper we present an investigation into how hand usage is affected by different mobile phone form factors. Our initial (qualitative) study explored how users interact with various mobile phone types (touchscreen, physical keyboard and stylus). The analysis of the videos revealed that each type of mobile phone affords specific handgrips and that the user shifts these grips and consequently the tilt and rotation of the phone depending on the context of interaction. In order to further investigate the tilt and rotation effects we conducted a controlled quantitative study in which we varied the size of the phone and the type of grips (Symmetric bimanual, Asymmetric bimanual with finger, Asymmetric bimanual with thumb and Single handed) to better understand how they affect the tilt and rotation during a dual pointing task. The results showed that the size of the phone does have a consequence and that the distance needed to reach action items affects the phones' tilt and rotation. Additionally, we found that the amount of tilt, rotation and reach required corresponded with the participant's grip preference. We finish the paper by discussing the design lessons for mobile UI and proposing design guidelines and applications for these insights.

> 在本文中，我们提出了一个调查如何手的使用受到不同的手机形式因素的影响。我们的初步（定性）研究探讨了用户如何与各种移动电话类型（触摸屏、物理键盘和触笔）进行交互。视频的分析发现，每种类型的手机提供了特定的手柄，用户将这些握把，因此手机取决于互动的背景下，倾斜和旋转。为了进一步探讨倾斜和旋转的影响进行了定量研究，控制不同的手机和握把大小类型（对称的双手，双手手指不对称，不对称的双手拇指和单手）更好地理解它们是如何影响的倾斜和旋转双指向任务中。结果表明，手机的大小确实有影响，而到达行动项目所需的距离影响手机的倾斜和旋转。此外，我们发现，倾斜，旋转和到达所需的量与参与者的握力偏好。我们通过讨论移动UI的设计经验，并提出这些见解的设计准则和应用程序来完成这篇论文。 article link

398. Structured Input Improves Usability and Precision for Solving Geometry-based Algebraic Problems

SESSION:Innovative Input Techniques

Previous research has shown that sketch-based input is efficient and preferable in the context of algebraic equation solving. However, research has not been conducted to evaluate whether this holds true when involving geometry input to facilitate quantitative problem-solving. We developed a bimodal (graphing geometric shapes and writing algebraic expressions) user interface, in order to conduct a within-subject, controlled experiment with 24 college students and varied two types of geometry input: 1) sketch-based input and 2) structured input. The sketch-based input was significantly faster than the structured input, but there were no significant differences based on perception and cognition. However, after a post-hoc analysis, we found a significant interaction effect on perception between prior knowledge and geometry input. Novice students preferred the sketch-based input, but advanced students preferred the structured input. Our study implies that natural sketch-based input may be less preferable than structured input for geometry-based interfaces toward math problem-solving.

> 以前的研究已经表明，基于草图的输入在代数方程求解中是有效且可取的。然而，还没有进行研究，以评估几何输入是否有助于定量解决问题。我们开发了一个双峰（绘制几何图形和编写代数表达式）用户界面，以便对24名大学生进行一个主题、控制实验和两种不同类型的几何输入：1）基于草图的输入和2）结构化输入。基于草图的输入明显快于结构化输入，但基于感知和认知的输入没有显著差异。然而，经过一次事后分析，我们发现先验知识和几何输入之间存在显著的相互影响。新手喜欢素描输入，但高级学生更喜欢结构化输入。我们的研究表明，基于几何草图的输入可能比基于几何输入的结构输入更不适合数学解题。 article link

399. Genie: Input Retargeting on the Web through Command Reverse Engineering

SESSION:Innovative Input Techniques

Most web applications are designed as one-size-fits-all, despite considerable variation in people's expertise, physical abilities, and other factors that impact interaction. For example, some web applications require the use of a mouse, precluding use by many people with severe motor disabilities. Other applications require laborious manual input that a skilled developer could automate if the application were scriptable. This paper presents Genie, a system that automatically reverse engineers an abstract model of the underlying commands in a web application, then enables interaction with that functionality through alternative interfaces and other input modalities (e.g., speech, keyboard, or command line input). Genie comprises an abstract model of command properties, behaviors, and dependencies as well as algorithms that reverse engineer this model from an existing web application through static and dynamic program analysis. We evaluate Genie by developing several interfaces that automatically add support for speech, keyboard, and command line input to arbitrary web applications.

> 尽管人们的专业知识、身体能力以及影响交互的其他因素都有很大的变化，但大多数Web应用程序都设计成一个适合所有人的应用程序。例如，一些Web应用程序需要使用一

> 个鼠标，而使用的许多人有严重的运动障碍。其他应用程序需要费力的手工输入，一个熟练的开发人员可以自动化如果应用程序脚本。本文提出了一种自动地将工程师的基本模型抽象为Web应用程序的抽象模型的系统，然后通过可选接口和其他输入方式（例如，语音、键盘或命令行输入）实现与该功能的交互。精灵包含了一个抽象的命令属性、行为和依赖模型，以及通过静态和动态程序分析逆向工程从现有的Web应用程序中提取这个模型的算法。我们通过开发多个接口来自动评估对任意Web应用程序的语音、键盘和命令行输入的支持。 article link

400. IconHK: Using Toolbar button Icons to Communicate Keyboard Shortcuts

SESSION:Innovative Input Techniques

We propose a novel perspective on the design of toolbar buttons that aims to increase keyboard shortcut accessibility. IconHK implements this perspective by blending visual cues that convey keyboard shortcut information into toolbar buttons without denaturing the pictorial representation of their command. We introduce three design strategies to embed the hotkey, a visual encoding to convey the modifiers, and a magnification factor that determines the blending ratio between the pictogram of the button and the visual representation of the keyboard shortcut. Two studies examine the benefits of IconHK for end-users and provide insights from professional designers on the practicality of our approach for creating iconsets. Building on these insights, we develop a tool to assist designers in applying the IconHK design principle.

> 我们提出了一种设计工具栏按钮的新视角，旨在提高键盘快捷方式的可访问性。iconhk实现这个视角的混合视觉线索，传达信息到键盘快捷工具栏按钮没有变性的命令的图形表示。我们介绍三种设计策略嵌入热键，视觉编码传达的改性剂，以及放大倍数，确定配比的按钮图像和视觉表现之间的键盘快捷键。两研究iconhk为最终用户提供的好处，对我们的方法的实用性的专业设计师创造iconsets见解。这些见解的基础上，我们开发了一个工具，帮助设计师在应用iconhk设计原则。 article link

401. Mouse, Tactile, and Tangible Input for 3D Manipulation

SESSION:Innovative Input Techniques

We evaluate the performance and usability of mouse-based, touch-based, and tangible interaction for manipulating objects in a 3D virtual environment. This comparison is a step toward a better understanding of the limitations and benefits of these existing interaction techniques, with the ultimate goal of facilitating an easy transition between the different 3D data exploration environments. For this purpose we analyze participants' performance in 3D manipulation using a docking task. We measured completion times, docking accuracy, as well as subjective criteria such as fatigue, workload, and preference. Our results show that the three input modalities provide similar levels of precision but require different completion times. We also discuss our qualitative observations as well as people's preferences and put our findings into context of the application domain of 3D data analysis environments.

> 我们评估了基于鼠标、基于触摸和有形交互的操作和可用性在3D虚拟环境中操作对象的性能和可用性。这种比较是朝着更好地理解这些现有交互技术的局限性和好处所迈出的一步，其最终目标是促进不同的3D数据勘探环境之间的轻松过渡。为此，我们使用对接任务分析参与者在3D操作中的表现。我们测量了完成时间、对接精度以及主观标准，如疲劳、工作量和偏好。我们的结果表明，三种输入方式提供了类似的精度水平，但需要不同的完成时间。我们还讨论了我们的定性观察以及人们的偏好，并将我们的发现应用到三维数据分析环境的应用领域中。 article link

402. Market Practices and the Bazaar: Technology Consumption in ICT Markets in the Global South

SESSION:Markets in the Global South

Local informal markets or bazaars play a central role in embedding the adoption, consumption, and reproduction of digital technologies within the economic and cultural fabric of the Global South. This paper presents ethnographic accounts of informal ICT markets in two sites, one in India and the other in Bangladesh, and assesses how technology consumption unfolds within local practices. Building on social practice theory, this paper depicts the role of materiality, relationships, and situated knowledge in the functioning of a bazaar. We discuss how this knowledge expands our understanding of the evaluation of technology and technical expertise, and the persistence of these informal spaces despite the uptake of corporatized technology marketplaces. We argue that the bazaar represents a special kind of local voice that enriches the HCI scholarship in postcolonial computing.

> 当地的非正规市场或集贸市场嵌入通过消费，发挥核心作用和再现数字技术在全球南方经济和文化结构。本文介绍了两个地点的非正式信息和通信技术市场的人种学统计，一个在印度，另一个在孟加拉，评估技术消费如何在当地实践中展开。本文以社会实践理论为基础，阐述了物质性、关系性和情境性知识在集市运作中的作用。我们讨论了这方面的知识，扩大了我们的技术和专业技术的评价的认识，并坚持这些非正式的空间，尽管市场化技术的吸收。我们认为，集市是一种特殊的地方声音，丰富了后殖民计算中的HCI奖学金。 article link

403. Cinehacking Cape Town - Embracing Informality in Pursuit of High Quality Media

SESSION:Markets in the Global South

Although many common tools of media making such as video cameras have become more accessible in recent years, many remain inaccessible. Cinematography, lighting and sound-recording equipment for example can be prohibitively expensive to obtain, complex to configure, and/or require specialist knowledge to operate effectively. These barriers can prevent non-professionals who want to produce high-quality media from being able to. Cinehack is an ongoing project to research ways to overcome these barriers. In this paper, we specifically report on Cinehack: Cape Town, a participatory media making project. By co-producing hip hop videos within a community for whom media making is often a "means-to-an-end", we were able gain insights into the kinds of support needed to enable high quality media making by non-professionals. Specifically, we highlight ways to meet users' needs by embracing informal codes of practice via experimental making and peer-support.

> 尽管近年来，诸如摄像机之类的媒体制作工具越来越普及，但仍有许多工具无法访问。摄影，照明和录音设备，例如，可能是昂贵的获得，复杂配置，和/或需要专业知识有效地运作。这些障碍可以防止非专业人士，希望能够生产高品质的媒体，能够。cinehack是研究如何克服这些障碍的一个正在进行的项目。在本文中，我们特别报道：开普敦cinehack，参与式媒体制作项目。通过在社区内共同制作嘻哈视频，媒体制作常常是“达到目的”的一种手段，我们可以深入了解支持非专业人士制作高质量媒体所需要的各种支持。具体来说，我们强调如何通过实验制定和同行支持，通过非正式的实践规范来满足用户的需求。 article link

404. Informality and Invisibility: Traditional Technologies as Tools for Collaboration in an Informal Market

SESSION:Markets in the Global South

This paper explores how actors in local markets in the Global South adapt traditional communication technologies to successfully collaborate to sustain the markets and their business practices. Drawing on ethnographic observations at a local technology goods market in Bangalore, India, the study details the use of a landline telephone intercom system as the primary tool for business communication in the market. Through analyzing how the intercom system relates to informality and physical space, the paper argues that it bridges the formal with the informal, and helps facilitate informal business practices while also allowing them to remain hidden from the formal regulatory gaze of the state.

> 本文探讨了如何在全球南部地区市场的演员适应传统的通信技术，成功地合作，以维持市场和他们的业务做法。在借鉴班加罗尔、印度当地的一家技术产品市场上的田野观察，研究细节的座机电话对讲系统的使用对于企业的市场沟通的主要工具。通过对楼宇对讲系统涉及的正规性和物理空间，本文认为，桥梁的非正式的形式，并有助于促进非正式的商业实践，同时也让他们继续隐藏来自国家的正式监管视线。 article link

405. From Margins to Seams: Imbrication, Inclusion, and Torque in the Aadhaar Identification Project

SESSION:Markets in the Global South

Problems of marginalization and inclusion are central to HCI scholarship and impact in the world, but are badly named in the binary models of access that currently dominate the field. Building on prior work in ICTD and infrastructure studies, this paper explores the problem of inclusion through historical and ethnographic study of Aadhaar, India's biometrics-based national identification project. We illustrate tensions between Aadhaar users' ability to register, authenticate and successfully deploy their registered identity to participate in the Public Distribution System (PDS), a government scheme that provides subsidized food grains to the Indian poor. We argue that rather than an all-or-nothing state, inclusion in ICTD infrastructures is an ongoing and fragile process, achieved (unevenly) at the seams of multiple interconnected systems. Finally, we show that questions of (effective) inclusion are determined not just at margins of a system (who is in and who is out) but also through the artful and often challenging negotiation of the seams that run through and connect complex distributed infrastructures.

> 边缘化和包容性的问题是HCI奖学金和世界影响的核心，但在目前占主导地位的二元访问模式中被严重地命名。在ICTD，基础设施研究的前期工作的基础，本文通过历史和民族志研究，包含Aadhaar问题，印度的生物识别技术为基础的国家鉴定项目。我们说明Aadhaar用户能够登记之间的紧张关系，验证并成功地部署他们的注册身份参与公共分配系统（PDS），政府计划，到印度穷人提供补贴的粮食。我们认为，而不是一个全或无的状态，在信息和通信技术促进发展基础设施纳入是一个持续的和脆弱的过程，实现了（不均匀）在多个互联系统的接缝。最后，我们证明了有效（包含）包含的问题不仅取决于系统的边缘（谁是谁和谁是谁），而且还取决于贯穿和连接复杂分布式基础设施的接缝的巧妙和通常具有挑战性的谈判。 article link

406. Performing Research: Four Contributions to HCI

SESSION:Performative Interactions

This paper identifies a body of HCI research wherein the researchers take part in digitally mediated creative experiences alongside participants. We present our definition and rationale for "self-situated performance research" based on theories in both the HCI and performance literatures. We then analyse four case studies of this type of work, ranging from overtly "performative" staged events to locative audio and public making.We argue that by interrogating experience from within the context of self-situated performance, the 'performer/researcher' extends traditional practices in HCI in the following four ways: developing an intimate relationship between researchers and participants, providing new means of making sense of interactions, shaping participants' relationship to the research, and enabling researchers to refine their work as it is being conducted.

> 本文确定了一个人机交互研究的机构，研究人员参与了参与者的数字引导的创造性体验。我们根据人机交互理论和性能文献提出了“自我定位性能研究”的定义和基本原理。我们分析了四个这类工作的案例研究，从公开的“表演”上演的事件对处所音频和公共决策。我们认为，通过询问体验内在自我情境绩效的背景下，“演员/研究员的延伸在HCI的传统做法，在以下四个方面：发展的研究者和参与者之间一个亲密的关系，提供有意义的互动的新方式，塑造参与者的关系的研究，使研究人员对它进行改进他们的工作。 article link

407. MagicFace: Stepping into Character through an Augmented Reality Mirror

SESSION:Performative Interactions

Augmented Reality (AR) is coming of age and appearing in various smartphone apps. One emerging AR type uses the front-facing camera and overlays a user's face with digital features that transform the physical appearance, making the user look like someone else, such as a popstar or a historical character. However, little is known about how people react to such stepping into character and how convincing they perceive it to be. We developed an app with two Egyptian looks, MagicFace, which was situated both in an opera house and a museum. In the first setting, people were invited to use the app, while in the second setting they came across it on their own when visiting the exhibition. Our findings show marked differences in how people approach and experience the MagicFace in these different contexts. We discuss how realistic and compelling this kind of AR technology is, as well as its implications for educational and cultural settings.

> 增强现实（AR）已经成熟，出现在各种智能手机应用程序中。一个新兴的AR型采用前置摄像头和覆盖用户的面部特征，数字变换的外表，让用户看起来像其他人，如明星或历史人物。然而，人们很少知道人们对这种性格的反应，以及他们对自己的看法是多么有说服力。我们开发了两magicface埃及看起来，一个应用程序，这是坐落在一个歌剧院和博物馆。在第一个场景中，人们被邀请使用这个应用程序，而在第二个场景中，他们在参观展览会时自己发现了这个应用程序。我们的研究结果显示显着的差异，在人们如何对待这些不同的情况下magicface经验。我们讨论了这种AR技术的现实性和吸引力，以及它对教育和文化环境的影响。 article link

408. Interactive Performance as a Means of Civic Dialogue

SESSION:Performative Interactions

This paper presents a case study of an interactive performance that was produced and designed to encourage civic engagement and reflection in relation to the social tensions in a low-income suburb, mostly inhabited by people with immigrant backgrounds. The design of the technological setup in the performance encouraged participation by means of text entries that audience members could share with others. The analysis draws on the corpus of interview and observational data collected, as well as the related text messages that were shared during the performance. We illustrate the different levels at which citizens make sense of societal issues they are concerned about, as well as the audience-citizens' perception of participating in such an artistic experience.

> 本文提出了一个互动表演的案例研究，它的产生和设计是为了鼓励公民参与和反思低收入郊区的社会紧张局势，这些郊区居民大多居住在移民背景中。演出中的技术设置鼓励观众通过与他人分享的文本条目参与。分析采用了收集的访谈和观察数据的语料，以及在演出期间共享的相关文本信息。我们说明了公民对他们所关心的社会问题的理解的不同层次，以及观众对参与这种艺术体验的看法。 article link

409. The Game of Performing Play: Understanding Streaming as Cultural Production

SESSION:Performative Interactions

Live streaming has become pervasive in digital game culture. Previous work has focused largely on technological considerations in streaming platforms. However, little is known about how streamers enter the practice, gain skills, and operate as content producers. We present a qualitative study of an online forum dedicated to streaming. By observing the conversations between veterans and newcomers to the practice, we develop an understanding of how streamers must tie together technological, social, and gameplay-based skills to craft an appealing performance of play. We find that a key skill in streaming is the development of a unique attitude and persona as a gamer, which permeates into every element of a streamer's performance. As individual identity becomes important in streaming practice, design considerations for platform features such as community moderation and stream metrics may help improve equitable participation in this increasingly important aspect of game culture.

> 直播在数字游戏文化中已经普及。以前的工作主要集中在流媒体平台的技术考虑上。然而，关于彩带如何进入实践、获取技能和作为内容生产者的操作，人们知之甚少。我们对一个致力于流媒体的在线论坛进行了定性研究。通过观察老兵和新手之间的对话，我们了解了横幅是如何将技术、社交和游戏技巧结合在一起的，从而产生一种吸引人的表演。我们发现流媒体的一项关键技能是开发一个独特的态度和角色，作为一个玩家，它渗透到流光演出的每一个元素中。随着个人身份在流媒体实践中的重要性，平台特性（如社区适度性和流度量）的设计考虑可能有助于提高公平参与游戏文化这一日益重要的方面。 article link

410. Finding the Right Fit: Understanding Health Tracking in Workplace Wellness Programs

SESSION:Serious + Educational + Exer Games

Workplace health and wellness programs are increasingly integrating personal health tracking technologies, such as Fitbit and Apple Watch. Many question whether these technologies truly support employees in their pursuit of better wellness levels, raising objections about workplace surveillance and further blurring of boundaries between work and personal life. We conducted a study to understand how tracking tools are adopted in wellness programs and employees' opinions about these programs. We find that employees are generally positive about incentivized health tracking in the workplace, as it helps raise awareness of activity levels. However, there is a gap between the intentions of the programs and individual experiences and health goals. This sometimes results in confusion and creates barriers to participation. Even if this gap can be addressed, health tracking in the workplace will not be for everyone; this has implications for the design of both workplace wellness programs and tracking technologies.

> 工作场所的卫生和健康计划越来越整合个人健康跟踪技术，如Fitbit和苹果手表。许多人质疑这些技术是否真正支持员工追求更好的健康水平，提出了对工作场所监视的异议，并进一步模糊了工作和个人生活之间的界限。我们进行了一项研究，以了解跟踪工具是如何通过的健康计划和员工对这些计划的意见。我们发现，员工一般是在工作场所积极鼓励健康的跟踪，因为它有助于提高活动水平的意识。然而，计划的意图与个人经验和健康目标之间存在着差距。这有时会造成混乱，造成参与的障碍。即使这种差距能够得到解决，工作场所的健康追踪也不会对每个人都有好处，这会对职场健康计划和跟踪技术的设计产生影响。 article link

411. Mastery Learning of Second Language through Asynchronous Modeling of Native Speakers in a Collaborative Mobile Game

SESSION:Serious + Educational + Exer Games

Acquiring Chinese tones is often considered as the most difficult task in learning Chinese as a Second Language (CSL). Recently, ToneWars, a collaborative mobile learning game, demonstrated the feasibility and efficacy of connecting CSL learners with native speakers for tone learning. However, the synchronous gameplay nature in ToneWars can be hard to scale due to the time constraint and limited availability of native speakers. We present principled research to make ToneWarsscalableandsustainable. First, we address the scalability issue via asynchronous modeling of native speakers. Second, we quantify whether a CSL learner achieves native level mastery for a specific phrase, and explore the use of fine-grained feedback on language mastery as a sustainable motivator for language learning. The insights in this research are generalizable to designing second language learning technologies beyond Chinese. In a longitudinal study with 18 CSL learners, we found that asynchronous gameplay significantly improved learning with an average gain of 29.7 tones and 16.4 syllables, and helped participants achieve native level mastery on 58.2 out of 69 phrases.

> 汉语声调习得一直被认为是汉语作为第二语言学习中最困难的任务。最近，tonewars，协作学习手机游戏，显示连接留学生与声调学习母语的可行性和疗效。然而，在ToneWars同步游戏自然难以规模由于时间约束和母语的局限性。我们提出了原则性的研究使tonewarsscalableandsustainable。首先，我们通过对母语者的异步建模来解决可伸缩性问题。第二，我们量化一个CSL学习者是否达到了某个短语的母语水平，并探讨了如何使用细粒度反馈作为语言学习的可持续动力。本研究的见解，于第二语言学习技术超越中国设计。在18名CSL学习者的纵向研究中，我们发现异步游戏显著地改善了学习，平均增益为29.7个音调和16.4个音节，并帮助参与者在69个短语中的58.2个达到母语水平。 article link

412. Misrepresentation of Health Research in Exertion Games Literature

SESSION:Serious + Educational + Exer Games

HCI often requires scholars to build upon research from fields outside their expertise, creating the risk that foundational work is misunderstood and misrepresented. The prevailing goal of "exergames" research towards ameliorating obesity appears to be built on just such a misunderstanding of health research. In this paper, we analyse all citations to a single influential study, which has been extensively cited to justify research on exergames. We categorise the 375 citations based on whether they represent the findings of that study accurately or inaccurately. Our findings suggest that 69% of exergames papers citing this study misrepresent the findings, demonstrating a systematic failure of scholarship in exergames research. We argue that exergaming research should cease focusing on games as treatment for obesity, and that HCI publications should demand more critical and scholarly engagement with research from outside HCI.

> 人机交互往往需要学者建立在研究在专业领域，创建基础工作的误解和歪曲的风险。“exergames”研究对改善肥胖流行的目标似乎是建立在这样一个误区，健康研究。在本文中，我们分析的所有引用一个有影响力的研究，它已被广泛引用来证明研究exergames。我们将根据他们是否代表这项研究的准确或不准确的结果的引用375。我们的研究结果表明，69%的论文引用本研究exergames歪曲结果，证明在exergames研究奖学金系统故障。我们认为，研究应该停止专注于健身游戏治疗肥胖和HCI出版物应该要求更多批判的学术与外界接触人机交互研究。 article link

413. Teaching Programming with Gamified Semantics

SESSION:Serious + Educational + Exer Games

Dominant approaches to programming education emphasize program construction over language comprehension. We presentReduct, an educational game embodying a new, comprehension-first approach to teaching novices core programming concepts which include functions, Booleans, equality, conditionals, and mapping functions over sets. In this novel teaching strategy, the player executes code using reduction-based operational semantics. During gameplay, code representations fade from concrete, block-based graphics to the actual syntax of JavaScript ES2015. We describe our design rationale and report on the results of a study evaluating the efficacy of our approach on young adults (18+) without prior coding experience. In a short timeframe, novices demonstrated promising learning of core concepts expressed in actual JavaScript. We also present results from an online deployment. Finally, we discuss ramifications for the design of future computational thinking games.

> 程序设计教育的主要途径是注重语言理解的程序建构。我们presentreduct，教育游戏的体现新的教学方法，理解第一个新手核心编程概念，包括函数、布尔型、平等、条件句和映射函数集。在这种新的教学策略中，播放器使用基于归约的操作语义执行代码。在游戏中，代码表示褪色的混凝土，基于块的图形es2015 JavaScript的实际语法。我们描述了我们的设计原理和报告的结果，评估我们的方法对年轻人（18 +）没有事先编码经验的有效性。在短时间内，新手表现出有希望的学习在实际JavaScript中表达的核心概念。我们还展示了在线部署的结果。最后，我们将讨论未来计算思维游戏的设计结果。 article link

414. Investigating the Suitability of the Asynchronous, Remote, Community-based Method for Pregnant and New Mothers

SESSION:Technology in Households

Traditional qualitative research methods, such as, interviews and focus groups, may not be feasible for certain populations- who face time, mobility, and availability constraints. We adapted the Asynchronous, Remote, Community-based (ARC) method that used closed Facebook groups to study people with rare diseases, to study a different population - pregnant and new mothers. During the course of eight weeks, we engaged 48 participants in 19 study activities using three closed Facebook groups. We added new activities to the original ARC method, informed by past HCI research, to triangulate participant input. We carefully analyzed participation patterns and activity engagement, to assess the suitability of the ARC method for engaging pregnant and new mothers in remote, group-based, qualitative research. We provide an in-depth analysis of the ARC method, noting participation characteristics, activity preferences, and the suitability of the ARC method as an online focus group.

> 传统的定性研究方法，如访谈和焦点小组，对于某些面对时间、流动性和可用性约束的人群可能是不可行的。我们采用了异步、远程、基于社区的方法，用封闭的脸谱网小组研究患有罕见疾病的人，研究不同人群——怀孕和新妈妈。在八周的过程中，我们用三个封闭的脸谱网小组参与了19项研究活动的48名参与者。我们增加了新的活动，原弧的方法，了解过去的人机交互研究，确定参与者输入。我们仔细分析了参与模式和活动参与，以评估ARC方法对孕妇和新妈妈进行远程、基于群体和定性研究的适宜性。我们提供了ARC方法的深入分析，指出了参与特性、活动偏好以及ARC方法作为在线焦点小组的适用性。 article link

415. Has Instagram Fundamentally Altered the 'Family Snapshot'?

SESSION:Technology in Households

This paper considers how parents use the social media platform Instagram to facilitate the capture, curation and sharing of 'family snapshots'. Our work draws upon established cross-disciplinary literature relating to film photography and the composition of family albums in order to establish whether social media has changed the way parents visually present their families. We conducted a qualitative visual analysis of a sample of 4,000 photographs collected from Instagram using hashtags relating to children and parenting. We show that the style and composition of snapshots featuring children remains fundamentally unchanged and continues to be dominated by rather bland and idealised images of thehappy familyand thecute child. In addition, we find that the frequent taking and sharing of photographs via Instagram has inevitably resulted in a more mundane visual catalogue of daily life. We note a tension in the desire to use social media as a means to evidence good parenting, while trying to effectively manage the social identity of the child and finally, we note the reluctance of parents to use their own snapshots to portray family tension or disharmony, but their willingness to use externally generated content for this purpose.

> 本文认为，家长如何利用社会媒体平台Instagram便于捕获、管理和家庭快照共享。我们的工作借鉴了有关电影摄影和家庭相册组成的跨学科文献，以确定社会媒体是否改变了父母形象地呈现家庭的方式。我们进行了一个定性的视觉分析的一个4000张照片的使用与儿童和父母的Instagram收集的样品标签。我们表明，风格和特色的儿童组成的快照并继续保持基本不变的清淡的，理想的美好的家庭和孩子thecute图像为主。此外，我们发现，频繁的和共享的照片通过Instagram已经不可避免地导致了更多的世俗日常生活的视觉目录。我们注意到在渴望使用社会媒体作为一种手段来证明良好的教养的张力，而试图有效地管理孩子的社会身份，最后，我们注意到父母用他们自己的照片描绘家庭关系紧张或不和谐的不情愿，但他们愿意使用外部生成的内容这一目的。 article link

416. Internet Search Roles of Adults in their Homes

SESSION:Technology in Households

Internet search is one of the major activities that American adults engage in online. Building on studies of youth Internet search roles, this paper investigates adults' online information seeking processes within the home. Through in-home interviews and observations of search task performance with 40 adult participants, we identify and describe characteristics of 9 search roles. By comparing these roles with those of youths, we explain how previously identified roles, such asPower SearcherandSocial Searcher, have evolved in adult populations, and how new roles, such asEfficient SearcherandInterest-driven Searcher, have emerged. We also review the challenges and benefits associated with search roles and their potential impacts on search performance. The findings of this study provide a better understanding of how contextual factors influence search roles in relation to ELIS, what can be learned from search roles, and opportunities to support different search roles.

> 互联网搜索是美国成年人上网的主要活动之一。本文以青少年网络搜索角色为研究对象，研究了成人在家中的网络信息搜索过程。通过对40名成年参与者的入户访谈和观察任务绩效的观察，我们发现并描述了9个搜索角色的特征。通过比较这些角色与那些年轻人，我们如何解释先前确定的角色，如电源searcherandsocial搜索，在成年人群的进化，以及新的角色，如高效率的searcherandinterest驱动搜索，出现。我们还回顾了搜索角色及其对搜索性能的潜在影响所带来的挑战和好处。这项研究的结果提供了一个更好地了解环境因素如何影响搜索的角色ELIS，有什么可以从搜索角色学习，和机会，支持不同的搜索功能。 article link

417. Understanding the Role of Human Senses in Interactive Meditation

SESSION:Technology in Households

In our fast-paced society, stress and anxiety have become increasingly common. Meditation for relaxation has received much attention. Meditation apps exploit various senses, e.g., touch, audio and vision, but the relationship between human senses and interactive meditation is not well understood. This paper empirically evaluates the effects of single and combined human senses on interactive meditation. We found that the effectiveness of human senses can be defined by their respective roles in maintaining the balance between relaxation and focus. This work is the first to attempt to understand these relationships. The findings have broad implications for the field of multi-modal interaction and

interactive meditation applications.

> 在我们快节奏的社会里，压力和焦虑变得越来越普遍。放松冥想备受关注。冥想应用程序利用各种感官，例如触觉、听觉和视觉，但人类感官和互动冥想之间的关系还不是很清楚。本文对单一和组合的人类感官对互动冥想的影响进行了实证评估。我们发现人类感官的有效性可以通过它们各自在保持放松和专注之间的平衡来定义。这项工作是第一次尝试了解这些关系。这些发现对多模态交互和交互式冥想应用领域有广泛的意义。 article link

418. Gender Norms and Attitudes about Childcare Activities Presented on Father Blogs

SESSION:Technology in Households

Father involvement is important for child well-being. However, fathers still do significantly less childcare than mothers, due in part to traditional gender norms. This research investigates whether incorporating do-it-yourself (DIY) language and imagery into parenting blogs is an effective mechanism for boosting fathers' willingness to perform childcare activities. We conducted a between-subjects experiment with 374 participants in the U.S. who responded to ten parenting blog posts. Subjects were randomized to view posts with either DIY or neutral language and either routine childcare activities (e.g., changing diapers) or interactive ones (e.g., finger painting). Results show that DIY language actually decreases a father's willingness to do a childcare activity. Further, fathers underestimate how socially appropriate it is for them to perform childcare activities and this misperception relates to their willingness to get involved. We draw on social norms literature to recommend next steps for designing interfaces to support father involvement in childrearing.

> 父亲的参与对孩子的幸福感很重要。然而，父亲仍然比母亲少照看孩子，部分原因是传统的性别规范。这项研究调查是否把自己动手（DIY）语言和形象纳入父母博客是一个有效的机制，以提高父亲的意愿进行托儿活动。我们进行了一项两个受试者之间的实验，在美国有374名参与者对十个育儿博客做出了回应。受试者被随机观察，无论是DIY或中性语言，或例行的托儿活动（如更换尿布）或互动的（如手指画）。结果表明，DIY语言实际上降低了父亲做育儿活动的意愿。此外，父亲对他们进行育儿活动低估和误解涉及他们愿意参与社会适当它是如何。我们利用社会规范文献推荐的下一步设计接口支持父亲参与育儿。 article link

419. WAVES: A Wearable Asymmetric Vibration Excitation System for Presenting Three-Dimensional Translation and Rotation Cues

SESSION:Textures and Haptics

WAVES, a Wearable Asymmetric Vibration Excitation System, is a novel wearable haptic device for presenting three dimensions of translation and rotation guidance cues. In contrast to traditional vibration feedback, which usually requires that users learn to interpret a binary cue, asymmetric vibrations have been shown to induce a pulling sensation in a desired direction. When attached to the fingers, a single voicecoil actuator presents a translation guidance cue and a pair of voicecoil actuators presents a rotation guidance cue. The directionality of mechanoreceptors in the skin led to our choice of the location and orientation of the actuators in order to elicit very strong sensations in certain directions. For example, users distinguished a "left" cue versus a "right" cue 94.5% of the time. When presented with one of six possible direction cues, users on average correctly identified the direction of translation cues 86.1% of the time and rotation cues 69.0% of the time.

> 波浪，一种可穿戴的非对称振动激励系统，是一种新型的可穿戴触觉装置，用于演示三个维度的平移和旋转引导线索。与传统的振动反馈相反，通常要求使用者学会理解二进制提示，非对称振动已被显示为在期望的方向上产生牵拉感觉。当连接到手指，一个音圈致动器了旋转导向因子的翻译指导线索和一双音圈致动器的礼物。机械感受器在皮肤的方向性导致我们对执行器的位置和方向的选择，为了引起非常强烈的感觉，一定的方向。例如，用户区分“左”提示和“右”提示94.5%的时间。当呈现六种可能的方向线索之一时，用户平均正确地确定了翻译线索的86.1%的时间方向和旋转线索69%的时间。 article link

420. Magnetic Plotter: A Macrotexture Design Method Using Magnetic Rubber Sheets

SESSION:Textures and Haptics

This paper presents a method for designing tactile macrotextures with magnetic rubber sheets. In the method, named "Magnetic Plotter", a desktop digital plotting machine combined with a tiny neodymium magnet writes fine magnetic patterns on the surface of the magnetic rubber sheets. This method enables users to design magnetic fields freely with inexpensive commercially available materials as if they are drawing pictures. Moreover, when the magnetic sheets are rubbed together, unique haptic stimuli are displayed on the fingers. The haptic stimuli can be changed by the magnetic patterns designed on the rubber sheets. We developed a prototype of the Magnetic Plotter and investigated the range of the generated haptic stimuli and the texture design possibilities.

> 本文提出了一种设计触觉macrotextures磁性橡胶板的方法。该方法称为“磁性绘图仪”，与微型钕磁铁相结合的台式数字标绘机，在磁性橡胶片的表面上形成精细的磁性图案。这种方法使用户可以自由地使用廉价的商用材料来设计磁场，就像他们正在绘制图片一样。此外，当磁片被摩擦在一起，独特的触觉刺激显示在手指上。触觉刺激可以通过在橡胶板上设计的磁图案来改变。我们开发了一个磁性绘图仪的原型，并研究了产生的触觉刺激的范围和纹理设计的可能性。 article link

421. Generating Haptic Textures with a Vibrotactile Actuator

SESSION:Textures and Haptics

Vibrotactile actuation is mainly used to deliver buzzing sensations. But if vibrotactile actuation is tightly coupled to users' actions, it can be used to create much richer haptic experiences. It is not well understood, however, how this coupling should be done or which vibrotactile parameters create which experiences. To investigate how actuation parameters relate to haptic experiences, we built a physical slider with minimal native friction, a vibrotactile actuator and an integrated position sensor. By vibrating the slider as it is moved, we create an experience of texture between the sliding element and its track. We conducted a magnitude estimation experiment to map how granularity, amplitude and timbre relate to the experiences of roughness, adhesiveness, sharpness and bumpiness. We found that amplitude influences the strength of the perceived texture, while variations in granularity and timbre create distinct experiences. Our study underlines the importance of action in haptic perception and suggests strategies for deploying such tightly coupled feedback in everyday devices.

> 振动驱动主要是用来传递嗡嗡的感觉。但如果感觉动作是紧密耦合的用户行为，它可以被用来创建更丰富的触觉体验。这是不好理解，但是，这种耦合振动参数应做或创造的经验。探讨如何驱动参数与触觉经验，我们以最小的人建造了一个物理滑块摩擦、震动器和集成位置传感器。通过滑动滑块的振动，我们在滑动元件和它的轨迹之间创建纹理体验。我们进行了一项规模估计实验地图如何粒度、振幅和音色与粗糙度，粘附性经验，清晰度和颠簸。我们发现振幅影响感知纹理的强度，而粒度和音色的变化创造了不同的体验。我们的研究强调了触觉感知的重要性，并提出了在日常设备中部署这种紧密耦合反馈的策略。 article link

422. Localized Haptic Texture: A Rendering Technique based on Taxels for High Density Tactile Feedback

SESSION:Textures and Haptics

We investigate the relevance of surface haptic rendering techniques for tactile devices. We focus on the two major existing techniques and show that they have complementary benefits. The first one, called textsc{S}urface textsc{H}aptic textsc{O}bject (textsc{SHO}), which is based on finger position, is shown to be more suitable to render sparse textures; while the second one, called textsc{S}urface textsc{H}aptic textsc{T}exture (textsc{SHT}), which is based on finger velocity, is shown to be more suitable for dense textures and fast finger movements. We hence propose a new rendering technique, called textsc{L}ocalized textsc{H}aptic textsc{T}exture (textsc{LHT}), which is based on the concept of textit{taxel} considered as an elementary tactile information that is rendered on the screen. By using a grid of taxels to encode a texture, textsc{LHT} is shown to provide a consistent tactile rendering across different velocities for high density textures, and is found to reduce user textit{error rate} by up to 77.68% compared to textsc{SHO}.

> 我们研究触觉设备表面触觉再现技术的相关性。我们专注于两种主要的现有技术，并显示它们有互补的好处。第一个，称为textsc { }表面textsc {H} textsc { }不小O（textsc {真}），这是基于手指的位置，被证明是更适合呈现稀疏纹理；而另一个，称为textsc { }表面textsc {H}爱谱textsc { T（textsc }、{她}），这是基于手指的速度，被证明是更适合于密集的纹理和快速的手指运动。因此我们提出了一个新的渲染技术，称为textsc { L }局限的textsc {H}爱谱textsc {T}纹理（textsc { LHT }），这是基于系统{紫杉醇}认为是一个基本的触觉信息，屏幕上呈现的概念。通过使用网格taxels编码纹理，textsc { LHT }是提供一个一致的触觉渲染在不同速度的高密度结构，并发现了77.68%个比较textsc {翔降低用户系统误码率} { }。 article link

423. Supporting Easy Physical-to-Virtual Creation of Mobile VR Maze Games: A New Genre

SESSION:Design and Games

With the fast development of virtual reality games, one of the key research questions is how players may express their creativity and participate in the process of game design. In this paper, we present a new game genre which combines user-controlled game design in physical space with game play in virtual space on a mobile device. The new system supports authoring by anyone, creating virtual reality games that can be easily modified or developed for physical space, and be used anywhere by novice end-users without any knowledge of tracking technology. We present the design and implementation of the system, as well as a user experiment. Findings illustrate that the proposed system promotes participation and provides a richer, more interactive and engaging experience.

> 随着虚拟现实游戏的快速发展，玩家如何表达自己的创造力，参与游戏设计的过程成为研究的关键问题之一。本文提出了一种新的游戏类型，它将用户控制的物理空间游戏设计与移动设备虚拟空间中的游戏相结合。新的系统支持任何人创作，创造虚拟现实游戏，可以很容易地修改或开发的物理空间，并使用任何新手终端用户没有任何跟踪技术知识。我们介绍了该系统的设计和实现，以及用户实验。研究结果表明，拟议的系统促进参与，并提供更丰富，更互动和引人入胜的经验。 article link

424. The UX of Avatar Customization

SESSION:Design and Games

Avatar customization is a feature that is offered in many computer and video games. Customization options are presented to users via Character Creation Interfaces or CCIs. CCIs differ greatly between games, independent of genre, with regard to the quantity and quality of customization options available. In addition, the way in which these options are presented to users differs from game to game. Research on avatar customization is typically focused on user-avatar identity or self-representation. In general, we have found that the User Experience (UX) of avatar customization has been greatly overlooked in academic literature. As such, we look to existing research on UX in order to propose how its methodologies may be used to study the impact of CCI affordances on player experience in games.

> 化身定制是一个功能，提供了许多电脑和视频游戏。定制方案，用户通过角色创建界面或CCI。CCIS大大不同游戏之间，独立的体裁，以数量和质量的定制选项。此外，将这些选项呈现给用户的方式不同于游戏和游戏。对头像定制的研究主要集中在用户头像身份或自我表征方面。总的来说，我们发现，用户体验（UX）化身定制已在学术文献极大地忽视了。因此，我们现有的UX研究以提出的方法可用于研究影响CCI对游戏玩家的经验启示。 article link

425. To Three or not to Three: Improving Human Computation Game Onboarding with a Three-Star System

SESSION:Design and Games

While many popular casual games use three-star systems, which give players up to three stars based on their performance in a level, this technique has seen limited application in human computation games (HCGs). This gives rise to the question of what impact, if any, a three-star system will have on the behavior of players in HCGs. In this work, we examined the impact of a three-star system implemented in the protein folding HCG Foldit. We compared the basic game's introductory levels with two versions using a three-star system, where players were rewarded with more stars for completing levels in fewer moves. In one version, players could continue playing levels for as many moves as they liked, and in the other, players were forced to reset the level if they used more moves than required to achieve at least one star on the level. We observed that the three-star system encouraged players to use fewer moves, take more time per move, and replay completed levels more often. We did not observe an impact on retention. This indicates that three-star systems may be useful for re-enforcing concepts introduced by HCG levels, or as a flexible means to encourage desired behaviors.

> 虽然许多受欢迎的休闲游戏玩家使用三星系统，这给了三颗基于一级性能，该技术已经在人类计算的游戏应用有限公司（HCGs）。这产生了什么影响，如果有任何的问题，三星系统将会对HCGs球员的行为。在这项工作中，我们研究了三星系统在蛋白质折叠游戏实现了HCG的影响。我们比较了基本游戏的入门级与两个版本使用三星级系统，其中球员奖励更多的星级完成水平较少的行动。在一个版本中，玩家可以继续玩他们喜欢的动作的级别，而在另一个版本中，如果玩家使用更多的移动，而不是在水平上至少需要一颗星，玩家就不得不重设水平。我们观察到三星级系统鼓励玩家使用更少的动作，每次移动花费更多的时间，并且经常重播完成的水平。我们没有观察到对保留的影响。这表明三星级系统可能有助于重新执行HCG水平引入的概念，或者作为一种灵活的手段来鼓励所期望的行为。 article link

426. What Is Interaction?

SESSION:Design Frameworks

The terminteractionis field-defining, yet surprisingly confused. This essay discusses what interaction is. We first argue that only few attempts to directly define interaction exist. Nevertheless, we extract from the literature distinct and highly developed concepts, for instance viewing interaction as dialogue, transmission, optimal behavior, embodiment, and tool use. Importantly, these concepts are associated with different scopes and ways of construing the causal relationships between the human and the computer. This affects their

ability to inform empirical studies and design. Based on this discussion, we list desiderata for future work on interaction, emphasizing the need to improve scope and specificity, to better account for the effects and agency that computers have in interaction, and to generate strong propositions about interaction.

> terminteractionis领域的定义，但令人惊讶的是迷茫。本文讨论了什么是互动。我们首先认为，只有少数尝试直接定义交互存在。尽管如此，我们从文献中提取不同的和高度发展的概念，例如观察交互作为对话、传输、最佳行为、实施例和工具使用。重要的是，这些概念与范围的不同，将人与计算机之间的因果关系的途径相关。这影响了他们告知实证研究和设计的能力。基于上述讨论，我们列出了对未来工作的交互需求，强调需要改进的范围和特异性，能更好的解释的影响，代理，互动有计算机，并产生相互作用强的命题。 article link

427. Beyond Grids: Interactive Graphical Substrates to Structure Digital Layout

SESSION:Design Frameworks

Traditional graphic design tools emphasize the grid for structuring layout. Interviews with professional graphic designers revealed that they use surprisingly sophisticated structures that go beyond the grid, which we callgraphical substrates. We present a framework to describe how designers establish graphical substrates based on properties extracted from concepts, content and context, and use them to compose layouts in both space and time. We developed two technology probes to explore how to embed graphical substrates into tools.Contextifylets designers tailor layouts according to each reader's intention and context; whileLinkifylets designers create dynamic layouts based on relationships among content properties. We tested the probes with professional graphic designers, who all identified novel uses in their current projects. We incorporated their suggestions intoStyleBlocks, a prototype that reifies CSS declarations into interactive graphical substrates. Graphical substrates offer an untapped design space for tools that can help graphic designers generate personal layout structures.

> 传统的图形设计工具强调构建布局的网格。有专业的平面设计师的访谈显示，他们用惊人的复杂结构，超越网格，我们callgraphical基板。我们提出了一个框架来描述设计者如何根据概念、内容和上下文中提取的属性建立图形基片，并使用它们在空间和时间上组合布局。我们开发了两种技术探讨探讨如何嵌入图形衬底的工具。contextifylets设计师定制布局根据每个读者的意图和语境；whilelinkifylets设计师创建基于内容属性的动态布局之间的关系。我们测试了探针与专业图形设计师，他们都确定了新的用途在其目前的项目。我们把他们的建议intostyleblocks，原型，具体化的CSS声明为交互式图形衬底。图形基板提供了一个未开发的设计空间，可以帮助图形设计师生成个人布局结构的工具。 article link

428. Expressive Fused Deposition Modeling by Controlling Extruder Height and Extrusion Amount

SESSION:Design Frameworks

Fused deposition modeling (FDM) 3D printers form objects by stacking layers having a linear structure. To print fine structures, an appropriate choice of parameters is necessary, or printing error occurs. On the other hand, the printing error is exploited as an expression technique. However, the relation between the printed structure and the parameters causing the printing error is unclear. In this paper, we focus on the height position of the extruder and the amount of extruded material, and explore the combination of these parameters to enhance the capability of FDM. By extending an equation that calculates the amount of material from the layer height, we investigate the behavior and structure of material extruded from various height positions. On the basis of experimental results, the printed structure is classified into six categories according to the structural feature. We describe these structural features and demonstrate examples with new inherent expressions for FDM.

> 熔融沉积建模（FDM）3D打印机通过层叠具有线性结构的层来形成对象。要打印精细结构，必须选择适当的参数，否则会出现打印错误。另一方面，打印错误被用作表达式技术。然而，印刷结构和引起印刷错误的参数之间的关系还不清楚。本文重点研究了挤出机的高度和挤出量，并探讨了这些参数的组合，以提高挤出机的性能。通过扩展一个从层高度计算材料的量的方程，我们研究了从不同高度位置挤压的材料的行为和结构。根据实验结果，将印刷结构按结构特征分为六类。我们描述了这些结构特征，并举例说明了FDM的新固有表达式。 article link

429. shiftIO: Reconfigurable Tactile Elements for Dynamic Affordances and Mobile Interaction

SESSION:Design Frameworks

Currently, virtual (i.e. touchscreen) controls are dynamic, but lack the advantageous tactile feedback of physical controls. Similarly, devices may also have dedicated physical controls, but they lack the flexibility to adapt for different contexts and applications. On mobile and wearable devices in particular, space constraints further limit our input and output capabilities. We propose utilizing reconfigurable tactile elements around the edge of a mobile device to enable dynamic physical controls and feedback. These tactile elements can be used for physical touch input and output, and can reposition according to the application both around the edge of and hidden within the device. We present shiftIO, two implementations of such a system which actuate physical controls around the edge of a mobile device using magnetic locomotion. One version utilizes PCB-manufactured electromagnetic coils, and the other uses switchable permanent magnets. We perform a technical evaluation of these prototypes and compare their advantages in various applications. Finally, we demonstrate several mobile applications which leverage shiftIO to create novel mobile interactions.

> 目前，虚拟（即触摸屏）控件是动态的，但缺乏物理控制的有利触觉反馈。类似地，设备也可能有专用的物理控件，但它们缺乏适应不同上下文和应用程序的灵活性。尤其是在移动和可穿戴设备上，空间限制进一步限制了我们的输入和输出能力。我们建议利用移动设备边缘周围的可重构触觉元件来实现动态物理控制和反馈。这些触觉元件可以用于物理触摸输入和输出，并且可以根据应用程序的边缘和设备内部的隐藏进行重新定位。我们目前的shiftio，实现这样一个系统的物理控制驱动磁运动的移动设备的边缘。一个版本利用PCB制造的电磁线圈，另一个使用可切换永久磁铁。我们对这些原型进行技术评估，并比较它们在各种应用中的优势。最后，我们展示了几个移动应用程序创建新的移动互动的杠杆shiftio。 article link

430. A Good Reason to Die: How Avatar Death and High Challenges Enable Positive Experiences

SESSION:Difficulty and Challenge in Games

Appropriate challenges and challenge-skill balance are usually key to positive player experiences. However, some games such as the successful series Dark Souls are notorious for their excessive difficulty. Yet, there has been little empirical investigation of why players enjoy games they constantly struggle and fail with. We surveyed 95 participants right after the release of Dark Souls III about their experiences with the game, employing both open questions and different player experience measures. Players generally enjoyed challenging play sessions and mostly reported positive experiences, with achievement and learning moments strongly contributing to positive experiences. However, these factors themselves were enabled by negative events such as difficulties and avatar death. Our findings showcase that negative events bear a potential for forming positive and meaningful experiences, thus expanding previous knowledge about the role of challenge and failing in games. Moreover, the significance of hard-earned achievements extends present design

conventions.

> 适当的挑战和挑战技巧平衡通常是积极球员经验的关键。然而，一些游戏，例如成功的黑灵魂系列，以其过度的难度而臭名昭著。然而，对于为什么玩家喜欢游戏，他们一直在挣扎和失败，很少有实证研究。我们调查了95名受试者，他们分别在公开的问题和不同的玩家体验措施之后，对暗黑灵魂III的游戏体验进行了调查。球员们通常都喜欢挑战性的比赛，而且大部分都是积极的经验，成就和学习时刻对积极的经历有很大的帮助。然而，这些因素本身是由负面事件，如困难和化身死亡。我们的研究结果表明，负面事件有可能形成积极的和有意义的经验，从而扩大以前的知识，在游戏中的挑战和失败的作用。此外，来之不易的成就的意义扩展了目前的设计惯例。 article link

431. How Human Am I?: EEG-based Evaluation of Virtual Characters

SESSION:Difficulty and Challenge in Games

There is a continuous effort by animation experts to create increasingly realistic and more human-like digital characters. However, as virtual characters become more human they risk evoking a sense of unease in their audience. This sensation, called the Uncanny Valley effect, is widely acknowledged both in the popular media and scientific research but empirical evidence for the hypothesis has remained inconsistent. In this paper, we investigate the neural responses to computer-generated faces in a cognitive neuroscience study. We record brain activity from participants (N = 40)} using electroencephalography (EEG) while they watch videos of real humans and computer-generated virtual characters. Our results show distinct differences in neural responses for highly realistic computer-generated faces such as Digital Emily compared with real humans. These differences are unique only to agents that are highly photorealistic, i.e. the

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uncanny' response. Based on these specific neural correlates we train a support vector machine~(SVM) to measure the probability of an un
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> 动画专家们不断努力创造越来越逼真、更人性化的数字角色。然而，当虚拟角色变得更人性化时，他们可能会在听众中激起一种不安感。这种感觉被称为“诡异谷效应”，在大众媒体和科学研究中得到广泛承认，但该假说的经验证据仍然不一致。在本文中，我们研究了认知神经科学研究中计算机生成面孔的神经反应。我们用脑电图（EEG）记录参与者的大脑活动（N＝40），同时他们观看真人视频和计算机生成的虚拟人物。我们的结果显示，与真实人类相比，高度逼真的计算机生成人脸（如数字艾米丽）的神经反应有明显的差异。这些差异只适用于具有高度真实感的代理，即“不可思议”的响应。基于这些特定的神经关联，我们训练了一个支持向量机（SVM）来测量EEG数据中任何给定计算机生成字符的奇异响应概率。这使得动画人物的排序基于他们的`神密的水平。 article link

432. Testing Incremental Difficulty Design in Platformer Games

SESSION:Difficulty and Challenge in Games

Designing difficulty levels in platformer games is a challenge for game designers. It is important because design decisions that affect difficulty also directly affect player experience. Consequently, design strategies for balancing game difficulty are discussed by both academics and game designers. In this paper, we study how manipulating the following design decisions, commonly found in platformers, moderates difficulty: Scroll Speed, Target Size, Jump Task Complexity, and Perspective. Results for Scroll Speed and Target Size indicate that errors increase as speed increases and platform size decreases. However, results for jump task complexity demonstrate a separation of errors from task complexity. Specifically, while double-jump tasks are harder than single-jump tasks, triple-jump tasks appear to be as difficult as double-jump tasks. Additionally, the study demonstrates how changes in perspective affect the errors made by players in gameplay. The study results are applicable both to automatic level generation and dynamic difficulty adjustment in platformer games.

> 在游戏设计的游戏难度是游戏设计者的挑战。这是很重要的，因为影响难度的设计决策也直接影响玩家体验。因此，平衡游戏难度的设计策略是由学术界和游戏设计者共同讨论的。在本文中，我们研究如何操纵以下设计决策中常见的游戏，对难点：滚动速度、目标大小、跳任务的复杂性，和透视。滚动速度和目标尺寸的结果表明，随着速度的增加和平台尺寸的减小，误差增大。然而，跳转任务复杂性的结果表明错误与任务复杂性的分离。具体来说，虽然双跳跃任务比单跳任务困难，但三跳任务似乎和双跳跃任务一样困难。此外，该研究还演示了视角的变化是如何影响玩家在游戏中所犯的错误的。研究的结果是适用于自动化水平的生成与平台游戏动态难度调整。 article link

433. EngageMeter: A System for Implicit Audience Engagement Sensing Using Electroencephalography

SESSION:Difficulty and Challenge in Games

Obtaining information about audience engagement in presentations is a valuable asset for presenters in many domains. Prior literature mostly utilized explicit methods of collecting feedback which induce distractions, add workload on audience and do not provide objective information to presenters. We present EngageMeter - a system that allows fine-grained information on audience engagement to be obtained implicitly from multiple brain-computer interfaces (BCI) and to be fed back to presenters for real time and post-hoc access. Through evaluation during an HCI conference (Naudience=11, Npresenters=3) we found that EngageMeter provides value to presenters (a) in real-time, since it allows reacting to current engagement scores by changing tone or adding pauses, and (b) in post-hoc, since presenters can adjust their slides and embed extra elements. We discuss how EngageMeter can be used in collocated and distributed audience sensing as well as how it can aid presenters in long term use.

> 在演讲中获得关于听众参与的信息对于许多领域的演讲者来说是一笔宝贵的财富。以往的文献大多采用显式收集反馈的方法来诱导分心，增加了受众的工作量，不给主持人提供客观的信息。我们目前的engagemeter -一个系统允许细粒度的信息对观众的参与是隐式地从多个脑机接口（BCI）和获得反馈的实时和事后访问主持人。通过评价人机交互会议期间（naudience = 11，npresenters = 3）我们发现engagemeter提供价值给主持人（一）在实时性，因为它允许通过改变音调或添加暂停当前参与评分的反应，和（b）在事后，因为主持人可以调整他们的幻灯片和嵌入额外的元素。我们将讨论如何engagemeter可用于配置和分散观众感知以及它如何帮助主持人在长期使用。 article link

434. Can I Think of Something Else when Using a BCI?: Cognitive Demand of an SSVEP-based BCI

SESSION:Difficulty and Challenge in Games

BCIs are presumably supposed to require the full attention of their users and to lose accuracy if they pay attention to another task. This assertion has been verified with several BCI paradigms (e.g. P300). But the cognitive demand of the promising SSVEP paradigm had never been specifically assessed yet. We measured the accuracy of an SSVEP-based BCI used by 26 participants in various conditions of mental workload. Our analysis revealed that surprisingly, for this type of BCI, little attention is actually needed from participants to reach optimal accuracy: participants were able to successfully perform a complex secondary task (N-back) without degrading the BCI accuracy. The same observation was made whether visual or auditive attention was solicited. These results indicate that SSVEP is a low-demanding paradigm in terms of cognitive resources, and are encouraging for its use in complex interaction settings.

> BCI是大概需要用户的充分重视，如果他们注意到另一个任务失去准确性。这种断言已经用几种BCI范式（如P300）进行了验证。但有前途的SSVEP范式的认知需求从来没有

> 专门评估，但。我们测量的精度SSVEP 26人心理负荷的各种条件的研究。我们的分析显示，令人惊讶的是，这种类型的BCI，很少是真正需要从参与者达到最佳精度：参与者能够成功地完成一个复杂的次要任务（回）在不降低精度的BCI。同样的观察无论视觉或听觉注意征求。这些结果表明，稳态视觉诱发电位是一种低要求在认知资源方面的范例，并鼓励其使用的复杂交互设置。 article link

435. "Not another Z piece!": Adaptive Difficulty in TETRIS

SESSION:Difficulty and Challenge in Games

Difficulty in TETRIS is adjusted by adapting the speed with which blocks fall. In this contribution, we describe results of an exploratory study in which we investigated relationships between players' performance and their subjective assessment of difficulty and fun. We tested five different algorithms that, instead of adjusting game speed, adjust difficulty by choosing blocks based on the current game state. With our results, we establish pile height and bumpiness as parameters that indicate the performance of a player during a live game, discuss the inherent difficulty of different block choosing algorithms and show how the relationship between fun and perceived difficulty varies for distinct player groups. With regard to adapting difficulty, we argue that one can still teach an old dog such a TETRIS a lot of new tricks.

> 俄罗斯方块的难度是通过调整块掉落的速度来调整的。在这项贡献中，我们描述了一个探索性研究的结果，我们调查了球员的表现和他们的主观评价困难和乐趣之间的关系。我们测试了五种不同的算法，而不是调整游戏速度，通过选择基于当前游戏状态的块来调整难度。我们的结果，我们建立了桩高度和颠簸，表示一个球员在比赛的性能参数，讨论不同的块选择算法固有的困难和显示之间的关系如何变化的乐趣和感知难度不同的玩家群体。关于适应困难，我们认为还可以教老狗这样一个俄罗斯方块很多新把戏。 article link

436. The World-as-Support: Embodied Exploration, Understanding and Meaning-Making of the Augmented World

SESSION:Embodied Interaction

Current technical capabilities of mobile technologies are consolidating the interest in developing context-aware Augmented/Mixed Reality applications. Most of these applications are designed based on the Window-on-the-World (WoW) interaction paradigm. A significant decrease in cost of projection technology and advances in pico-sized projectors have spurred applications of Projective Augmented Reality. This research has focused mainly on technological development. However, there is still a need to fully understand its communicational and expressive potential. Hence, we define a conceptual paradigm that we call World-as-Support (WaS). We compare the WaS and WoW paradigms by contrasting their assumptions and cultural values, as well as through a study of an application aimed at supporting the collaborative improvisation of site-specific narratives by children. Our analysis of children's understanding of the physical and social environment and of their imaginative play allowed us to identify the affordances, strengths and weaknesses of these two paradigms.

> 当前移动技术的技术能力正在巩固开发上下文感知增强/混合现实应用程序的兴趣。这些应用程序大部分是基于世界（魔兽）交互范式的窗口设计的。投影技术的成本大幅下降和小型投影机的进步推动了投影增强现实的应用。这项研究主要集中在技术发展上。然而，仍然需要充分了解它的交流和表达潜力。因此，我们定义了一个我们称之为“支持”的概念范式。我们通过比较他们的假设和文化价值观，以及通过一个旨在支持儿童特定地点叙事协作即兴的应用程序的研究来比较“是”和“哇”的范例。我们的分析儿童的自然环境和社会环境的理解和他们的想象力的发挥使我们能够识别的启示，优势和弱点，这两种范式。 article link

437. Extending the Body for Interaction with Reality

SESSION:Embodied Interaction

In this paper, we explore how users can control remote devices with a virtual long arm, while preserving the perception that the artificial arm is actually part of their own body. Instead of using pointing, speech, or a remote control, the users' arm is extended in augmented reality, allowing access to devices that are out of reach. Thus, we allow users to directly manipulate real-world objects from a distance using their bare hands. A core difficulty we focus on is how to maintain ownership for the unnaturally long virtual arm, which is the strong feeling that one's limbs are actually part of the own body. Fortunately, what the human brain experiences as being part of the own body is very malleable and we find that during interaction the user's virtual arm can be stretched to more than twice its real length, without breaking the user's sense of ownership for the virtual limb.

> 在本文中，我们将探讨用户如何使用虚拟长臂控制远程设备，同时保持人工臂实际上是自己身体的一部分。而不是使用指向，讲话，或远程控制，用户的手臂扩展在增强现实，允许访问的设备，遥不可及。因此，我们允许用户用手直接从远处操纵真实世界的物体。核心问题是我们关注的焦点是如何保持不长的虚拟手臂的所有权，这是一个四肢实际上是对自己身体的一部分的强烈的感觉。幸运的是，人脑作为自己身体的一部分经历了很强的可塑性，我们发现，在交互过程中，用户的虚拟手臂可以伸展到实际长度的两倍以上，而不会破坏用户对虚拟肢体的归属感。 article link

438. Embodied Design Ideation Methods: Analysing the Power of Estrangement

SESSION:Embodied Interaction

Embodied design ideationpractices work with relationships between body, material and context to enliven design and research potential. Methods are often idiosyncratic and due to their physical nature not easily transferred. This presents challenges for designers wishing to develop and share techniques or contribute to research. We present a framework that enables designers to understand, describe and contextualise their embodied design ideation practices in ways that can be understood by peers, as well as those new to embodied ideation. Our framework developed over two conference workshops provides a frame for discussion of embodied design actions that leverage the power of estrangement. We apply our framework to eight embodied design ideation methods. Our contribution is thus twofold: (1) a framework to understand and leverage the power of estrangement in embodied design ideation, and (2) an inspirational catalogue demonstrating the diversity of ideas that embodied design ideation methods can foster.

> ideationpractices体现设计工作的关系体，材料和背景活跃的设计和研究的潜力。方法往往是特殊的，由于它们的物理性质不容易转移。这对希望开发和共享技术或促进研究的设计者来说是一个挑战。我们提出了一个框架，使设计人员能够了解、描述和研究他们的设计意念体现实践的方式，可以理解的同行，以及那些新的体现意念。我们在两个会议研讨会上制定的框架提供了一个框架，用来讨论体现了隔阂的力量的具体设计行动。我们将我们的框架应用于八种体现设计思维方法。我们的贡献有两个方面：（1）理解和利用体现设计构思的疏离感的框架，（2）一个鼓舞人心的目录，展示了体现设计思维方法可以培养的思想的多样性。 article link

439. Designing for Kinesthetic Awareness: Revealing User Experiences through Second-Person Inquiry

SESSION:Embodied Interaction

We consider kinesthetic awareness, the perception of our own body position and movement in space, as a critical value for embodied design within third wave HCI. We designed an interactive sound installation that supports kinesthetic awareness of a participant's micro-movements. The installation's interaction design uses continuous auditory feedback and leverages an adaptive mapping strategy, refining its sensitivity to increase sonic resolution at lower levels of movement activity. The installation uses field recordings as rich source materials to generate a sound environment that attunes to a participant's micro-movements. Through a qualitative study using a second-person interview technique, we gained nuanced insights into the participants' subjective experiences of the installation. These reveal consistent temporal patterns, as participants build on a gradual process of integration to increase the complexity and capacity of their kinesthetic awareness during interaction.

> 我们认为动觉意识，我们自己的身体的位置和运动空间的感知，是体现设计在第三波HCI的临界值。我们设计了一个互动的声音装置，支持运动参与者的微动作意识。安装程序的交互设计使用连续的听觉反馈，并利用自适应映射策略，提高其灵敏度，以提高运动水平较低时的声波分辨率。安装使用现场录音作为丰富的素材，产生一个良好的环境，接通到一个参与者的微运动。通过使用第二人称访谈技术进行定性研究，我们对参与者安装的主观体验有了细致入微的见解。这些发现一致的时间模式，为学员建立一个逐渐融合的过程中互动增加他们的肌肉运动知觉的复杂性和能力。 article link

440. Chameleon Devices: Investigating More Secure and Discreet Mobile Interactions via Active Camouflaging

SESSION:Emerging Privacy

Many users value the ability to have quick and frequent sight of their mobiles when in public settings. However, in doing so, they expose themselves to potential risks, ranging from being targets of robbery to the more subtle social losses through being seen to be rude or inattentive to those around them. In nature, some animals can blend into their environments to avoid being eaten or to reduce their impact on the ecosystem around them. Taking inspiration from these evolved systems we investigate the notion of chameleon approaches for mobile interaction design. Our probes were motivated, inspired and refined through extended interactions with people drawn from contexts with differing ranges of security and privacy concerns. Through deployments on users' own devices, our prototypes show the value of the concept. The encouraging results motivate further research in materials and form factors that can provide more effective automatic plain-sight hiding.

> 许多用户重视在公共场合快速、频繁地看到手机的能力。然而，在这样做时，他们暴露自己潜在的风险，从抢劫的目标到更微妙的社会损失，被视为对他们周围的人粗鲁或不注意。在自然界中，一些动物可以融入它们的环境，以避免被吃掉或减少它们对周围生态系统的影响。从这些进化系统中得到灵感，我们研究了移动交互设计中变色龙方法的概念。我们的探针是通过与来自不同安全和隐私关注范围的上下文的人进行扩展交互而激发、启发和改进的。通过在用户自己的设备上部署，我们的原型展示了这个概念的价值。令人鼓舞的结果激励了材料和形式因素的进一步研究，可以提供更有效的自动视觉掩盖。 article link

441. Toys that Listen: A Study of Parents, Children, and Internet-Connected Toys

SESSION:Emerging Privacy

Hello Barbie, CogniToys Dino, and Amazon Echo are part of a new wave of connected toys and gadgets for the home that listen. Unlike the smartphone, these devices are always on, blending into the background until needed. We conducted interviews with parent-child pairs in which they interacted with Hello Barbie and CogniToys Dino, shedding light on children's expectations of the toys' "intelligence" and parents' privacy concerns and expectations for parental controls. We find that children were often unaware that others might be able to hear what was said to the toy, and that some parents draw connections between the toys and similar tools not intended as toys (e.g., Siri, Alexa) with which their children already interact. Our findings illuminate people's mental models and experiences with these emerging technologies and will help inform the future designs of interactive, connected toys and gadgets. We conclude with recommendations for parents, designers, and policy makers.

> 你好，芭比，CogniToys Dino，和亚马逊的回声是一个新的连接，听家里的玩具和小玩意波部分。与智能手机不同的是，这些设备总是处于启动状态，直到需要混合到后台。我们进行了亲子对它们相互作用的哈罗芭比和CogniToys Dino的访谈，揭示对孩子的期望的玩具“智力”和父母的隐私的关注和期望家长控制。我们发现孩子们常常不知道其他人可能会听到对玩具所说的话，有些家长会把玩具和类似工具的联系联系起来，而这些工具并不是玩具（如西丽，Alexa），他们的孩子已经相互影响了。我们的发现阐明了人们对这些新兴技术的心智模式和经验，并将有助于了解未来交互式、连接玩具和小器具的设计。最后，我们对家长、设计师和决策者提出建议。 article link

442. Better the Devil You Know: Exposing the Data Sharing Practices of Smartphone Apps

SESSION:Emerging Privacy

Most users of smartphone apps remain unaware of what data about them is being collected, by whom, and how these data are being used. In this mixed methods investigation, we examine the question of whether revealing key data collection practices of smartphone apps may help people make more informed privacy-related decisions. To investigate this question, we designed and prototyped a new class of privacy indicators, called Data Controller Indicators (DCIs), that expose previously hidden information flows out of the apps. Our lab study of DCIs suggests that such indicators do support people in making more confident and consistent choices, informed by a more diverse range of factors, including the number and nature of third-party companies that access users' data. Furthermore, personalised DCIs, which are contextualised against the other apps an individual already uses, enable them to reason effectively about the differential impacts on their overall information exposure.

> 大多数智能手机应用程序的用户仍然不知道他们正在收集哪些数据、由谁以及这些数据是如何使用的。在这种混合方法调查中，我们研究了是否揭示了智能手机应用程序的关键数据收集实践可能有助于人们作出更明智的隐私相关决策。为了探讨这一问题，我们设计和原型的一个新的隐私指标类、指标数据控制器（DCIS），揭露以前隐藏的信息流的应用。我们实验室的研究表明，DCIS等指标作出更自信和一致的选择不支持的人，通过更多元化的因素，包括数量和第三方公司访问用户数据的性质。此外，个性化的DCIS，这情境对一个人已经使用其他应用程序，使他们能够有效地对他们的整体原因信息暴露的不同影响。 article link

443. Parents? and Children?s Preferences about Parents Sharing about Children on Social Media

SESSION:Emerging Privacy

Prior research shows that parents receive a number of benefits through sharing about their children online, but little is known about children?s perspectives about parent sharing. We conducted a survey with 331 parent-child pairs to examine parents? and children?s preferences about what parents share about their children on social media. We find that parents and children are in agreement in their perception of how often and how much information parents share about their children on social media. However, there is disagreement about the permission-seeking process: children believe their parents should ask permission more than parents think they should, and parents believe they should ask for permission more often than they actually do, especially younger parents. We describe two categories of content that children are okay, or not okay, with their parents sharing about them. We offer design directions for managing parent sharing.

> 先前的研究表明，父母通过在网上分享他们的孩子得到一些好处，但对儿童知之甚少。关于父母分享的观点。我们进行了一项调查，有331对父母对父母进行调查。和孩子吗？关于父母在社交媒体上分享孩子的偏好。我们发现父母和孩子们对父母在社交媒体上分享孩子的信息的频率和信息的看法是一致的。然而，在寻求许可的过程中存在着分歧：孩子们认为他们的父母应该比父母认为他们应该得到的请求更多，父母认为他们应该比他们实际要求更多的请求许可，尤其是年轻的父母。我们描述了两个类别的内容，孩子们是好的，或不好的，与他们的父母分享他们。我们提供了管理家长共享的设计方向。 article link

444. Challenges of using Personal Data to Drive Personalised Electronic Programme Guides

SESSION:Emerging Privacy

Media researchers are adopting personalisation in diverse ways to deliver increasingly context-sensitive and customised media experiences. This paper explores user attitudes towards a personalised Electronic Programme Guide which tailors media recommendations based on users' personal data. We used scenario based exploration enabled by the use of probes to convey the functionalities of data-driven personalised EPGs and to facilitate user discussions around its potential use. Users preferred personalised EPGs over current popular EPGs but expressed a significant lack of trust in the personal data collection that drives personalisation. Users appreciated the functionalities afforded by personalisation of media but were apprehensive about the implications of the personal data being collected about them, particularly in the context of their homes. This calls for the need to design future personalised media experiences that help enhance trust in these socio-technical settings.

> 媒体研究者采用不同的个性化提供越来越多的上下文敏感的和定制的媒体体验。本文探讨了用户对个性化电子节目指南的态度，该指南根据用户的个人数据整理媒体建议。我们使用基于场景的探索探针传达个性化功能使用数据驱动电源系统的启用和方便用户的讨论其潜在用途。用户首选的电源系统电源系统在当前流行的个性化而表达在个人数据采集驱动的个性化信任显著不足。用户对个性化媒体提供的功能，但对个人数据被搜集的影响感到担忧，特别是在他们的家中。这就需要设计未来个性化的媒体体验，以帮助增强对这些社会技术环境的信任。 article link

445. Reflective Informatics Through Family Storytelling: Self-discovering Physical Activity Predictors

SESSION:Family Health

HCI research has increasingly examined how sensing technologies can help people capture and visualize data about their health-related behaviors. Yet, few systems help people reflect more fundamentally on the factors that influence behaviors such as physical activity (PA). To address this research gap, we take a novel approach, examining how such reflections can be stimulated through a medium that generations of families have used for reflection and teaching: storytelling. Through observations and interviews, we studied how 13 families interacted with a low-fidelity prototype, and their attitudes towards this tool. Our prototype used storytelling and interactive prompts to scaffold reflection on factors that impact children's PA. We contribute to HCI research by characterizing how families interacted with a story-driven reflection tool, and how such a tool can encourage critical processes for behavior change. Informed by the Transtheoretical Model, we present design implications for reflective informatics systems.

> HCI研究越来越多地研究传感技术如何帮助人们捕捉和可视化与健康有关的行为数据。然而，很少有系统能帮助人们更全面地反映影响行为的因素，如体力活动（PA）。为了解决这一研究空白，我们采取了一种新的方法，研究如何通过一种媒介来刺激这种思考，一代代家庭用来思考和教学：讲故事。通过观察和访谈，我们研究了13个家庭如何与低保真原型互动，以及他们对这一工具的态度。我们的原型用讲故事和互动提示支架反射影响到孩子的PA.我们有助于人机交互研究的特点如何家庭互动故事驱动的反射工具的因素，以及如何这样的工具可以鼓励行为改变的关键过程。通过跨理论模型，提出了反射式信息系统设计的影响。 article link

446. Supporting Families in Reviewing and Communicating about Radiology Imaging Studies

SESSION:Family Health

Diagnostic radiology reports are increasingly being made available to patients and their family members. However, these reports are not typically comprehensible to lay recipients, impeding effective communication about report findings. In this paper, we present three studies informing the design of a prototype to foster patient-clinician communication about radiology report content. First, analysis of questions posted in online health forums helped us identify patients' information needs. Findings from an elicitation study with seven radiologists provided necessary domain knowledge to guide prototype design. Finally, a clinical field study with 14 pediatric patients, their parents and clinicians, revealed positive responses of each stakeholder when using the prototype to interact with and discuss the patient's current CT or MRI report and allowed us to distill three use cases: co-located communication, preparing for the consultation, and reviewing radiology data. We draw on our findings to discuss design considerations for supporting each of these use cases.

> 越来越多地向病人及其家属提供诊断性放射学报告。然而，这些报告通常不被接受者所理解，阻碍了对报告结果的有效沟通。在本文中，我们提出了三个研究的原型设计，以促进病人的临床医生沟通的放射报告内容。首先，分析在线健康论坛发布的问题，帮助我们识别患者的信息需求。从七个放射科医师的启发研究结果提供必要的领域知识，以指导原型设计。最后，14个儿童患者的临床研究，父母和临床医生，揭示各利益相关者积极响应时，使用原型的互动和病人的CT或MRI报告讨论并允许我们提取三个用例：合作沟通，准备咨询和评估放射学数据。我们利用我们的发现来讨论支持每个用例的设计考虑。 article link

447. How Values Shape Collaboration Between Patients with Multiple Chronic Conditions and Spousal Caregivers

SESSION:Family Health

Individuals with multiple chronic conditions (MCC) collaborate with spousal caregivers daily to pursue what is most important to their health and well-being. Previous research in human-computer interaction has supported individuals with chronic conditions or their caregivers, but little has supported both as a unit. We conducted a field study with 12 patient-caregiver dyads, all married and living together, to identify partners' values and how they shape collaborative management of MCC. Partners' coinciding values motivated them to empathize with and support each other in the face of challenges related to health and well-being. When their values were asymmetric, they perceived tensions between individual autonomy and their ability to coordinate with their partner. Systems to support partners in this context could help them overcome asymmetric values, but should balance this with support for individual autonomy.

> 与多种慢性疾病的人（MCC）与配偶照顾者的日常合作，追求的是什么对他们的健康和幸福最重要。以前的人机交互研究支持有慢性疾病的人或他们的照顾者，但很少支持作为一个单位。我们进行了实地研究，12病人照顾者的二元关系，所有的结婚生活在一起，寻找合作伙伴的价值观和他们如何塑造MCC协同管理。合作伙伴的一致的价值观驱使他们同情和在相关的健康和福祉的挑战面前相互支持。当他们的价值观是不对称的，他们认为个人自主性和他们与伴侣协调的能力之间的紧张关系。在这方面支持伙伴的制度可以帮助他们克服不对称的价值观，但应与支持个人自治相平衡。 article link

448. Through the Looking Glass: The Effects of Feedback on Self-Awareness and Conversational Behaviour during Video Chat

SESSION:Improving Video Communication

Video chat is a popular form of computer-mediated communication in a range of contexts from online job interviews to chatting with friends. Although seeing your own video feedback is the predominant interface design, self-awareness research suggests that seeing oneself could induce self-consciousness and affect interaction. We created a custom video chat application and asked pairs of strangers to engage in an online personal information exchange task with or without video feedback. Feedback increased self-awareness and the use of socially-focused words, and decreased the use of words expressing certainty. In addition, mixed-gender dyads rated themselves as more socially orientated with feedback than without, which was reflected in an increased use of inclusive pronouns and affiliation words, and fewer words expressing discrepancy. However, with feedback, same-gender dyads reported greater task orientation than mixed-gender dyads reflected in increased use of task-relevant words. We discuss design implications in contexts from remote therapy to online dating.

> 视频聊天是一种广泛的计算机媒介沟通方式，从网上求职到与朋友聊天。自我意识反馈是主要的界面设计，但自我意识的研究表明，看自己能引起自我意识并影响互动。我们创建了一个自定义视频聊天应用程序，并要求两对陌生人在有或没有视频反馈的情况下进行在线个人信息交换任务。反馈提高了自我意识和使用社交中心词的能力，减少了表示肯定的词语的使用。此外，混合性别的二元关系划分为更多的社会导向和反馈比没有的，这体现在包容性代词和关系词的使用增加，和更少的文字表达的差异。然而，反馈，同一性别的二元关系的报道比混合性别的二元关系体现在任务相关的词语的使用增加了更大的任务取向。我们讨论从远程治疗到在线约会的设计含义。 article link

449. Gestures From the Point of View of an Audience: Towards Anticipatable Interaction of Presenters With 3D Content.

SESSION:Improving Video Communication

Presenting content to an audience is important in several fields, including education, marketing, and entertainment. Therefore, the main goal of the presenter is to transport messages to the audience.The paper aims to improve the process of message transportation by providing audience-friendly and anticipatable gestures for the presenter to be used for 3D interaction with the content. For this purpose, we first gathered input from a potential audience through a Wizard of Oz experiment and implemented three coherent gesture sets using the Kinect. We conducted an online survey to evaluate the hypotheses regarding the anticipation rate and perceived user experience. In particular, two of our three gesture sets show tendencies to be intuitively predictable by an untrained, uninformed audience. As the three sets differ significantly in the anticipation level, we conclude that future improvements of such gestures would enhance the audience's ability to predict the intended actions even further.

> 向观众提供内容在教育、营销和娱乐等几个领域都很重要。因此，演讲者的主要目的是将信息传递给观众。本文旨在通过提供观众友好的主持人可以用于内容的三维交互手势和预期提高报文的传输过程。为此，我们首先通过一个奥兹向导实验从潜在的观众中获得了输入，并使用Kinect实现了三个连贯的手势集。我们进行了一次在线调查来评估关于预期率和感知用户体验的假设。特别是，我们三个手势集中的两个显示了未经训练的、不知情的观众可以直观地预测的倾向。由于三组在预期水平上有很大的不同，我们得出结论，未来这种手势的改进将进一步提高观众预测预期行动的能力。 article link

450. Showing Objects: Holding and Manipulating Artefacts in Video-mediated Collaborative Settings

SESSION:Improving Video Communication

In this paper we report on a pervasive practice in video-mediated communication: where participants show one another one or more objects. This is a distinct activity from others considered by researchers of video-mediated technologies that focus on a face-to-face orientation, or just on the support necessary to help people to refer to objects. We first present examples of this pervasive phenomenon in naturally occurring Skype conversations, revealing how this conduct is configured and organized within the interaction between participants. We reveal how the subtle adjustment of the position of the body, the head and gaze with respect to the handheld objects offers crucial resources for participants to achieve joint seeing. Then we report on a quite different setting, a naturalistic experiment where participants collaborate on a collective task with remote colleagues through maneuverable, orientable devices (Kubis). Again, in these experiments participants frequently show objects, and at times the devices provide additional resources to support these activities. But at other times they also involve some difficulties. We conclude by suggesting possible technological developments, some quite simple, others more radical, that might support participants to show objects, whether they are in domestic settings or undertaking work activities.

> 在本文中，我们报告了一个普遍的做法，在视频介导的沟通：参与者显示彼此一个或多个对象。这是由视频中介技术的研究者们考虑的一个独特的活动，这些技术侧重于面对面的定位，或者仅仅是为了帮助人们参考对象所必需的支持。我们首先介绍了这种现象在自然发生的Skype会话中的例子，揭示了这种行为是如何在参与者之间的交互中配置和组织的。我们揭示了如何调整身体的位置，头部和注视的手持对象提供了关键的资源，使参加者实现联合观察。我们报告一个完全不同的环境，一个自然的实验参与者协作与远程同事通过机动的集体任务，定向装置（Kubis）。同样，在这些实验中，参与者经常显示对象，有时设备提供额外的资源来支持这些活动。但有时也会遇到一些困难。最后，我们提出可能的技术发展，有些非常简单，有些更激进，可能会支持参与者展示对象，无论它们是在国内设置还是从事工作活动。 article link

451. ThirdEye: Simple Add-on Display to Represent Remote Participant's Gaze Direction in Video Communication

SESSION:Improving Video Communication

A long-standing challenge in video-mediated communication systems is to represent a remote participant's gaze direction in local environments correctly. To address this issue, we developed ThirdEye, an add-on eye-display for a video communication system. This display is made from an artificial ulexite (TV rock) that is cut into a hemispherical shape, enabling light from the bottom surface to be projected onto the hemisphere surface. By drawing an appropriate ellipse on an LCD and placing ThirdEye over it, this system simulates an eyeball. Our experiment proved that an observer could perceive a remote Looker's gaze direction more precisely when the gaze was presented using ThirdEye compared to the case in which the gaze was presented using the Looker's face on a flat display.

> 视频中介通信系统中的一个长期挑战是正确地代表远程参与者在本地环境中的注视方向。为了解决这个问题，我们开发了第三眼，对于视频通信系统的一个附加的眼睛显示。这显示是由人工钠硼解石（电视岩），剪成半球形，使光从底面被投影到半球面。通过在液晶显示器和放置在一个合适的第三眼画椭圆，该系统模拟眼球。我们的实验证明，观测者可以看到远程旁观者的注视方向更准确时，采用第三眼注视的情况相比，目光以旁观者的脸上呈现了平板显示器。 article link

452. FaceShare: Mirroring with Pseudo-Smile Enriches Video Chat Communications

SESSION:Improving Video Communication

"Mirroring" refers to the unconscious mimicry of another person's behaviors, such as their facial expressions. Mirroring has many positive effects, such as enhancing closeness and improving the flow of a conversation, which enriches the quality of communication. Our study set out to devise a means of evoking these positive effects in a video chat without any

conscious effort of participants. We constructed a videophone system, calledFaceShare, which can deform the user's face into a smile in response to their partner's smiling. That is, our system generates mirroring by producing a pseudo-smile through image processing. We conducted an experiment in which pairs of participants had brief conversations viaFaceShare. The results implied that mirroring using the pseudo-smile lets the mimicker, whose face is deformed according to the expressions of their partner, feel a closeness, and improves the flow of the conversation for both the mimicker and the mimickee, who sees the mimicker's deformed face.

> “镜像”是指对另一个人的行为，如面部表情的无意识模仿。镜像有许多积极的作用，如加强亲密度和改善谈话流程，从而丰富了交流的质量。我们的研究旨在设计一种在没有任何意识的参与者的情况下，在视频聊天中唤起这些积极效果的方法。我们构建了一个可视电话系统，calledfaceshare，可变形的用户面对回应伴侣的微笑微笑。也就是说，我们的系统通过图像处理产生一个伪微笑来生成镜像。我们进行了一项实验，对参与者有简短的交谈viafaceshare。结果表明，镜像使用伪笑让模仿别人的人，其面对的是根据对方的表情变形，感到亲近，并提高双方的mimickee似的对话流，谁看到似的变形的脸。 article link

453. Squeezeback: Pneumatic Compression for Notifications

SESSION:Online and On-the-go

Current mobile devices commonly use vibration feedback to signal incoming notifications. However, vibration feedback exhibits strong attention capture, limiting its use to short periods and prominent notifications. Instead, we investigate the use ofcompression feedbackfor notifications, which scales from subtle stimuli to strong ones and can provide sustained stimuli over longer periods. Compression feedback utilizes inflatable straps around a user's limbs, a form factor allowing for easy integration into many common wearables. We explore technical aspects of compression feedback and investigate its psychophysical properties with several lab and in situ studies. Furthermore, we show how compression feedback enablesreactivefeedback. Here, deflation patterns are used to reveal further information on a user's query. We also compare compression and vibrotactile feedback and find that they have similar performance.

> 当前的移动设备通常使用振动反馈来指示传入的通知。然而，振动反馈表现出强烈的注意力捕获，限制了它在短时间内的使用和显著的通知。相反，我们使用压缩反馈通知，尺度从细微的刺激强的和可以在更长的时间内提供持续的刺激。压缩反馈利用充气带子围绕用户的四肢，外形允许方便地集成到许多常见的服饰。我们探索压缩反馈的技术方面，并研究其心理物理学特性与几个实验室和原位研究。此外，我们展示了如何压缩反馈enablesreactivefeedback。在这里，通缩模式用于显示用户查询的进一步信息。我们也比较了压缩和振动触觉反馈，发现它们具有相似的性能。 article link

454. Cito: An Actuated Smartwatch for Extended Interactions

SESSION:Online and On-the-go

We propose and explore actuating a smartwatch face to enable extended interactions. Five face movements are defined: rotation, hinging, translation, rising, and orbiting. These movements are incorporated into interaction techniques to address limitations of a fixed watch face. A 20-person study uses concept videos of a passive low fidelity prototype to confirm the usefulness of the actuated interaction techniques. A second 20-person study uses 3D rendered animations to access social acceptability and perceived comfort for different actuation dynamics and usage contexts. Finally, we present Cito, a high-fidelity proof-of-concept hardware prototype that investigates technical challenges.

> 我们提出并探讨执行的SmartWatch面对启用扩展的相互作用。定义了五面运动：旋转、铰、翻译、上升，和轨道。这些动作被纳入交互技术，以解决固定手表面的局限性。一个20人的研究使用被动低保真原型的概念视频来确认驱动交互技术的实用性。第二个20人的研究使用3D渲染动画，以获取社会可接受性和感知舒适性，针对不同的驱动动态和使用环境。最后，我们提出了CITO，高保真的概念研究证明硬件原型技术挑战。 article link

455. How Busy Are You?: Predicting the Interruptibility Intensity of Mobile Users

SESSION:Online and On-the-go

Smartphones frequently notify users about newly available messages or other notifications. It can be very disruptive when these notifications interrupt users while they are busy. Our work here is based on the observation that people usually exhibit different levels of busyness at different contexts. This means that classifying users' interruptibility as a binary status, interruptible or not interruptible, is not sufficient to accurately measure their availability towards smartphone interruptions. In this paper, we propose, implement and evaluate a two-stage hierarchical model to predict people's interruptibility intensity. Our work is the first to introduce personality traits into interruptibility prediction model, and we found that personality data improves the prediction significantly. Our model bootstraps the prediction with similar people's data, and provides a good initial prediction for users whose individual models have not been trained on their own data yet. Overall prediction accuracy of our model can reach 66.1%.

> 智能手机经常通知用户新可用的消息或其他通知。当这些通知忙着打断用户时，会造成很大的破坏性。我们这里的工作是基于这样的观察：人们通常表现出不同程度的忙碌在不同的语境中。这意味着用户可中断分类为二进制状态，中断或不中断，不足以精确地衡量他们对智能手机的可用性中断。在本文中，我们提出，实施和评估的两阶段分层模型来预测人的可中断性强度。我们的工作是介绍人格特质为可中断的预测模型，第一，我们发现人格数据提高了预测显著。我们的模型的力量类似人的数据预测，并提供其个人的模型没有被训练自己的数据而用户良好的初步预测。总体预测精度可达66.1%。 article link

456. Demand Around the Clock: Time Use and Data Demand of Mobile Devices in Everyday Life

SESSION:Online and On-the-go

Motivated by mobile devices' growing demand for connectivity, and concern in HCI with the energy intensity and sustainability of networked services, in this paper we reveal the impact of applications on smartphones and tablets in terms of network demand and time use. Using a detailed mixed methods study with eight participants, we first provide an account of how data demand has meaning and utility in our participants' social practices, and the timing and relative impacts of these. We then assess the scale of this demand by drawing comparison between our fine-grained observations and a more representative dataset of 398 devices from the Device Analyzer corpus. Our results highlight the significant categories of data demanding practice, and the identification of where changes in app time and duration of use might reduce or shift demand to reduce services' impacts.

> 由于移动设备对连接的需求日益增长，以及HCI对网络服务的能量强度和可持续性的关注，本文从网络需求和时间使用两方面揭示了应用对智能手机和平板电脑的影响。使用八个参与者的详细混合方法研究，我们首先说明了数据需求在参与者的社会实践中的意义和效用，以及这些时间和相对影响。然后，我们通过我们的细粒度观测和比较有代表性的数据集从设备分析仪语料库398设备的需求评估的规模。我们的研究结果突出显示了数据需求实践的重要类别，并确定应用程序时间和使用时间的变化可能减少或转移需求以减少服务的影响。 article link

457. Reworking the Gaps between Design and Ethnography

SESSION:Speculation & Storytelling

Since Dourish's critique of 'implications for design' [15], researchers have asked how design and ethnography should or could relate in HCI. Here we reflect on two experiences with cross-informing ongoing ethnographic investigation with the early stages of research through design. One uses speculative design to reflect on and inform ethnographic fieldwork on busyness in middle-class familes; the other uses speculative design to complement late-stage analysis of a historical ethnography of rural technological infrastructure. Rather than trying to do away with the gap between ethnography and design by seamlessly integrating the two processes, we reworked the relationship between ethnography and design by closing the gap in the temporal workflows while simultaneously maintaining a distinction in the performance of the two roles. We found that this new gap resulted in a series of misunderstandings; but by putting the two roles in active dialogue, we were able leverage misunderstandings into mutual benefit.

> 由于设计的[15] Dourish批判的影响，研究人员询问如何设计和民族志应该或可能涉及人机交互。在这里，我们反思两个经验，交叉通知正在进行的人种学调查与早期阶段的研究，通过设计。一个使用投机性设计体现并告知田野调查对中产阶级家庭忙碌；另用投机的设计补充了农村科技基础设施历史民族志的后期分析。而不是试图消灭民族志和无缝集成的两个过程设计之间的差距，我们重做志和设计之间的关系通过缩小时间的工作流程，同时保持这两个角色的性能区别。我们发现，这一新的差距导致了一系列的误解，但把这两个角色放在积极对话中，我们能够把误解变成互惠互利。 article link

458. On Speculative Enactments

SESSION:Speculation & Storytelling

Speculative Enactments are a novel approach to speculative design research with participants. They invite the empirical analysis of participants acting amidst speculative but consequential circumstances. HCI as a broadly pragmatic, experience-centered, and participant-focused field is well placed to innovate methods that invite first-hand interaction and experience with speculative design projects. We discuss three case studies of this approach in practice, based on our own work: Runner Spotters, Metadating and a Quantified Wedding. In distinguishing Speculative Enactments we offer not just practical guidelines, but a set of conceptual resources for researchers and practitioners to critique the different contributions that speculative approaches make to HCI discourse.

> 投机活动是一种与参与者投机的设计研究方法。他们邀请参与者在投机但后果重大的情况下进行实证分析。人机交互作为一种广泛实用的、以经验为中心、以参与者为中心的领域，有助于创新方法，邀请第一手互动和经验与投机性设计项目。我们讨论了三这个方法在实践中的案例研究，基于自己的工作：转轮观察员，metadating和量化的婚礼。在区分投机活动我们不仅提供了实用的指导方针，但一系列的研究人员和从业人员的批判，投机的方法使人机交互的话语不同的概念资源。 article link

459. Research Fiction: Storytelling, Plot and Design

SESSION:Speculation & Storytelling

What kind of stories and plots do researchers of Human Computer Interaction draw on when they make fictions? This paper applies the "basic plots" identified in the study of literature to scenarios, speculative design and design fiction. Traditional HCI scenarios employ the plot of "Overcoming the Monster" where the monster is some problem to be solved. Much of the commentary on critical, speculative or adversarial design also draws on this plot as it attempts to overcome monsters like public apathy or a lack of debate. Design Fiction more frequently takes the form of a "Voyage and Return" or a "Quest". The paper argues that a better understanding of plot and storytelling could contribute to more reflective research fiction.

> 人类与计算机交互的研究人员在创作小说时采用什么样的故事和情节？本文将文学研究中的“基本情节”运用到情节、思辨性设计和虚构小说中。传统的人机交互场景使用“克服怪物”的情节，怪物需要解决的问题。许多关于批判性、投机性或对抗性设计的评论也利用这一情节，试图克服诸如公众冷漠或缺乏辩论等怪物。设计小说更频繁地采取“航程和返回”或“探索”的形式。本文认为，更好地了解情节和讲故事有助于更多的反思性研究小说。 article link

460. Intersectional HCI: Engaging Identity through Gender, Race, and Class

SESSION:Speculation & Storytelling

Understanding users becomes increasingly complicated when we grapple with various overlapping attributes of an individual's identity. In this paper we introduce intersectionality as a framework for engaging with the complexity of users' "and authors" "identities", and situating these identities in relation to their contextual surroundings. We conducted a meta-review of identity representation in the CHI proceedings, collecting a corpus of 140 manuscripts on gender, ethnicity, race, class, and sexuality published between 1982-2016. Drawing on this corpus, we analyze how identity is constructed and represented in CHI research to examine intersectionality in a human-computer interaction (HCI) context. We find that previous identity-focused research tends to analyze one facet of identity at a time. Further, research on ethnicity and race lags behind research on gender and socio-economic class. We conclude this paper with recommendations for incorporating intersectionality in HCI research broadly, encouraging clear reporting of context and demographic information, inclusion of author disclosures, and deeper engagement with identity complexities.

> 了解用户身份的各种重叠属性时，理解用户变得越来越复杂。本文介绍了交叉性作为一个框架，用于处理的复杂性，用户的“作者”的身份，这些身份和情境与它们的上下文环境。我们进行了一项在CHI诉讼身份表示荟萃，收集140篇稿件的性别，种族，种族，阶级，性别之间的1982-2016发表。这样的语料库，我们分析如何构建和代表身份卡研究研究人机交互（HCI）背景的交叉性。我们发现以前的以身份为中心的研究倾向于一次分析身份的一个方面。民族和种族的研究滞后于性别和社会经济阶层的研究。我们将在人机交互研究的交叉性广泛的建议，本文的结论是，鼓励环境和人口信息明确的报告，作者披露的夹杂物，和身份的复杂性更深入的接触。 article link

461. Vremiere: In-Headset Virtual Reality Video Editing

SESSION:Virtual Reality

Creative professionals are creating Virtual Reality (VR) experiences today by capturing spherical videos, but video editing is still done primarily in traditional 2D desktop GUI applications such as Premiere. These interfaces provide limited capabilities for previewing content in a VR headset or for directly manipulating the spherical video in an intuitive way. As a result, editors must alternate between editing on the desktop and previewing in the headset, which is tedious and interrupts the creative process. We demonstrate an application that enables a user to directly edit spherical video while fully immersed in a VR headset. We first interviewed professional VR filmmakers to understand current practice and derived a suitable workflow for in-headset VR video editing. We then developed a prototype system implementing this new workflow. Our system is built upon a familiar timeline

design, but is enhanced with custom widgets to enable intuitive editing of spherical video inside the headset. We conducted an expert review study and found that with our prototype, experts were able to edit videos entirely within the headset. Experts also found our interface and widgets useful, providing intuitive controls for their editing needs.

> 创造性的专业人员现在通过捕捉球形视频来创造虚拟现实（VR）体验，但视频编辑仍然主要在传统的2D桌面GUI应用程序中完成，如首映。这些接口中预览VR耳机或直接操纵的球形视频以直观的方式提供内容的能力有限。因此，编辑必须轮流编辑和预览在桌面上的耳机，这是繁琐和中断创作过程。我们演示了一个应用程序，用户可以直接编辑球形视频，同时完全沉浸在VR耳机中。我们首先采访了专业的虚拟现实电影制作人，以了解当前的实践，并为耳机VR视频编辑制作了一个合适的工作流程。然后我们开发了一个原型系统来实现这个新的工作流。我们的系统建立在一个熟悉的时间轴设计上，但使用自定义小部件增强了，以便在耳机内部直观地编辑球形视频。我们进行了一次专家审查研究，发现我们的原型可以完全在耳机内编辑视频。专家们还发现我们的界面和小部件很有用，为他们的编辑需求提供直观的控制。 article link

462. "They're Just Tixel Pits, Man": Disputing the 'Reality' of Virtual Reality Pornography through the Story Completion Method

SESSION:Virtual Reality

Pornography is a substantial part of humans' everyday interaction with computers, yet to date the topic has been underconsidered by HCI. Here, we examine some of the common cultural ideals non-experts constructed of a "new" pornographic experience - Virtual Reality (VR) Porn - through use of the "Story Completion Method". Forty five participants completed a story stem about a male character who was about to have his "very first virtual reality porn experience". Through our analysis, we demonstrate a narrative of a "perfect", idealised sexual experience, as well as one which emphasised the imagined "precarious" and dangerous consequences around this technology use. We indicate how the stories reproduced ideals around heteronormativity and hegemonic masculinity, suggesting an agenda of "Designing for Eroticism" as a tactic which could avoid such problematic discourses. We also suggest the opportunities and challenges presented through use of the "Story Completion Method".

> 色情是人类日常与计算机交互的重要组成部分，但迄今已underconsidered HCI。在这里，我们将通过“故事完成法”来研究一些由“新”色情体验——虚拟现实（色情）色情作品构成的非文化专家的共同文化理想。四十个五名参与者完成了一个故事，讲述了一个即将出现“第一次虚拟现实色情体验”的男性角色。通过我们的分析，我们证明了叙述的是一个“完美”的、理想化的性经验，以及一个强调想象的“不稳定”和危险的后果在这个技术的使用。我们如何在异性恋的故事再现和霸权的男性气质的理想，这一议程”设计色情”作为一种策略，可以避免此类问题的论述。我们还建议使用“故事完成法”提出的机会和挑战。 article link

463. ThermoVR: Exploring Integrated Thermal Haptic Feedback with Head Mounted Displays

SESSION:Virtual Reality

Head Mounted Displays (HMDs) provide a promising opportunity for providing haptic feedback on the head for an enhanced immersive experience. In ThermoVR, we integrated five thermal feedback modules on the HMD to provide thermal feedback directly onto the user's face. We conducted evaluations with 15 participants using two approaches: Firstly, we provided simultaneously actuated thermal stimulations (hot and cold) as directional cues and evaluated the accuracy of recognition; secondly, we evaluated the overall immersive thermal experience that the users experience when provided with thermal feedback on the face. Results indicated that the recognition accuracy for cold stimuli were of approx. 89.5% accuracy while the accuracy for hot stimuli were 68.6%. Also, participants reported that they felt a higher level of immersion on the face when all modules were simultaneously stimulated (hot and cold). The presented applications demonstrate the ThermoVR's directional cueing and immersive experience.

> 头戴式显示器（HMD）提供一个增强的身临其境的体验在头部的触觉反馈的一种很有前途的机会。在thermovr，我们集成五热反馈模块对HMD提供热直接反馈到用户的脸。我们进行了评价，15的参与者使用两种方法：首先，我们同时提供驱动的热刺激（冷热）为方向的线索和评估识别的准确性；其次，我们评估整体沉浸式热的经验，当有脸上热反馈的用户体验。结果表明，冷刺激的识别准确率约为89.5%，热刺激的准确率为68.6%。此外，参与者报告说，当所有模块同时受到刺激（热和冷）时，他们会感觉到更高程度的面部浸入。该应用程序演示了thermovr定向线索和身临其境的体验。 article link

464. Efficient Typing on a Visually Occluded Physical Keyboard

SESSION:Virtual Reality

The rise of affordable head-mounted displays (HMDs) has raised questions about how to best design user interfaces for this technology. This paper focuses on the use of HMDs for home and office applications that require substantial text input. A physical keyboard is a familiar and effective text input device in normal desktop computing. But without additional camera technology, an HMD occludes all visual feedback about a user's hand position over the keyboard. We describe a system that assists HMD users in typing on a physical keyboard. Our system has a virtual keyboard assistant that provides visual feedback inside the HMD about a user's actions on the physical keyboard. It also provides powerful automatic correction of typing errors by extending a state-of-the-art touchscreen decoder. In a study with 24 participants, we found our virtual keyboard assistant enabled users to type more accurately on a visually-occluded keyboard. We found users wearing an HMD could type at over 40 words-per-minute while obtaining an error rate of less than 5%.

> 负担得起的头戴式显示器（HMD）上涨提出质疑，如何最好地设计用户界面技术。本文侧重于家庭和办公室应用程序，需要大量的文本输入HMDS的使用。物理键盘是普通桌面计算中常见而有效的文本输入设备。但没有额外的相机技术，HMD阻塞所有视觉反馈用户的手在键盘上的位置。我们描述一个助攻HMD用户在物理键盘打字系统。我们的系统有一个虚拟键盘助手，提供视觉反馈在物理键盘上用户行为的HMD。它还通过扩展一个最先进的触摸屏解码器，提供了强大的自动更正打字错误的功能。在一项有24名参与者的研究中，我们发现我们的虚拟键盘助手可以让用户在视觉键盘上更精确地打字。我们发现用户戴着头盔可以输入每分钟超过40字而获得小于5%的误差率。 article link

465. Showing People Behind Data: Does Anthropomorphizing Visualizations Elicit More Empathy for Human Rights Data?

SESSION:Visualization for the People

We investigate the impact of using anthropomorphized data graphics over standard charts on viewers' empathy for, and prosocial behavior toward suffering populations, in the context of human rights narratives. We present a series of experiments conducted on Amazon Mechanical Turk, in which we compare various forms of anthropomorphized data graphics-ranging from a single human figure that "fills up" to show proportional data, to separated groups of individual human beings-with a standard chart baseline. Each experiment uses two carefully crafted human rights data-driven stories to present the graphics. Contrary to our expectations, we consistently find that anthropomorphized data graphics and standard charts have very similar effects on empathy and prosocial behavior.

> 我们研究过观众的同情标准图使用拟人化的数据图形的影响，以及对苦难的群体的亲社会行为，在人权的叙事语境。我们提出了一系列关于亚马逊机械土耳其人进行的实验，在其中我们比较各种形式的人性化数据图形的范围从一个单一的人物，“填补”显示比例数据，分离群体的人类个体与标准图的基线。每个实验使用两个精心编写的人权数据驱动的故事来呈现图形。出乎我们的意料，我们坚持认为人性化数据图形和标准图对移情与亲社会行为的影响非常相似。 article link

466. Narratives in Crowdsourced Evaluation of Visualizations: A Double-Edged Sword?

SESSION:Visualization for the People

We explore the effects of providing task context when evaluating visualization tools using crowdsourcing. We gave crowdsource workers i) abstract information visualization tasks without any context, ii) tasks where we added semantics to the dataset, and iii) tasks with two types of backstory narratives: an analytic narrative and a decision-making narrative. Contrary to our expectations, we did not find evidence that adding data semantics increases accuracy, and further found that our backstory narratives can even decrease accuracy. Adding dataset semantics can however increase attention and provide subjective benefits in terms of confidence, perceived easiness, task enjoyability and perceived usefulness of the visualization. Nevertheless, our backstory narratives did not appear to provide additional subjective benefits. These preliminary findings suggest that narratives may have complex and unanticipated effects, calling for more studies in this area.

> 我们探索在使用包众评估可视化工具时提供任务上下文的效果。我们给众包工人我）摘要信息可视化的任务，没有任何背景，II）的任务，我们增加了语义的数据集，和III）两类故事叙事的任务：分析叙事和决策的叙述。出乎我们的意料，我们没有发现证据表明，添加数据的语义增加准确性，并进一步发现，我们的故事的叙述，甚至可以降低精度。添加数据集的语义可以提高注意力和信心而言，提供主观利益知觉易用性、欣赏性和感知有用性任务的可视化。然而，我们的故事的叙述似乎并没有提供额外的主观福利。这些初步研究结果表明，叙事可能有复杂的和意想不到的影响，呼吁在这方面更多的研究。 article link

467. Visualization Literacy at Elementary School

SESSION:Visualization for the People

This work advances our understanding of children's visualization literacy, and aims to improve it through a novel approach for teaching visualization at elementary school. We first contribute an analysis of data graphics and activities employed in grade K to 4 educational materials, and the results of a survey conducted with 16 elementary school teachers. We find that visualization education could benefit from integrating pedagogical strategies for teaching abstract concepts with established interactive visualization techniques. Building on these insights, we develop and study design principles for novel interactive teaching material aimed at increasing children's visualization literacy. We specifically contribute C'est La Vis, an online platform for teachers and students to respectively teach and learn about pictographs and bar charts, and report on our initial observations of its use in grades K and 2.

> 这项工作促进了我们对儿童视觉素养的理解，旨在通过一种新的小学视觉教学方法来改进它。我们首先分析了K年级到4年级的数据图表和活动，并对16名小学教师进行了调查。我们发现，可视化教育可以从整合抽象概念和建立交互式可视化技术的教学策略中获益。基于这些见解，我们开发和研究新的互动教学材料的设计原则，旨在提高儿童的视觉素养。我们特别为这就是可见，教师和学生教与学的象形文字，分别对条形图的在线平台，并报告我们在等级K和2使用的初步观察。 article link

468. Finding Similar People to Guide Life Choices: Challenge, Design, and Evaluation

SESSION:Visualization for the People

People often seek examples of similar individuals to guide their own life choices. For example, students making academic plans refer to friends; patients refer to acquaintances with similar conditions, physicians mention past cases seen in their practice. How would they want to search for similar people in databases? We discuss the challenge of finding similar people to guide life choices and report on a need analysis based on 13 interviews. Our PeerFinder prototype enables users to find records that are similar to a seed record, using both record attributes and temporal events found in the records. A user study with 18 participants and four experts shows that users are more engaged and more confident about the value of the results to provide useful evidence to guide life choices when provided with more control over the search process and more context for the results, even at the cost of added complexity.

> 人们经常寻找相似的人来指导他们自己的生活选择。例如，制定学术计划的学生指的是朋友；病人指的是具有相似条件的熟人，医生提及他们在实践中看到的过去的案例。他们将如何寻找数据库中相似的人？我们讨论了寻找相似的人来指导生活选择的挑战，并根据13次访谈报告了需要分析。我们的peerfinder原型让用户找到类似种子的记录，使用记录的属性和时间事件记录中的发现。18参与者和四专家表明，用户更多地参与和对结果的价值提供指导人生选择时提供了更多的控制搜索过程和更多的上下文的结果有用的证据，更自信的用户研究，即使在复杂性增加的成本。 article link

469. Better Organization or a Source of Distraction?: Introducing Digital Peer Feedback to a Paper-Based Classroom

SESSION:Classroom Tools

Peer feedback is a central activity for project-based design education. The prevalence of devices carried by students and the emergence of novel peer feedback systems enables the possibility of collecting and sharing feedback immediately between students during class. However, pen and paper is thought to be more familiar, less distracting for students, and easier for instructors to implement and manage. To evaluate the efficacy of in-class digital feedback systems, we conducted a within-subjects study with 73 students during two weeks of a game design course. After short student presentations, while instructors provided verbal feedback, peers provided feedback either on paper or through a device. The study found that both methods yielded comments of similar quality and quantity, but the digital approach provided additional ways for students to participate and required less effort from the instructors. While both methods produced similar behaviors, students held inaccurate perceptions about their behavior with each method. We discuss design implications for technologies to support in-class feedback exchange.

> 同侪反馈是以项目为基础的设计教育的中心活动。学生携带的设备的普及和新的同伴反馈系统的出现使得学生在课堂上立即收集和分享反馈信息成为可能。然而，纸和纸被认为更为熟悉，对学生来说更不易分心，而且教师更容易实施和管理。为了评估课堂数字反馈系统的有效性，我们在一个游戏设计课程的两周内，对73名学生进行了一项内部研究。在简短的学生陈述之后，当教师提供口头反馈时，同事们在纸上或通过设备提供反馈。研究发现，这两种方法都产生了类似的质量和数量的评论，但是数字化方法为学生提供了更多的参与方式，并且要求教师较少的努力。虽然这两种方法都产生了类似的行为，但学生们对每个方法的行为都持有不正确的看法。我们讨论了支持类反馈交换的技术的设计含义。 article link

470. Group Spinner: Recognizing and Visualizing Learning in the Classroom for Reflection, Communication, and Planning

SESSION:Classroom Tools

Group Spinner is a digital visual tool intended to help teachers observe and reflect on children's collaborative technology-enhanced learning activities in the classroom. We

describe the design of Group Spinner, which was informed by activity theory, previous work and teachers' focus group feedback. Based on a radar chart and a set of indicators, Group Spinner allows teachers to record in-class observations as to different aspects of group learning and learning behaviors, beyond the limited knowledge acquisition measures. Our exploratory study involved 6 teachers who used the tool for a total of 23 classes in subjects ranging from Maths and Geography to Sociology and Art. Semi-structured interviews with these teachers revealed a number of different uses of the tool. Depending on their experience and pedagogy, teachers considered Group Spinner to be a valuable tool to support awareness, reflection, communication, and/or planning.

> “组旋转器”是一种数字视觉工具，旨在帮助教师观察和思考儿童协作技术在课堂上增强的学习活动。通过活动理论、先前的工作和教师的焦点小组反馈，描述了小组旋转器的设计。基于雷达图和一组指标，小组成员可以在课堂观察中记录不同群体学习和学习行为的不同方面，超出了有限的知识获取措施。我们的探索性研究包括6名教师，他们从数学和地理到社会学和艺术，总共使用了23门课程。这些教师的半结构化面试揭示了该工具的许多不同用途。根据他们的经验和教育学，教师认为小组微调是一个有价值的工具，以支持认识，反思，沟通，和/或规划。 article link

471. ViVo: Video-Augmented Dictionary for Vocabulary Learning

SESSION:Classroom Tools

Research on Computer-Assisted Language Learning (CALL) has shown that the use of multimedia materials such as images and videos can facilitate interpretation and memorization of new words and phrases by providing richer cues than text alone. We present ViVo, a novel video-augmented dictionary that provides an inexpensive, convenient, and scalable way to exploit huge online video resources for vocabulary learning. ViVo automatically generates short video clips from existing movies with the target word highlighted in the subtitles. In particular, we apply a word sense disambiguation algorithm to identify the appropriate movie scenes with adequate contextual information for learning. We analyze the challenges and feasibility of this approach and describe our interaction design. A user study showed that learners were able to retain nearly 30% more new words with ViVo than with a standard bilingual dictionary days after learning. They preferred our video-augmented dictionary for its benefits in memorization and enjoyable learning experience.

> 计算机辅助语言学习（CALL）的研究表明，使用多媒体材料，如图像和视频，可以通过提供比文字更丰富的线索来解释和记忆新单词和短语。我们提出了一种新的视频增强词典，它提供了一种廉价、方便、可扩展的方法来利用大量的在线视频资源进行词汇学习。活体会自动从现有电影中生成字幕中突出显示的目标视频短片。特别是，我们应用一个词义消歧算法，以确定适当的电影场景，为学习提供足够的上下文信息。我们分析了这种方法的挑战和可行性，并描述了我们的交互设计。一项用户研究表明，学习者在学习后的天数比标准双语词典要多保留近30%个新单词。他们喜欢我们的视频增强字典，因为它有助于记忆和愉快的学习体验。 article link

472. From in the Class or in the Wild?: Peers Provide Better Design Feedback Than External Crowds

SESSION:Classroom Tools

As demand for design education increases, instructors are struggling to provide timely, personalized feedback for student projects. Gathering feedback from classroom peers and external crowds offer scalable approaches, but there is little evidence of how they compare. We report on a study in which students (n=127) created early- and late-stage prototypes as part of nine-week projects. At each stage, students received feedback from peers and external crowds: their own social networks, online communities, and a task market. We measured the quality, quantity and valence of the feedback and the actions taken on it, and categorized its content using a taxonomy of critique discourse. The study found that peers produced feedback that was of higher perceived quality, acted upon more, and longer compared to the crowds. However, crowd feedback was found to be a viable supplement to peer feedback and students preferred it for projects targeting specialized audiences. Feedback from all sources spanned only a subset of the critique categories. Instructors may fill this gap by further scaffolding feedback generation. The study contributes insights for how to best utilize different feedback sources in project-based courses.

> 随着设计教育需求的增加，教师们正在努力为学生项目提供及时、个性化的反馈。收集课堂同行和外部人群的反馈提供了可伸缩的方法，但几乎没有证据表明它们是如何进行比较的。我们报告了一项研究，其中学生（N = 127）创建了早期和晚期原型，作为九周项目的一部分。在每一个阶段，学生都会得到同龄人和外部人群的反馈：他们自己的社交网络、在线社区和任务市场。我们测量了反馈的质量、数量和效价以及采取的行动，并用批评话语的分类对其内容进行了分类。研究发现，同龄人产生的反馈质量更高，行动更多，而且比人群更长。然而，人群反馈被认为是一个可行的补充同侪反馈，学生更喜欢针对专门观众的项目。所有来源的反馈只涉及批评类别的一小部分。教师可以通过进一步的脚手架反馈生成来填补这一空白。该研究为如何在项目课程中更好地利用不同反馈源提供了见解。 article link

473. Collection Objects: Enabling Fluid Formation and Manipulation of Aggregate Selections

SESSION:Finger and Pen

Despite the long development of Graphical User Interfaces, working with multiple graphical objects remains a challenge, due to the difficulties of forming complex selections, ambiguities of operations, and tediousness of repetitively unselect-reselect or ungroup-regroup objects. Instead of tackling them as individual problems, we attribute it to the lack of system support to the general selection-action cycles. We propose Collection Objects to not only support a single fast selection-action cycle but also allow multiple cycles to be chained together into a fluid workflow. Collection Objects unifies selection, grouping, and manipulation of aggregate selections into a single object, with which selection can be composed with various techniques, modified for later actions, grouped with objects inside still directly accessible, and quasi-moded for less context switching. We implemented Collection Object in the context of a vector drawing application with simultaneous pen and touch input. Results of an expert evaluation show that Collection Objects holds considerable promises for fluid interaction with multiple objects.

> 尽管图形用户界面的发展，与多个图形对象的工作仍然是一个挑战，由于形成复杂的选择困难，模糊操作，并反复取消重新选择或取消重组对象沉闷。我们不把它们当作单个问题来解决，而是把它归结为缺乏对一般选择操作周期的系统支持。我们建议集合对象不仅支持单一的快速选择操作周期，而且允许多个循环被链接在一起成为流体工作流。集合对象相结合的选择、分组和操纵总选择到一个单一的对象，它的选择可以由各种不同的技术，改进后的动作，分组对象里面还是直接访问，和准模型更少的上下文切换。我们在一个矢量绘图应用程序的上下文中实现了采集对象，同时使用笔和触摸输入。专家评估的结果表明，集合对象与多个对象的流体交互具有相当大的承诺。 article link

474. IllumiPaper: Illuminated Interactive Paper

SESSION:Finger and Pen

Due to their simplicity and flexibility, digital pen-and-paper solutions have a promising potential to become a part of our daily work. Unfortunately, they lack dynamic visual feedback and thereby restrain advanced digital functionalities. In this paper, we investigate new forms of paper-integrated feedback, which build on emerging paper-based electronics and novel thin-film display technologies. Our approach focuses on illuminated elements, which are seamlessly integrated into standard paper. For that, we introduce an extended

design space for paper-integrated illuminations. As a major contribution, we present a systematic feedback repertoire for real-world applications including feedback components for innovative paper interaction tasks in five categories. Furthermore, we contribute a fully-functional research platform including a paper-controller, digital pen and illuminated, digitally controlled papers that demonstrate the feasibility of our techniques. Finally, we report on six interviews, where experts rated our approach as intuitive and very usable for various applications, in particular educational ones.

> 由于其简单和灵活，数字笔和纸的解决方案有很好的潜力，成为我们日常工作的一部分。不幸的是，它们缺乏动态的视觉反馈，从而抑制了先进的数字功能。在本文中，我们研究了纸张集成反馈的新形式，它建立在新兴的纸上电子和新的薄膜显示技术之上。我们的方法侧重于照明元件，这是无缝集成到标准的文件。这样，我们引入结合照明扩展设计空间。作为一个主要贡献，我们提出了一个系统反馈剧目，为现实世界的应用，包括反馈组件的创新纸交互任务在五个类别。此外，我们提供了一个功能齐全的研究平台，包括纸张控制器，数字笔和照明，数字控制的文件，证明了我们的技术的可行性。最后，我们报告了六个访谈，专家们认为我们的方法直观，非常适用于各种应用，特别是教育应用。 article link

475. Does Practice Make Perfect?

SESSION:Finger and Pen

Touch latency has been shown to deteriorate users' performances at levels as low as 25 ms, but this was tested only in short experimental sessions. Real life usage of touchscreens covers much longer periods. It provides training which could lead to reduce the impact of latency.We investigate users' ability to compensate for touch latency with training. Two groups of participants were trained on a tracking task during ten different days over two weeks with either high or low latency. The gap of performances between the two groups, observed at the beginning of the experiment, was reduced by 54 % after training. Users can thus compensate for latency, at least partially. These results nuance the negative effects of touch latency reported in previous work. They suggest that long-term studies could provide better insights on users' behaviors when dealing with touch latency.

> 触摸延迟已被证明恶化用户的性能在低至25毫秒的水平，但这只在短的实验会话测试。触摸屏的使用涵盖现实生活更长时间。它提供了可以减少延迟影响的培训，我们研究了用户通过培训来补偿触摸延迟的能力。两组受试者在十个不同的日子里接受了跟踪任务，他们在两周内接受了高或低的潜伏期。两组在实验开始时观察到的成绩差距在训练后减少了54%。因此，用户至少可以部分地弥补延迟。这些结果细微地反映了以前工作中报告的触摸延迟的负面影响。他们认为长期研究可以更好地理解用户在处理触摸延迟时的行为。 article link

476. MarkPad: Augmenting Touchpads for Command Selection

SESSION:Finger and Pen

We present MarkPad, a novel interaction technique taking advantage of the touchpad. MarkPad allows creating a large number of size-dependent gestural shortcuts that can be spatially organized as desired by the user. It relies on the idea of using visual or tactile marks on the touchpad or a combination of them. Gestures start from a mark on the border and end on another mark anywhere. MarkPad does not conflict with standard interactions and provides a novice mode that acts as a rehearsal of the expert mode. A first study showed that an accuracy of 95% could be achieved for a dense configuration of tactile and/or visual marks allowing many gestures. Performance was 5% lower in a second study where the marks were only on the borders. A last study showed that borders are rarely used, even when the users are unaware of the technique. Finally, we present a working prototype and briefly report on how it was used by two users for a few months.

> 我们目前的markpad，一个新的互动技术，利用触摸板。markpad允许创建大量的大小依赖于手势的快捷方式，可根据用户需要的空间组织。它依赖于使用触摸板上的视觉或触觉标记或它们的组合的想法。手势从边界上的标记开始，最后在另一个标记上结束。MarkPad不标准的交互冲突和提供新手模式作为排练的专家模式。第一项研究表明，对于触觉和/或视觉标记的密集配置，可以实现95%的准确率。在第二项研究中，只有边界上的成绩比对照组低5%。最后一项研究表明，即使用户不知道这种技术，也很少使用边界。最后，我们提出了一个工作原型，并简要报告了它如何被两个用户使用了几个月。 article link

477. Experimental Evaluation of Sketching on Surfaces in VR

SESSION:Interactions in Virtual Reality

Sketching in immersive 3D virtual reality (VR) environments has great potential for a variety of interactive 3D design applications. Precisely sketching the intended strokes in mid-air, however, can be a challenge. In this paper, we present a set of controlled studies to analyze the factors affecting human ability to sketch freely in a 3D VR environment. In our first study, we directly compare traditional sketching on a physical surface to sketching in VR, with and without a physical surface to rest the stylus on. Our results indicate that the lack of a physical drawing surface is a major cause of inaccuracies in VR drawing, and that the effect is dependent on the orientation of the drawing surface. In a second experiment, we evaluate the extent to which visual guidance can compensate for the loss of sketching precision in VR. We found that while additional visual guidance improves positional accuracy, it can be detrimental to the aesthetic quality of strokes. We conclude by distilling our experimental findings into design guidelines for sketching tools in immersive 3D environments.

> 沉浸式三维虚拟现实（VR）环境中的草图对各种交互式三维设计应用有很大的潜力。然而，准确地描绘空中的划划是一个挑战。在本文中，我们提出了一套控制研究，以分析影响因素的能力，自由素描在三维虚拟现实环境中。在我们的第一项研究中，我们直接比较传统的素描在物理表面上素描VR，有没有物理表面休息的手写笔。我们的研究结果表明，缺乏一个物理绘图表面的一个主要原因是不准确的VR绘图，其效果是取决于方向的绘图表面。在第二个实验中，我们评估了视觉引导在虚拟现实中如何弥补草图精度损失的程度。我们发现，虽然额外的视觉指导提高了定位精度，但它可能会损害中风的美学质量。最后，我们将我们的实验结果提炼成沉浸式3D环境中草图工具的设计准则。 article link

478. I Am The Passenger: How Visual Motion Cues Can Influence Sickness For In-Car VR

SESSION:Interactions in Virtual Reality

This paper explores the use of VR Head Mounted Displays (HMDs) in-car and in-motion for the first time. Immersive HMDs are becoming everyday consumer items and, as they offer new possibilities for entertainment and productivity, people will want to use them during travel in, for example, autonomous cars. However, their use is confounded by motion sickness caused in-part by the restricted visual perception of motion conflicting with physically perceived vehicle motion (accelerations/rotations detected by the vestibular system). Whilst VR HMDs restrict visual perception of motion, they could also render it virtually, potentially alleviating sensory conflict. To study this problem, we conducted the first on-road and in motion study to systematically investigate the effects of various visual presentations of the real-world motion of a car on the sickness and immersion of VR HMD wearing passengers. We established new baselines for VR in-car motion sickness, and found that there is no one best presentation with respect to balancing sickness and immersion.

Instead, user preferences suggest different solutions are required for differently susceptible users to provide usable VR in-car. This work provides formative insights for VR designers and an entry point for further research into enabling use of VR HMDs, and the rich experiences they offer, when travelling.

> 本文探讨了虚拟现实头戴式显示器（HMD）使用首次汽车与运动。身临其境的HMDS正在成为日常消费品，为他们提供娱乐和生产力的新的可能性，人们会希望在旅行中，使用例如，自主车。然而，他们的使用被运动病所困扰，部分原因是运动知觉受限，与身体感知的车辆运动相冲突（前庭系统检测到的加速/旋转）。虽然VR HMD限制运动的视觉感受，也使其几乎，可能缓解感觉冲突。为了研究这个问题，我们进行了道路和运动分析系统研究车的实际运动的各种视觉表现的疾病和虚拟现实头盔戴乘客浸泡作用的第一。我们在汽车运动病中建立了新的VR基线，发现在平衡疾病和沉浸感方面没有最好的表现。相反，用户偏好建议不同的解决方案需要不同的易感用户提供可用的VR汽车。这项工作对于VR设计师和切入点，进一步研究可使用VR HMD的形成提供了丰富的经验，以及他们的报价，旅行时。 article link

479. VaiR: Simulating 3D Airflows in Virtual Reality

SESSION:Interactions in Virtual Reality

The integration of multi-sensory stimuli, e.g. haptic airflow, in virtual reality (VR) has become an important topic of VR research and proved to enhance the feeling of presence. VaiR focuses on an accurate and realistic airflow simulation that goes far beyond wind. While previous works on the topic of airflow in VR are restricted to wind, while focusing on the feeling of presence, there is to the best of our knowledge no work considering the conceptual background or on the various application areas. Our pneumatic prototype emits short and long term flows with a minimum delay and is able to animate wind sources in 3D space around the user's head. To get insights on how airflow can be used in VR and how such a device should be designed, we arranged focus groups and discussed the topic. Based on the gathered knowledge, we developed a prototype which proved to increase presence, as well as enjoyment and realism, while not disturbing the VR experience.

> 虚拟现实中多感觉刺激（如触觉气流）的集成已成为虚拟现实研究的一个重要课题，并被证明能增强存在感。毛皮以精确的气流模拟，远远超越了风和现实。虽然以前关于VR气流问题的研究仅限于风，而关注存在感，但据我们所知，没有考虑概念背景或各种应用领域的工作。我们的气动样机以最小的延迟发出短时间和长时间的流量，并能够在用户头部周围的三维空间中激发风源。为了了解气流如何在VR中使用，以及如何设计这样的装置，我们安排了焦点小组并讨论了这个话题。基于所收集的知识，我们开发了一个原型，证明了增加的存在，以及享受和现实主义，而不干扰虚拟现实体验。 article link

480. Collaborative Map Making: A Reflexive Method for Understanding Matters of Concern in Design Research

SESSION:Mobility and Navigation in Many Forms

HCI researchers investigating the politics of technology design have recently focused on how design practice can tackle "Matters of Concern" - complex social issues perceived and experienced in multiple ways. These researchers suggest design research can generate new networks of human and non-human actors to express and act on these issues. Prior studies, however, tend to restrict their networks within traditional boundaries (e.g. existing organizations, local communities) and categories (e.g. human/nonhuman binary) without examining their significance for participants. We suggest collaborative map making as a reflexive method for understanding current Matters of Concern from the perspectives of diverse actors, not just researchers. As case studies of the method's use, we present two studies of domestic computing technologies in the US and South Korea, which show how collaborative map making allows salient networks to expand beyond the individual actors in the home to local and global power issues outside of boundaries (e.g. physical house) and categories (e.g. private/public space) commonly recognized in HCI. Our methodology provides HCI researchers with a way to understand existing Matters of Concern, so they can position themselves to address and act on these issues.

> 研究技术设计政治学的HCI研究人员最近关注于设计实践如何处理“关注的问题”——复杂的社会问题，以多种方式感知和体验。这些研究人员建议设计研究可以产生新的人类和非人类行动者的网络来表达和行动这些问题。然而，以前的研究倾向于限制他们的网络在传统的边界（如现有的组织，当地社区）和类别（如人/非人的二进制），而不检查他们的参与者的意义。我们建议协同地图制作作为一种反射方法，从不同的参与者的角度来理解当前的问题，而不仅仅是研究人员。作为方法的应用案例研究，提出国内计算技术研究在美国和韩国，这表明如何协同制作地图允许突出网络扩大超越个体演员在家中的局部和全局的权力之外的问题（如物理边界房子）和类别（如私人/公共空间）在人机交互领域的普遍认可。我们的方法为HCI研究人员提供了一种了解现有问题的方法，以便他们能够自己定位和处理这些问题。 article link

481. Toward Principles for the Design of Navigation Affordances in Code Editors: An Empirical Investigation

SESSION:Mobility and Navigation in Many Forms

Design principles are a key tool for creators of interactive systems; however, a cohesive set of principles has yet to emerge for the design of code editors. In this paper, we conducted a between-subjects empirical study comparing the navigation behaviors of 32 professional LabVIEW programmers using two different code-editor interfaces: the ubiquitous tabbed editor and the experimental Patchworks editor. Our analysis focused on how the programmers arranged and navigated among open information patches (i.e., code modules and program output). Key findings of our study included that Patchworks users made significantly fewer click actions per navigation, juxtaposed patches side by side significantly more, and exhibited significantly fewer navigation mistakes than tabbed-editor users. Based on these findings and more, we propose five general principles for the design of effective navigation affordances in code editors.

> 设计原则是交互式系统创建者的一个关键工具；然而，代码编辑器的设计还没有形成一套连贯的原则。在本文中，我们进行了一项实证研究比较32个学科专业的LabVIEW程序员使用了两种不同的代码编辑器界面的导航行为之间：无处不在的标签编辑器和实验拼凑编辑。我们的分析着重于程序员如何在开放的信息补丁（即代码模块和程序输出）之间安排和导航。本研究的主要发现包括：拼凑用户显着较少的点击动作/导航，将补丁并排更明显，并表现出显着更少的错误比标签编辑器的用户导航。基于这些发现，更多的，我们提出了有效的导航功能在代码编辑器的设计的一般原则五。 article link

482. Follow-My-Lead: Intuitive Indoor Path Creation and Navigation Using Interactive Videos

SESSION:Mobility and Navigation in Many Forms

We present Follow-My-Lead, an alternative indoor navigation technique that uses visual information recorded on an actual navigation path as a navigational guide. Its design revealed a trade-off between the fidelity of information provided to users and their effort to acquire it. Our first experiment revealed that scrolling through a continuous image stream of the navigation path is highly informative, but it becomes tedious with constant use. Discrete image checkpoints require less effort, but can be confusing. A balance may be struck by adding fast video transitions between image checkpoints, but precise control is required to handle difficult situations. Authoring still image checkpoints is also difficult, and this inspired us to invent a new technique using video checkpoints. We conducted a second experiment on authoring and navigation performance and found video checkpoints plus fast video transitions to be better than both image checkpoints plus fast video transitions and traditional written instructions.

> 我们提出跟随我的领导，一种替代的室内导航技术，使用视觉信息记录在实际导航路径上作为导航指南。它的设计揭示了提供给用户的信息的保真度与他们获取信息的努力之间的权衡。我们的第一个实验表明，通过导航路径的连续图像流滚动是非常翔实的，但它变得单调乏味的不断使用。离散图像检查站需要较少的努力，但可能会混淆。可以通过在图像检查点之间添加快速视频转换来实现平衡，但需要精确控制来处理困难情况。编写静态图像检查点也很困难，这启发我们使用视频检查点发明一种新技术。我们进行了第二个关于创作和导航性能的实验，发现视频检查站加上快速视频转换比图像检查点加上快速视频转换和传统的书面指令要好。 article link

483. Mobility in Later Life: Appropriation of an Integrated Transportation Platform

SESSION:Mobility and Navigation in Many Forms

We present the results of a design case study focusing on supporting the daily transportation of elderly in Germany. We conceptualized, developed and studied the appropriation of a transportation information system intended to ease switching between different transportation modes. Based on a literature review and a context study with 21 interviews we explored routinized transport mode usage and barriers when switching between modes. Iteratively, we co-designed a transport platform accessible via a website, a mobile app, and an iTV app. We further looked at the appropriation of the platform into the daily lives of 19 persons. Studying the appropriation highlighted different factors that facilitate the adoption of alternative transport options. The factors included reducing uncertainty, complementing transport information with context information (e.g. weather) and providing informational access based on the user's preferences as well as fitting in with the situational needs (activity related).

> 我们提出了一个设计案例研究的结果，重点是支持德国老年人的日常交通。我们构思、开发和研究了运输信息系统的用途，旨在缓解不同运输方式之间的切换。基于文献回顾和语境研究21访谈探索常规运输方式的使用和壁垒模式之间切换时。迭代地，我们共同设计了通过一个网站、一个移动应用程序和一个ITV应用程序访问的传输平台。我们进一步研究了这个平台在19个人的日常生活中的用途。研究拨款强调了促进替代运输选择的不同因素。这些因素包括减少不确定性，补充上下文信息（例如天气）的传输信息，并根据用户的喜好提供信息访问，以及与情境需求（活动相关）相适应。 article link

484. Gains from Participatory Design Team Membership as Perceived by Child Alumni and their Parents

SESSION:Participant Design with Children

The direct gains children perceive from their membership on Participatory Design (PD) teams are seldom the focus of research studies. Yet, how HCI practitioners choose to include children in PD methods may influence the value participants see in their participation, and thereafter the outcomes of PD processes. To understand what gains former child members of a PD team perceive from their participation we conducted a two-part study. In Study 1 we surveyed and interviewed child alumni of a PD team to determine gains that are perceived first-hand. In Study 2 we obtained a secondary perspective by surveying and interviewing parents of alumni. We report on the perceived gains to former participants that were identified and described in these two studies-including collaboration, communication, design process knowledge, and confidence. We reflect on our findings through discussions of the continued applicability of gains, new opportunities, and implications for PD practitioners and methods.

> 儿童从参与式设计团队中获得的直接收益很少是研究的重点。然而，HCI从业者如何选择将儿童纳入PD方法可能会影响参与者在参与中看到的价值，以及随后PD过程的结果。为了了解PD团队的前儿童成员从他们的参与中获得了什么，我们进行了两部分的研究。在研究1中，我们调查并采访了一个PD团队的儿童校友，以确定他们的亲身体验。在研究2中，我们通过对校友家长的调查和访谈，获得了中学视角。我们报告了在这两项研究中发现和描述的前参与者的感知收益，包括协作、沟通、设计过程知识和信心。我们通过讨论收益的持续适用性、新的机会以及对PD从业人员和方法的影响，对我们的研究结果进行反思。 article link

485. Examining Adult-Child Interactions in Intergenerational Participatory Design

SESSION:Participant Design with Children

Prior studies have focused on child interactions in participatory design (PD) with adults and children, but less is known about what specific adult-child interactions constitute a partnership. In this study, we unpack what constitutes an "equal partnership" in PD between adults and children. On the basis of prior literature, we created a new framework that examines the complementary roles between children and adults. Next, we analyzed a case study of a year-long intergenerational design team of children (ages 7-11) and adults. From this analysis, we determined that design partnerships are composed of four dimensions that span from unbalanced to balanced interactions: facilitation, relationship building, design-by-doing, and elaborating together. Finally, to demonstrate its utility, we analyzed two focal co-design sessions using our framework. Our analysis suggests that equal partnership in PD is not a single static interaction but a development over time of design interactions influenced by context, experience, and participants.

> 以往的研究主要集中在成人和儿童参与设计（PD）中的儿童互动，但对具体的成人儿童互动构成伙伴关系的了解较少。在这项研究中，我们打开了在成人和儿童之间PD的“平等伙伴关系”。在先前文献的基础上，我们建立了一个新的框架，考察儿童和成人之间的互补作用。接下来，我们进行了长达一年的代际设计团队儿童个案研究（7-11岁）和成人。从这一分析中，我们确定了设计伙伴关系由四个维度组成，从不平衡到平衡的相互作用：促进、建立关系、通过做设计和一起阐述。最后，为了演示它的实用性，我们使用我们的框架分析了两个焦点协同设计会话。我们的分析表明，在PD的平等伙伴关系不是一个单一的静态互动，但随着时间的推移设计交互影响的发展，受影响的上下文，经验和参与者。 article link

486. Participatory Evaluation with Autistic Children

SESSION:Participant Design with Children

Participatory Design (PD) has become a standard methodology in HCI, however, the evaluation of the outcomes of participatory processes is often exclusively driven by researcher defined measures of success. Through our work with autistic children, who have radically different life worlds from our own, it became evident that their criteria for the success of a project are most likely also very different. In order to address the limitations of researcher defined and led evaluations in this context, we developed an approach forparticipatory evaluationcalled PEACE (Participatory Evaluation with Autistic ChildrEn). Using this approach, we were able to include autistic children in dedicated evaluation phases through the co-definition of goals and methods, joint processes of data gathering and the co-interpretation of results. We discuss three case studies in which we successfully applied our approach and conclude with a reflection on the novel insights created through participatory evaluation and researchers' roles in such a process.

> 参与式设计（PD）已成为人机交互中的标准方法，然而，对参与过程结果的评价往往仅由研究人员定义的成功措施驱动。通过我们与自闭症儿童的工作，他们从我们自己的生活世界完全不同，显然他们的项目成功的标准也很可能是非常不同的。为了解决研究者定义的局限性，导致这方面的评估，我们开发了一种方法forparticipatory evaluationcalled和平（自闭症儿童参与式评估）。通过这种方法，我们可以通过对目标和方法的共同定义、数据收集的联合过程和结果的共同解释，将自闭症儿童纳入专门的评估阶段。我们讨论了三个案例研究，我们成功地应用了我们的方法，并通过参与性评估和研究人员在这一过程中的作用，反映了新见解。 article link

487. Co-Designing with Preschoolers Using Fictional Inquiry and Comicboarding

SESSION:Participant Design with Children

In this case study, we describe a design workshop with 7 children age 4-6 using existing co-design techniques known to elicit design insights in older individuals. We found that our 5- and 6-year-old participants successfully generated design ideas using these methods, while 4-year-olds were unable to use create solutions in a traditional format. How-ever, these younger children enthusiastically offered opportunities where, with methodological guidance, the research-er could have followed the child's lead and shifted the design question to one that was potentially more meaningful for the participant. We propose a future work to examine the effectiveness of giving these younger participants great-er authority in defining and scoping the problem space.

> 在这个案例研究中，我们描述了一个设计研讨会，有7个年龄4-6岁的儿童使用现有的共同设计技术，可以引起老年人的设计见解。我们发现，我们的5岁的参与者成功生成的设计思想，使用这些方法，而儿童不能使用传统的格式创建解决方案。不管怎样，这些年幼的孩子热情地提供了机会，在方法指导下，研究ER可以跟随孩子的领导，将设计问题转移到对参与者更有意义的问题上。我们提出了检查的有效性，给这些年轻的参与者更大的权威的定义和范围界定问题空间未来的工作。 article link

488. Making Space for the Quality Care: Opportunities for Technology in Cognitive Behavioral Therapy for Insomnia

SESSION:Patient-generated Data in the Clinic

Insomnia can drastically affect individuals' overall well-being and work performance, with substantial costs to society and industry. Cognitive behavioral therapy for insomnia (CBT-I) is a psychotherapeutic treatment, which requires patients to track sleep and share the data with CBT-I clinicians. However, the number of specialists who can provide CBT-I limits the number of patients who can receive it. In this paper, we aim to identify opportunities to leverage technology to assist clinicians in delivering quality and effective CBT-I services to broader populations. Toward this goal, we conducted formative studies, including 11 CBT-I clinic observations and 17 semi-structured interviews, to understand the current workflow of CBT-I and associated challenges. We discuss how technology can assist clinicians and patients throughout the various steps of CBT-I workflow while addressing some of the identified challenges, and more broadly, how technology can make space for clinicians and patients to build quality therapeutic relationships.

> 失眠会严重影响个人的整体福利和工作绩效，给社会和工业带来巨大的成本。失眠的认知行为治疗（CBT-I）是一种心理治疗，这需要患者追踪睡眠，CBT-I临床医生共享数据。然而，专家可以提供CBT-I限制患者接受数。在本文中，我们的目标是确定的机会，利用技术来帮助临床医生提供优质有效的服务于更广泛的群体行为认知。为了实现这个目标，我们进行了形成性研究，其中包括11 CBT-I的临床观察和17半结构式访谈，了解CBT-I当前工作流和相关的挑战。我们将讨论如何技术可以帮助临床医生和患者在工作流程的各个步骤CBT-I同时解决其中的一些挑战，以及更广泛的技术如何可以让临床医生和患者建立治疗关系的空间质量。 article link

489. Prescribing 10,000 Steps Like Aspirin: Designing a Novel Interface for Data-Driven Medical Consultations

SESSION:Patient-generated Data in the Clinic

Due to the prevalence of personal health tracking, cases of self-logged data being utilized in the clinic are gradually increasing. However, obstacles to clinicians' ability to further adopt such data-driven medical consultations in the existing workflow remain, such as lack of time and poor interoperability. In this paper, we conducted a workshop to design a clinician interface supporting the integration of data-driven consultation into the existing workflow and investigate the role of the interface in situ. After implementing the clinician interface designed based on the workshop results, we observed 32 cases of actual use within the clinical context. We found that our interface,DataMD, helped the clinician construct a new workflow, enhanced the clinician's counseling skills, and facilitated more in-depth conversation. This paper contributes to empirically identifying the role of a clinician interface through a user-centered design approach.

> 由于个人健康追踪的盛行，临床上使用的自我记录资料逐渐增多。然而，临床医生在现有工作流中进一步采用这种数据驱动的医疗协商的障碍仍然存在，例如缺乏时间和互操作性差。在本文中，我们举办了一个研讨会，设计一个临床医生接口，支持将数据驱动的咨询集成到现有的工作流程中，并研究界面在原位的作用。在完成了根据车间结果设计的临床医生界面后，我们观察了32例临床应用情况。我们发现我们的界面，datamd，帮助临床医生建立一个新的工作流程，提高临床医生的咨询技能，促进更深入的谈话。本文通过以用户为中心的设计方法，有助于经验确定临床医生界面的作用。 article link

490. Crafting a View of Self-Tracking Data in the Clinical Visit

SESSION:Patient-generated Data in the Clinic

When self-tracking encounters clinical practices, the data is reshaped by goals and expertise that exist within a healthcare framework. To uncover these shaping practices, we provided a Fitbit Zip step-count sensor to nine patients with Parkinson's disease. Each patient wore the sensor for four weeks and then returned for a clinical visit with their neurologist. Our analysis focuses on this first clinical visit after four weeks of data had been collected. Our use of conversation analysis of both talk and action makes visible the practices engaged in by both collaborative members to 'craft a view' of the data toward shared decision making. Our findings reveal the deliberate guiding of attention to specific interpretations of the data through both talk and actions and we explain how our systematic analysis has uncovered tools for the mutually beneficial crafting practices of the clinician and patient.

> 当自我跟踪遇到临床实践时，数据被医疗框架内的目标和专门知识所重塑。为了揭开这些整形的做法，我们提供了一个Fitbit Zip步数传感器九帕金森病患者。每个病人戴上传感器四个星期，然后返回与他们的神经科医生的临床访问。我们的分析主要集中在收集了四周的第一次临床访问之后。我们对谈话和行动的会话分析的使用，可见了两个合作成员所从事的实践，使“数据的视图”朝着共同决策的方向发展。我们的发现揭示了通过谈话和行动对数据进行具体解释的有意指导，并解释了我们的系统分析揭示了临床医生和患者相互有益的手工艺实践的工具。 article link

491. What Happens to Digital Feedback?: Studying the Use of a Feedback Capture Platform by Care Organisations

SESSION:Patient-generated Data in the Clinic

In this paper we report on a four-month long field trial of ThoughtCloud, a feedback collection platform that allows people to leave ratings and audio or video responses to simple prompts. ThoughtCloud was trialled with four organisations providing care services for people with disabilities. We conducted interviews with staff and volunteers that used ThoughtCloud before, during and after its deployment, and workshops with service users and staff. While the collection of feedback was high, only one organisation regularly reviewed and responded to collected opinions. Furthermore, tensions arose around data access and sharing, and the mismatch of values between "giving voice" and the capacity

for staff to engage in feedback practices. We contribute insights into the challenges faced in using novel technologies in resource constrained organisations, and discuss opportunities for designs that give greater agency to service users to engage those that care for them in reflecting and responding to their opinions.

> 在本文中，我们报告的thoughtcloud长达四个月的现场试验，反馈收集平台，可以使人离开评级和简单的提示音频或视频的反应。thoughtcloud进行试验与四家机构为残疾人士提供保健服务。我们进行了采访，工作人员和志愿者，用thoughtcloud之前，期间和之后的部署，以服务用户和员工工作坊。虽然反馈的收集率很高，但只有一个组织定期审查并对收集的意见作出回应。此外，在数据访问和共享方面出现了紧张局势，“给予声音”和工作人员参与反馈做法的能力之间的价值不匹配。我们有助于洞察在资源受限的组织中使用新技术所面临的挑战，并讨论为服务用户提供更大代理的设计机会，以使那些关心他们的人参与并反映他们的意见。 article link

492. Facade: Auto-generating Tactile Interfaces to Appliances

SESSION:Personal Object Recognizers: Feasibility and Challenges

Common appliances have shifted toward flat interface panels, making them inaccessible to blind people. Although blind people can label appliances with Braille stickers, doing so generally requires sighted assistance to identify the original functions and apply the labels. We introduceFacade- a crowdsourced fabrication pipeline to help blind people independently make physical interfaces accessible by adding a 3D printed augmentation of tactile buttons overlaying the original panel. Facade users capture a photo of the appliance with a readily available fiducial marker (a dollar bill) for recovering size information. This image is sent to multiple crowd workers, who work in parallel to quickly label and describe elements of the interface. Facade then generates a 3D model for a layer of tactile and pressable buttons that fits over the original controls. Finally, a home 3D printer or commercial service fabricates the layer, which is then aligned and attached to the interface by the blind person. We demonstrate the viability of Facade in a study with 11 blind participants.

> 普通电器已转向平板接口面板，使盲人无法进入。虽然盲人可以用盲文贴纸贴上电器标签，但这样做通常需要有远见的帮助来识别原始功能并应用标签。我们introducefacade - 一个众包制作管道来帮助盲人独立进行物理接口可以通过添加一个3D打印增强触觉按钮覆盖原板。门面用户用一个现成的基准标记（一美元钞票）捕捉设备的照片，以获取尺寸信息。该图像被发送给多个拥挤的工作人员，他们并行工作以快速标记和描述接口的元素。然后产生一个三维模型表面一层触压按钮，适合在原有的控制。最后，家用3D打印机制造或商业服务层，然后对准并受到盲人的接口。我们在一项研究中展示了11名盲人参与者的可行性。 article link

493. People with Visual Impairment Training Personal Object Recognizers: Feasibility and Challenges

SESSION:Personal Object Recognizers: Feasibility and Challenges

Blind people often need to identify objects around them, from packages of food to items of clothing. Automatic object recognition continues to provide limited assistance in such tasks because models tend to be trained on images taken by sighted people with different background clutter, scale, viewpoints, occlusion, and image quality than in photos taken by blind users. We explore personal object recognizers, where visually impaired people train a mobile application with a few snapshots of objects of interest and provide custom labels. We adopt transfer learning with a deep learning system for user-defined multi-label k-instance classification. Experiments with blind participants demonstrate the feasibility of our approach, which reaches accuracies over 90% for some participants. We analyze user data and feedback to explore effects of sample size, photo-quality variance, and object shape; and contrast models trained on photos by blind participants to those by sighted participants and generic recognizers.

> 盲人通常需要识别周围的物体，从食物包装到衣物物品。自动目标识别在这些任务中继续提供有限的帮助，因为模型往往被视为视觉上的人所采取的图像与不同的背景杂波，规模，观点，闭塞，图像质量比盲人用户拍摄的照片。我们寻求个人目标的识别，在视障人士火车移动应用快照几个感兴趣的对象并提供自定义标签。我们采用用户自定义的多标签分类k-instance深入学习系统学习迁移。盲目参与者的实验证明了我们的方法的可行性，达到了90%以上的一些参与者的精度。我们分析用户数据和反馈研究样本大小的影响，照片质量的差异，和物体的形状；和对比模型的训练，盲目的参与者的照片给那些近视的和通用的识别。 article link

494. Jackknife: A Reliable Recognizer with Few Samples and Many Modalities

SESSION:Personal Object Recognizers: Feasibility and Challenges

Despite decades of research, there is yet no general rapid prototyping recognizer for dynamic gestures that can be trained with few samples, work with continuous data, and achieve high accuracy that is also modality-agnostic. To begin to solve this problem, we describe a small suite of accessible techniques that we collectively refer to as the Jackknife gesture recognizer. Our dynamic time warping based approach for both segmented and continuous data is designed to be a robust, go-to method for gesture recognition across a variety of modalities using only limited training samples. We evaluate pen and touch, Wii Remote, Kinect, Leap Motion, and sound-sensed gesture datasets as well as conduct tests with continuous data. Across all scenarios we show that our approach is able to achieve high accuracy, suggesting that Jackknife is a capable recognizer and good first choice for many endeavors.

> 尽管几十年的研究，还没有通用的快速原型识别动态手势，可以训练少量的样本，工作与连续数据，并实现高精确度，这也是模态不可知的。为了解决这个问题，我们描述了一个小套房的访问技术，我们统称为重叠的手势识别。我们的动态时间弯曲为基础的分段和连续数据的方法被设计成一个健壮的，去的方法，在不同的模式，只使用有限的训练样本的手势识别。我们评估笔和触摸，Wii遥控器，Kinect，跳跃运动，和声音感知的手势数据集，以及进行连续数据测试。在所有情况下我们显示我们的方法能够达到很高的精度，这表明Jackknife是一个能够识别和许多努力的好的第一选择。 article link

495. Ubiquitous Accessibility for People with Visual Impairments: Are We There Yet?

SESSION:Personal Object Recognizers: Feasibility and Challenges

Ubiquitous access is an increasingly common vision of computing, wherein users can interact with any computing device or service from anywhere, at any time. In the era of personal computing, users with visual impairments required special-purpose, assistive technologies, such as screen readers, to interact with computers. This paper investigates whether technologies like screen readers have kept pace with, or have created a barrier to, the trend toward ubiquitous access, with a specific focus on desktop computing as this is still the primary way computers are used in education and employment. Towards that, the paper presents a user study with 21 visually-impaired participants, specifically involving the switching of screen readers within and across different computing platforms, and the use of screen readers in remote access scenarios. Among the findings, the study shows that, even for remote desktop access - an early forerunner of true ubiquitous access - screen readers are too limited, if not unusable. The study also identifies several accessibility needs, such as uniformity of navigational experience across devices, and recommends potential solutions. In summary, assistive technologies have not made the jump into the era of ubiquitous access, and multiple, inconsistent screen readers create new practical problems for users with visual impairments.

> 无处不在的访问是越来越普遍的计算愿景，用户可以随时随地与任何计算设备或服务进行交互。在个人计算时代，有视觉障碍的用户需要特殊用途的辅助技术，如屏幕阅读器，与计算机交互。本文探讨了像屏幕阅读器这样的技术是否已经跟上了，或者已经形成了一个障碍，即普及访问的趋势，特别关注桌面计算，因为这仍然是计算机在教育和就业中使用的主要方式。在这方面，本文提出了一个用户研究与21视障参与者，特别涉及开关屏幕阅读器内和跨不同的计算平台，并使用屏幕阅读器在远程访问场景。研究结果表明，即使是远程桌面访问——真正无处不在的访问的早期先驱——屏幕阅读器也很有限，如果不可用的话。该研究还确定了几个可访问性需求，如跨设备导航体验的一致性，并推荐了潜在的解决方案。总之，辅助技术并没有进入无所不在的访问时代，而多个、不一致的屏幕阅读器为视觉障碍的用户带来了新的实际问题。 article link

496. BIGnav: Bayesian Information Gain for Guiding Multiscale Navigation

SESSION:Spatial Manipulation and Navigation

This paper introduces BIGnav, a new multiscale navigation technique based on Bayesian Experimental Design where the criterion is to maximize the information-theoretic concept of mutual information, also known as information gain. Rather than simply executing user navigation commands, BIGnav interprets user input to update its knowledge about the user's intended target. Then it navigates to a new view that maximizes the information gain provided by the user's expected subsequent input. We conducted a controlled experiment demonstrating that BIGnav is significantly faster than conventional pan and zoom and requires fewer commands for distant targets, especially in non-uniform information spaces. We also applied BIGnav to a realistic application and showed that users can navigate to highly probable points of interest on a map with only a few steps. We then discuss the tradeoffs of BIGnav--including efficiency vs. increased cognitive load--and its application to other interaction tasks.

> 本文介绍了bignav，基于贝叶斯实验设计的准则是最大化互信息的信息理论的概念，一种新的多尺度导航技术，也被称为信息增益。而不是简单地执行用户的导航命令，bignav解释用户的输入来更新其关于用户的预定目标知识。然后导航到一个新的视角，使信息得到用户的预期，随后输入设置。我们进行了一项对照实验证明BIGnav比传统的平移和缩放的速度明显和需要远距离目标指令少，尤其是在非均匀的信息空间。我们还应用bignav到现实的应用和显示，用户可以导航到地图上只有几步的兴趣极有可能点。然后我们讨论bignav权衡--包括效率与增加认知负荷和其他交互任务的应用。 article link

497. Design and Evaluation of a Handheld-based 3D User Interface for Collaborative Object Manipulation

SESSION:Spatial Manipulation and Navigation

Object manipulation in 3D virtual environments demands a combined coordination of rotations, translations and scales, as well as the camera control to change the user's viewpoint. Then, for many manipulation tasks, it would be advantageous to share the interaction complexity among team members. In this paper we propose a novel 3D manipulation interface based on a collaborative action coordination approach. Our technique explores a smartphone -- the touchscreen and inertial sensors -- as input interface, enabling several users to collaboratively manipulate the same virtual object with their own devices. We first assessed our interface design on a docking and an obstacle crossing tasks with teams of two users. Then, we conducted a study with 60 users to understand the influence of group size in collaborative 3D manipulation. We evaluated teams in combinations of one, two, three and four participants. Experimental results show that teamwork increases accuracy when compared with a single user. The accuracy increase is correlated with the number of individuals in the team and their work division strategy.

> 三维虚拟环境中的对象操作需要旋转、平移和缩放的组合协调，以及摄像机控制来改变用户的视点。然后，对于许多操作任务，共享团队成员之间的交互复杂性是有好处的。在本文中，我们提出了一种新的基于协同行动协调方法的三维操作界面。我们的技术探索了一种智能手机——触摸屏和惯性传感器——作为输入接口，允许多个用户用自己的设备协同操作同一个虚拟对象。我们首先评估了对接的接口设计和两个用户团队的越障任务。然后，我们对60名用户进行了一项研究，以了解协同三维操作中群体大小的影响。我们评估了一、二、三和四参与者的组合。实验结果表明，与单个用户相比，团队协作提高了准确性。准确性的增加与团队中的个体数量和工作分工策略有关。 article link

498. TDome: A Touch-Enabled 6DOF Interactive Device for Multi-Display Environments

SESSION:Spatial Manipulation and Navigation

The rapid evolution of multi-display environments (MDEs) has created a vacuum in need of novel input devices to optimize interaction in MDEs. In this paper, we propose TDome, a novel touch-enabled 6DOF input and output device to facilitate interactions in MDEs. TDome offers a private display as output, and multiple degrees of freedom as input by combining touch gestures on the display with physical rotation, roll and translation manipulations of the device. TDome allows versatile interactions that address major MDE tasks, which we illustrate through various proof-of-concept implementations: detect surrounding displays, select one display, transfer data across displays, reach distant displays and perform private interactions. We explore TDome's usability and suitability for MDEs through three user studies. First we explore combinedphysical+touchgestures from which we discard uncomfortable combinations. We experimentally validate their feasibility and come up with a set of 71 combined gestures that are comfortable and ensure a high success rate, i.e. that can be easily performed and efficiently detected. Finally, we collect user feedback to identify natural mappings between gestures and MDE interactions.

> 多显示器环境的快速进化（MDES）创造了新的输入设备优化互动在MDEs需要一个真空。在本文中，我们提出了一个新的tdome，触摸功能的6DOF输入和输出装置便于相互作用在MDEs。tdome提供一个私人的显示器作为输出，和多自由度结合触摸手势与物理旋转显示输入，轧辊和设备的翻译手法。tdome允许灵活的交互，解决重大MDE的任务，我们通过概念的实现各种证据：检测周围显示，选择一个显示，传输数据在显示，到达遥远的显示和进行私人交往。我们探讨MDEs tdome的可用性和适宜性通过三用户研究。首先我们探讨combinedphysical + touchgestures从我们丢弃不舒服的组合。我们在实验上验证了他们的可行性，并提出了一套71个组合手势，是舒适的，并确保高成功率，即可以很容易地执行和有效地检测到。最后，我们收集用户的反馈信息来识别手势和身边的自然映射之间的相互作用。 article link

499. A Field Experiment of Spatially-Stable Overviews for Document Navigation

SESSION:Spatial Manipulation and Navigation

Finding (and re-finding) locations in text documents is a common activity for most computer users -- but tools for document navigation are still limited in many ways. Previous research has shown that a spatially-stable overview of the entire document can be substantially faster than any other navigation technique -- particularly when revisiting previous locations. However, the overview technique has only been tested in a limited laboratory study, so little is known about whether it works in more realistic contexts. To answer this question, we developed a PDF viewer that incorporates several document-navigation techniques, and carried out two studies. First, we ran a field experiment in which users carried out search tasks using an overview and other techniques -- on their own computers in a non-laboratory environment. Second, we ran a smaller field study in which people used our viewer (with choice of navigation techniques) for their own PDF tasks. In the field experiment, the overview was significantly and substantially faster than other techniques, and in the field study, the technique was frequently used for a wide variety of documents. Our work provides confirmation of the value of spatially stable overviews as a basis for document navigation.

> 对大多数计算机用户来说，在文本文档中查找（并重新找到）位置是一项常见的活动，但文档导航工具在许多方面仍然受到限制。先前的研究表明，对整个文档进行空间稳定的概述可以比任何其他导航技术都快得多——尤其是在重新访问以前的位置时。然而，概述技术仅在有限的实验室研究中进行过测试，所以人们对它是否在更现实的环境中工作还知之甚少。为了回答这个问题，我们开发了一个PDF查看器，它集成了几种文档导航技术，并进行了两项研究。首先，我们进行了一项实地实验，用户使用概述和其他技术——在非实验室环境中的计算机上执行搜索任务。第二，我们进行了一项小规模的实地研究，在这项研究中，人们使用我们的查看器（选择导航技术）来完成他们自己的PDF任务。在田间试验中，概述比其他技术快得多，而且在实地研究中，该技术经常用于各种各样的文件。我们的工作提供了空间稳定性概述的价值，作为文档导航的基础。 article link

500. Imagined Connectivities: Synthesized Conceptions of Public Wi-Fi in Urban India

SESSION:Technology Use Around the Globe

India and other economies in the Global South are undergoing a proliferation in public Wi-Fi, with large-scale deployments from industry and government. In this paper, we report on a qualitative study on public Wi-Fi conceptions as held by urban Indians, textit{a priori} to connecting to a network. Our findings show that prior public Wi-Fi users and non-users alike raised a surprising range and depth of conceptions---ranging from suspicion of operators' intentions to monetize, to concerns about sexual image morphing, to fears of phone wipeouts, to aspiration---which were informed by popular media, BlueTooth cultures, and social learning. We found these conceptions of Wi-Fi networks to significantly influence adoption of public Wi-Fi. With enormous investments in public Wi-Fi initiatives, we call for network providers to address these deep conceptions among emerging users; by suggesting ways to build public awareness, better user experiences, and business model innovation.

> 印度和全球南部的其他经济体正在进行公共Wi-Fi的扩散，大规模部署来自工业和政府。在本文中，我们报告的定性研究，在公共Wi-Fi概念的城市印第安人举行，先验}到{系统连接到网络。我们的研究结果表明，现有的公共Wi-Fi用户和非用户都提出了一个令人惊讶的范围和深度的概念，从运营商的意图的猜疑，赚钱的，关于性的图像变形问题，对手机的影响的担忧，愿望---被大众媒体、蓝牙文化和社会学习。我们发现Wi-Fi网络的概念对公共Wi-Fi的采用有重大影响。通过对公共Wi-Fi举措的巨大投资，我们呼吁网络提供商解决新兴用户的这些深层概念；建议如何建立公众意识、更好的用户体验和商业模式创新。 article link

501. Agency in Assistive Technology Adoption: Visual Impairment and Smartphone Use in Bangalore

SESSION:Technology Use Around the Globe

Studies on technology adoption typically assume that a user's perception of usability and usefulness of technology are central to its adoption. Specifically, in the case of accessibility and assistive technology, research has traditionally focused on the artifact rather than the individual, arguing that individual technologies fail or succeed based on their usability and fit for their users. Using a mixed-methods field study of smartphone adoption by 81 people with visual impairments in Bangalore, India, we argue that these positions are dated in the case of accessibility where a non-homogeneous population must adapt to technologies built for sighted people. We found that many users switch to smartphones despite their awareness of significant usability challenges with smartphones. We propose a nuanced understanding of perceived usefulness and actual usage based on need-related social and economic functions, which is an important step toward rethinking technology adoption for people with disabilities.

> 技术采纳的研究通常假定用户对技术的可用性和有用性的感知是其采用的核心。具体而言，在可访问性和辅助技术的情况下，研究传统上侧重于工件，而不是个人，认为单个技术失败或成功的基础上，他们的可用性和适合他们的用户。使用智能手机的混合方法研究了81人在班加罗尔，印度的视觉障碍，我们认为，这些位置是过时的的情况下，非均匀性人口必须适应建立正常人的技术。我们发现许多用户转向智能手机，尽管他们意识到智能手机对可用性的巨大挑战。我们提出了一种细致入微的理解，即基于需求相关的社会和经济功能，认识到有用性和实际使用情况，这是重新考虑残疾人技术采用的重要一步。 article link

502. Money, God, and SMS: Explorations in Supporting Social Action Through a Bangladeshi Mosque

SESSION:Technology Use Around the Globe

Religious institutions hold a significant place in daily life for the vast majority of people in the world, especially in developing countries. Yet despite their social prominence, and despite HCI's emphasis on the social context of technology, organized religion is neglected in both the HCI and ICTD literature. This paper explores the relationship that mosques in Bangladesh have with their constituencies and with technology, with an eye toward the integration of technology with existing religious institutions as a way to achieve positive social ends. We first describe a qualitative exploration of several mosque communities in Bangladesh, where we find that skepticism and pragmatism about modern technology interact in a complex way that nevertheless leaves room for technical interventions. We then describe a randomized controlled trial to study the relative value of SMS messages infused with overtly religious or secularly altruistic frames for the purpose of mosque fundraising. We find that SMS messages increase donations overall, but that their framing is significant. Messages with secular altruistic framing increased donations by 9.5%, while those with religious sentiment increased donations by 57.3%. Our findings demonstrate how technologies like SMS amplify underlying religious forces and suggest the possibility of working with religious institutions in applying positive ICT interventions.

> 宗教机构在世界上绝大多数人的日常生活中占有重要地位，特别是在发展中国家。尽管他们的社会地位，尽管HCI的强调技术的社会背景下，有组织的宗教是在人机交互和信息通信技术促进发展的文献忽略。本文探讨了孟加拉清真寺与他们的选民和技术之间的关系，着眼于将技术与现有的宗教机构结合起来，以达到积极的社会目的。我们首先描述了孟加拉几个清真寺社区的定性探索，我们发现现代技术的怀疑主义和实用主义以复杂的方式相互作用，但也留下了技术干预的空间。我们描述一个随机对照试验来研究短信注入公然宗教或长期的筹款目的利他框架清真寺的相对价值。我们发现SMS消息总体上增加了捐款，但他们的框架是重要的。带有长期利他框架的信息增加了9.5%的捐款，而那些有宗教信仰的人增加了57.3%的捐款。我们的研究结果表明，像SMS这样的技术如何扩大潜在的宗教力量，并表明有可能与宗教机构合作，应用积极的信息和通信技术干预措施。 article link

503. Negotiating Absent Practices and Dormant Features: Discourse as a Means of Shaping the Implementation of a Global Enterprise System to Meet Local Work Culture

SESSION:Technology Use Around the Globe

The introduction of a new enterprise system to an organization often necessitates the accommodation of standardized practices, which may be in conflict with local users' practices and their work culture. We explore such a conflict in an India-based multinational organization using an eight-month interpretive case study. Based on grounded analysis, we present a narrative account of how consultants, on contract for managing the deployment and making necessary adjustments, used discourse as a means of shaping user understanding about the features and practices embedded in the underlying system, which were not initially realized through the interface. Sustained user resistance to this shaping led to a negotiated compromise and adaptation of the system to incorporate local work culture. Our findings allow us to explore the under-theorized role of discursive power within an implementer-user-technology trio, and illustrate the feedback utility of user resistance in developing culturally-inclusive designs.

> 向一个组织引入新的企业制度往往需要规范化做法，这可能与当地用户的做法和工作文化相冲突。我们用一个八个月的解释案例研究在印度的多国组织中探讨这样的冲突。基于实证分析，提出如何顾问的叙述，对管理的部署和必要的调整合同，用话语作为一种手段，塑造用户了解的特点和做法，底层系统，这是最初不是通过接口实现。持续的用户对这种塑造的抵制导致了谈判妥协和制度的调整，融入了当地的工作文化。我们的研究结果让我们探索理论的作用在一个主体话语权的用户技术三下，说明用户的反馈电阻实用文化包容性的设计开发。 article link

504. Hybrid HFR Depth: Fusing Commodity Depth and Color Cameras to Achieve High Frame Rate, Low Latency Depth Camera Interactions

SESSION:What Things Look Like

The low frame rate and high latency of consumer depth cameras limits their use in interactive applications. We propose combining the Kinect depth camera with an ordinary color camera to synthesize a high frame rate and low latency depth image. We exploit common CMOS camera region of interest (ROI) functionality to obtain a high frame rate image over a small ROI. Motion in the ROI is computed by a fast optical flow implementation. The resulting flow field is used to extrapolate Kinect depth images to achieve high frame rate and low latency depth, and optionally predict depth to further reduce latency. Our "Hybrid HFR Depth" prototype generates useful depth images at maximum 500Hz with minimum 20ms latency. We demonstrate Hybrid HFR Depth in tracking fast moving objects, handwriting in the air, and projecting onto moving hands. Based on commonly available cameras and image processing implementations, Hybrid HFR Depth may be useful to HCI practitioners seeking to create fast, fluid depth camera-based interactions.

> 低帧速率和高延迟的消费者深度相机限制了它们在交互式应用中的应用。提出将Kinect深度相机与普通彩色摄像机相结合，合成高帧频低延时深度图像。我们利用常见的CMOS相机感兴趣区域（ROI）的功能，以获得较高的帧速率图像在一个小的投资回报率。ROI的运动是通过快速光流实现来计算的。由此产生的流场被用来推断Kinect深度图像，以实现高帧率和低延迟深度，并且可以选择性地预测深度以进一步减少延迟。我们的“混合HFR深度”原型生成有用的深度图像20ms延迟最小最大500hz。我们证明混合HFR深度跟踪快速运动的物体，在空中书写，并投射到移动的手。基于常用的相机和图像处理的实现，混合HFR深度可能是HCI从业人员寻求快速创建有用的，流体深度相机为基础的相互作用。 article link

505. Understanding the Aesthetic Evolution of Websites: Towards a Notion of Design Periods

SESSION:What Things Look Like

In art and music, time periods like "classical" and "impressionist" are powerful means for academics and practitioners to compare and contrast artifacts that share aesthetics or philosophies. While web designs have undergone changes for 25 years, we lack theories to describe or explain these changes. In this paper, we take a first step towards identifying and understanding the design periods of websites. Drawing from humanistic HCI methods, we asked subject experts of web design to critically analyze a dataset of prominent websites whose lifetimes span over a decade. These informed judgments reveal a set of keymarkersthat signal shifts in design periods. For instance, advances in display technologies and changes in company strategies help explain how design periods demarcated by particular layout templates and navigation models arise. We suggest that designers and marketers can draw inspiration from website designs curated into design periods. Future work should examine the utility of applying design periods to any computationally embedded artifact that is an interaction design.

> 在艺术和音乐中，像“古典”和“印象派”这样的时间段是学术界和实践者们比较和对比分享美学或哲学的艺术品的有力手段。虽然网页设计经历了25年的变化，但我们缺乏描述或解释这些变化的理论。在本文中，我们对识别和理解网站的设计阶段迈出了第一步。借鉴人性化的人机交互方法，我们要求网页设计的学科专家批判性分析一个十年以上寿命的著名网站的数据集。这些明智的判断出一套设计阶段keymarkersthat信号变化。例如，显示技术的进步和公司策略的变化有助于解释如何通过特定的布局模板和导航模型划分设计周期。我们认为，设计师和营销人员可以从网站策划到设计阶段的设计灵感。未来的工作应该检查应用程序周期对任何计算嵌入的伪影，即交互设计的实用性。 article link

506. Understanding Blind People's Experiences with Computer-Generated Captions of Social Media Images

SESSION:What Things Look Like

Research advancements allow computational systems to automatically caption social media images. Often, these captions are evaluated with sighted humans using the image as a reference. Here, we explore how blind and visually impaired people experience these captions in two studies about social media images. Using a contextual inquiry approach (n=6 blind/visually impaired), we found that blind people place a lot of trust in automatically generated captions, filling in details to resolve differences between an image's context and an incongruent caption. We built on this in-person study with a second, larger online experiment (n=100 blind/visually impaired) to investigate the role of phrasing in encouraging trust or skepticism in captions. We found that captions emphasizing the probability of error, rather than correctness, encouraged people to attribute incongruence to an incorrect caption, rather than missing details. Where existing research has focused on encouraging trust in intelligent systems, we conclude by challenging this assumption and consider the benefits of encouraging appropriate skepticism.

> 研究进展允许计算系统自动标注社会媒体图像。通常，这些注释是用图像作为参照物用有远见的人类来评价的。在这里，我们将探讨盲人和视障人士如何在两个关于社交媒体图像的研究中体验这些说明。使用上下文查询方法（N = 6盲/视障），我们发现盲人的地方很多自动生成字幕的信任，填充细节解决图像的背景和不一致的描述之间的差异。我们在第二个更大的在线实验（N = 100盲/视觉障碍）的基础上进行了这项亲自研究，以调查措辞在鼓励信任或怀疑中的作用。我们发现，标题强调错误的概率，而不是正确性，鼓励人们属性不一致到一个不正确的描述，而不是丢失的细节。现有的研究集中于鼓励对智能系统的信任，我们最后通过挑战这一假设，并考虑鼓励适当怀疑的好处。 article link

507. Time Travel with One Click: Effects of Digital Filters on Perceptions of Photographs

SESSION:What Things Look Like

Today's digital photographs are being heavily "filtered." By simple clicks on mobile apps like Hipstamatic and Instagram, users can easily apply digital filters to their pictures to create effects such as faux-vintage and light leaks. To understand the potential impacts of photo filters, we conducted an online experiment and investigated how the use of the black-and-white and film-style photo filters changed viewers' perceptions and descriptions of photographs. We found that photo filters substantially increased viewers' perceived temporal distances to photographs. Participants also tended to describe analogue-style photos more interpretively and tentatively than unfiltered ones, indicating an increase in construal levels. We suggest that the widely used photo filter is not just a tool to change aesthetics; it also adds a layer of history, meaning, and defamiliarization to photographs, allowing users to construct a mental distance in images that deviates from everyday experiences. We offer insights into the psychology of visual styles and implications for designing filter apps and photo-sharing platforms.

> 今天的数码照片被大量“过滤”，通过简单的点击像Hipstamatic和Instagram的移动应用程序，用户可以很容易地应用数字滤波器对图片产生效果如假古董和光泄漏。为了了解照

> 片过滤器的潜在影响，我们进行了一项在线实验，研究黑白照片和电影样式的滤镜如何改变观众对照片的感知和描述。我们发现照片滤镜大大增加了观众对照片的感知距离。参与者也倾向于描述类似风格的照片更是尝试性比未过滤的，说明在识解水平的增加。我们建议广泛使用照片滤镜不仅仅是改变美学的工具；它还增加了一层历史意义，和陌生化的照片，让用户在图像偏离日常经验构建的心理距离。我们提供洞察视觉风格的心理学，以及设计过滤器应用程序和照片共享平台的意义。 article link

508. ForgetMeNot: Active Reminder Entry Support for Adults with Acquired Brain Injury

SESSION:Accessibility

Smartphone reminding apps can compensate for memory impairment after acquired brain injury (ABI). In the absence of a caregiver, users must enter reminders themselves if the apps are going to help them. Poor memory and apathy associated with ABI can result in failure to initiate such configuration behaviour and the benefits of reminder apps are lost. ForgetMeNot takes a novel approach to address this problem by periodically encouraging the user to enter reminders with unsolicited prompts (UPs). An in situ case study investigated the experience of using a reminding app for people with ABI and tested UPs as a potential solution to initiating reminder entry. Three people with severe ABI living in a post-acute rehabilitation hospital used the app in their everyday lives for four weeks to collect real usage data. Field observations illustrated how difficulties with motivation, insight into memory difficulties and anxiety impact reminder app use in a rehabilitation setting. Results showed that when 6 UPs were presented throughout the day, reminder-setting increased, showing UPs are an important addition to reminder applications for people with ABI. This study demonstrates that barriers to technology use can be resolved in practice when software is developed with an understanding of the issues experienced by the user group.

> 智能手机提醒应用程序可以弥补后天性脑损伤（ABI）后的记忆障碍。如果没有护理人员，用户必须输入提醒，如果应用程序能帮助他们的话。与ABI相关的糟糕内存和冷漠可能导致无法启动这种配置行为，提示应用程序的好处将丢失。ForgetMeNot需要一个新的来解决这一问题，通过周期性地鼓励用户主动提醒提示输入方法（UPS）。一个现场案例研究调查了一个提醒应用程序的人ABI和测试UPS作为一个潜在的解决方案开始提醒条目的经验。三名患有严重ABI的急性后康复医院的患者在日常生活中使用应用程序四周，收集实际使用数据。现场观察表明，在康复环境中，动机的困难、对记忆困难和焦虑的洞察影响提醒应用程序的使用。结果显示，当一天中有6个UPS出现时，提醒设置增加了，显示对于ABI的提醒应用程序来说，UPS是一个重要的补充。这项研究表明，技术的使用障碍可以在实践中解决时，软件开发的理解用户组所经历的问题。 article link

509. Interaction Proxies for Runtime Repair and Enhancement of Mobile Application Accessibility

SESSION:Accessibility

We introduce interaction proxies as a strategy for runtime repair and enhancement of the accessibility of mobile applications. Conceptually, interaction proxies are inserted between an application's original interface and the manifest interface that a person uses to perceive and manipulate the application. This strategy allows third-party developers and researchers to modify an interaction without an application's source code, without rooting the phone, without otherwise modifying an application, while retaining all capabilities of the system (e.g., Android's full implementation of the TalkBack screen reader). This paper introduces interaction proxies, defines a design space of interaction re-mappings, identifies necessary implementation abstractions, presents details of implementing those abstractions in Android, and demonstrates a set of Android implementations of interaction proxies from throughout our design space. We then present a set of interviews with blind and low-vision people interacting with our prototype interaction proxies, using these interviews to explore the seamlessness of interaction, the perceived usefulness and potential of interaction proxies, and visions of how such enhancements could gain broad usage. By allowing third-party developers and researchers to improve an interaction, interaction proxies offer a new approach to personalizing mobile application accessibility and a new approach to catalyzing development, deployment, and evaluation of mobile accessibility enhancements.

> 我们引入交互代理作为运行时修复和增强移动应用程序可访问性的策略。从概念上讲，交互代理被插入到应用程序的原始接口和用户用来感知和操作应用程序的显式接口之间。这种策略可以让第三方开发者和研究者的互动没有修改应用程序的源代码，没有生根的电话，而不修改应用程序，同时保留所有功能的系统（如Android的全面实施对讲屏幕阅读器）。本文介绍了互动代理，定义了一个交互重新映射的设计空间，确定必要的实现的抽象，提出了在Android实现这些抽象的细节，并演示了一套互动代理Android实现在我们的设计空间。我们提出了一套与盲及低视力的人与我们的原型交互代理互动访谈，通过这些访谈探讨互动性，感知有用性和互动代理的潜力，和愿景如何增强能得到广泛使用。通过允许第三方开发者和研究人员提高交互的，交互的代理提供的个性化的移动应用程序的可访问性和催化的发展，一种新的方法部署一种新的方法，移动访问的改进和评价。 article link

510. SUGILITE: Creating Multimodal Smartphone Automation by Demonstration

SESSION:Accessibility

SUGILITE is a new programming-by-demonstration (PBD) system that enables users to create automation on smartphones. SUGILITE uses Android's accessibility API to support automating arbitrary tasks in any Android app (or even across multiple apps). When the user gives verbal commands that SUGILITE does not know how to execute, the user can demonstrate by directly manipulating the regular apps' user interface. By leveraging the verbal instructions, the demonstrated procedures, and the apps? UI hierarchy structures, SUGILITE can automatically generalize the script from the recorded actions, so SUGILITE learns how to perform tasks with different variations and parameters from a single demonstration. Extensive error handling and context checking support forking the script when new situations are encountered, and provide robustness if the apps change their user interface. Our lab study suggests that users with little or no programming knowledge can successfully automate smartphone tasks using SUGILITE.

> 舒俱来石是由一种新的编程示范（PBD）系统，用户可以创建自动化的智能手机。舒俱来石采用Android的可访问性API支持自动任意任务在任何Android应用程序（甚至跨多个应用程序）。当用户发出的口头命令，舒不知道如何执行，用户可以通过直接操纵普通的应用程序的用户界面。通过使用口头指令、演示过程和应用程序？UI层次结构、舒俱来石可以自动从记录的行动推广脚本，所以大量学习如何执行任务的不同变化和参数从一个单一的示范。大量的错误处理和背景检查支持分叉脚本时遇到新的情况，并提供鲁棒性，如果应用程序改变他们的用户界面。我们实验室的研究表明，与很少或没有编程知识的用户可以成功地使用智能手机的大量任务自动化。 article link

511. Automated Detection of Facial Expressions during Computer-Assisted Instruction in Individuals on the Autism Spectrum

SESSION:Accessibility

It has been suggested that computer-assisted instruction (CAI) is a promising method for educating students on the autism spectrum. We aimed to determine whether automated recognition of facial expressions aided in predicting CAI engagement and learning performance. Seven youth with autism (mean age = 12.7, SD = 4.2) interacted with a CAI program, TeachTown Basics, for 15 consecutive sessions. Video recordings of the participants' faces were collected during these sessions and facial expressions from these videos were analyzed using CERT, an algorithm that automatically outputs intensity values for each facial action unit (AU). Using these data, we attempted to operationally define two engagement indices: (1) behavioral engagement, the proportion of time a participant had their face oriented to the computer screen; and (2) emotional engagement, the activation of AUs previously associated with CAI. Our results suggest that both indices strongly correlated with one another, but that emotional (not behavioral) engagement predicted test

performance. CAI knowledge domain, participant sex, and developmental age also contributed to the prediction.

> 据认为，计算机辅助教学（CAI）是一种很有前途的方法来教育学生的自闭症谱。我们的目的是确定是否有助于预测CAI参与和学习绩效的面部表情的自动识别。七青少年自闭症患者（平均年龄= 12.7，SD = 4.2）与CAI课件，互动teachtown基础，连续15届。的参与者面临视频记录收集在这些会议和面部表情从这些视频进行分析，使用证书，一个算法，自动输出每个表情动作单元的强度值（金）。利用这些数据，我们试图操作定义两参与指标：（1）行为的参与，时间的参与者有自己的脸面向计算机的屏幕比例；和（2）的情感参与，AUs以前与CAI的激活。我们的研究结果表明，这两个指数彼此密切相关，但情绪（非行为）参与预测测试性能。CAI知识领域、参与性和发展年龄也有助于预测。 article link

512. Comparing Touchscreen and Mouse Input Performance by People With and Without Upper Body Motor Impairments

SESSION:Accessibility

Controlled studies of touchscreen input performance for users with upper body motor impairments remain relatively sparse. To address this gap, we present a controlled lab study of mouse vs. touchscreen performance with 32 participants (16 with upper body motor impairments and 16 without). Our study examines: (1) how touch input compares to an indirect pointing device (a mouse); (2) how performance compares across a range of standard interaction techniques; and (3) how these answers differ for users with and without motor impairments. While the touchscreen was faster than the mouse overall, only participants without motor impairments benefited from a lower error rate on the touchscreen. Indeed, participantswithmotor impairments had athree-fold increasein pointing (tapping) errors on the touchscreen compared to the mouse. Our findings also highlight the high frequency of spurious touches for users with motor impairments and update past accessibility recommendations for minimum touchscreen target sizes to at least 18mm.

> 对上肢运动障碍患者的触摸屏输入性能的对照研究相对稀疏。为了解决这个问题，我们提供了一个控制实验研究小鼠与触摸屏的性能与32名参加者（16与上身运动损伤和16没有）。我们的研究考察了：（1）触摸输入如何与间接指向设备（鼠标）进行比较；（2）如何在一系列标准交互技术中进行性能比较；（3）对于有无运动障碍的用户，这些答案是如何不同的。虽然触摸屏的速度比鼠标快，但只有没有运动障碍的参与者受益于触摸屏的低错误率。事实上，participantswithmotor障碍有三倍增加指向（攻）触摸屏上的误差相比，小鼠。我们的研究结果强调运动障碍的用户提供虚假的接触和高频率的更新目标尺寸最小的触摸屏可建议至少18mm过去。 article link

513. Designing Cultural Values into Interaction

SESSION:Cultural Heritage

In this paper, we highlight possibilities for designing intangible cultural values into interactions with technologies in heritage spaces. We do this specifically through the design of elwkw-- Belongings, an interactive tangible table installed in a cultural heritage museum. The tabletop was collaboratively designed to communicate complex and narrative information and values about Musqueam culture. Rather than focusing only on content and interface design, we wanted visitors to also experience Musqueam values through their interactions with the system. We describe our value-sensitive design process, present five interdependent design goals, discuss the design strategies that enabled us to meet these goals, and evaluate our approach through a user study. From our design process and evaluation we offer recommendations for designing values into interactions more generally and for tangible interactions specifically in ways that support visitors' experience and understanding of specific cultural values through technology.

> 在本文中，我们强调了在遗产空间中设计非物质文化价值与技术交互的可能性。我们这样做，特别是通过elwkw——物品的设计、互动的有形表安装在一个文化遗产博物馆。桌面合作设计复杂的故事musqueam文化信息和价值的交流。而不是只专注于内容和界面的设计，我们希望游客也经历musqueam值通过它们之间的相互作用与系统。我们描述了我们的价值敏感的设计过程，提出了五个相互依存的设计目标，讨论了设计策略，使我们能够实现这些目标，并通过用户研究评估我们的方法。从我们的设计过程和评价，我们提供了建议，设计价值更广泛的互动和具体的互动，具体的方式，以支持游客的经验和理解特定的文化价值观，通过技术。 article link

514. Kinecting with Orangutans: Zoo Visitors' Empathetic Responses to Animals? Use of Interactive Technology

SESSION:Cultural Heritage

Animal conservation organisations occasionally harness depictions of animals using digital technology to inspire interest in, and concern for animals. To better understand the forms of empathy experienced by people observing animal-computer interaction, we designed and studied an interactive installation for orangutans at a zoo. Through collaborative design we established an understanding of zoos' objectives and strategies related to empathy in the zoo context. We deployed a prototype installation, and observed and interviewed visitors who watched orangutans use the installation. Analysis of observations and interviews revealed that visitors responded withcognitive, affectiveandmotorempathy for the animals. We propose that these empathetic responses are prompted by the visibility of orangutans' bodily movements, by the "anthropic frame" provided by digital technology, and by prompting reflection on animals' cognitive processes and affective states. This paper contributes new evidence and understanding of people's empathetic responses to observing animal-computer interaction and confirms the value of designing for empathy in its various forms

> 动物保护组织偶尔利用数字技术来描述动物，以激发动物的兴趣和关心动物。为了更好地理解移情的人观察动物的人机交互体验形式，我们设计了一个互动装置在一个动物园的猩猩。通过合作设计，我们了解了动物园在动物园环境中与移情有关的目标和策略。我们部署了一个原型装置，并观察和采访了游客观看猩猩使用安装。观察和访谈发现，游客的反应认知分析，为动物affectiveandmotorempathy。我们建议，这些移情反应是由于它们的身体运动的知名度，由“人择”框架通过数字技术提供，并鼓励对动物的认知过程和情感状态的反思。本文提供了新的证据和人的观察动物的计算机交互移情反应的理解和确认为各种形式的移情设计的价值 article link

515. Reconsidering Nature: The Dialectics of Fair Chase in the Practices of American Midwest Hunters

SESSION:Cultural Heritage

In this paper, we describe an ethnographic study consisting of 14 interviews with hunters and participant observations in the American Midwest. We find that the ethos of "fair chase" serves to unite an eclectic group of hunters under a single moral compass. Fair chase posits, for example, that hunters must not have an improper advantage over animals. The actual practices of hunters in different communities (e.g., communities revolving around different weapons or professions), however, reveals a series of opposing points of view among hunters at large on what actually constitutes fair chase. We suggest that an understanding of fair chase and its dialectics can constructively problematize nature for human-computer interaction.

> 在本文中，我们描述了一个人种学研究，包括14次采访，猎人和参与者观察在美国中西部。我们发现，“公平追逐”的风气在一个道德罗盘下团结起一群折衷的猎人。例如，公平追逐者认为猎人不能对动物有不正当的优势。然而，猎人在不同的社区（例如，围绕不同的武器或职业的社区）的实际做法，却揭示了猎人们在实际上构成公平追逐的一系列对立的观点。我们认为，公平追逐及其辩证法的理解可以有建设性的问题化自然人机交互。 article link

516. Exploring Seasonality in Mobile Cultural Heritage

SESSION:Cultural Heritage

We present results of an investigation into the role of seasonality in mobile cultural heritage applications. 45 participants in 26 groups used one of two applications when visiting the Finnish recreational island of Seurasaari. Each provided summer and winter content, but varied in how this was presented. We uncovered how users consider seasonality in content, seasonal preferences, as well as how different media becomes more or less interesting if shown in or out of season. We present design considerations for future researchers to consider seasonality in cultural heritage applications.

> 我们介绍了季节性在移动文化遗产应用中的作用的调查结果。26组45人所用的一个应用程序访问的伴侣岛芬兰休闲岛时。每个提供夏季和冬季的内容，但在如何呈现这一点。我们揭示了用户如何考虑季节性的内容，季节性偏好，以及不同的媒体如何变得或多或少有趣的，如果显示在或在淡季。我们提出未来的研究人员考虑文化遗产应用季节性的设计考虑。 article link

517. Where No One Has Gone Before: A Meta-Dataset of the World's Largest Fanfiction Repository

SESSION:Cultural Heritage

With its roots dating to popular television shows of the 1960s such as Star Trek, fanfiction has blossomed into an extremely widespread form of creative expression. The transition from printed zines to online fanfiction repositories has facilitated this growth in popularity, with millions of fans writing stories and adding daily to sites such as Archive Of Our Own, Fanfiction.net, FIMfiction.net, and many others. Enthusiasts are sharing their writing, reading stories written by others, and helping each other to grow as writers. Yet, this domain is often undervalued by society and understudied by researchers. To facilitate the study of this large but often marginalized community, we present a fully anonymized data release (via differential privacy) of the metadata from a large fanfiction site (to protect author privacy, story, profile, and review text is excluded, and only metadata is provided). We use visual analytics techniques to draw several intriguing insights from the data and show the potential for future research. We hope other researchers can use this data to explore further questions related to online fanfiction communities.

> 其根源可追溯到上世纪60年代流行的电视节目如星际迷航，它已经发展成一种极为普遍的形式的创意表达。从印刷杂志网上同人库过渡促进这一增长的人气，有粉丝写故事和增加日常网站如档案我们自己，fimfiction.net fanfiction.net，数以百万计的人，和许多其他。爱好者们分享他们的写作，阅读别人写的故事，并帮助对方成长为作家。然而，这一领域是经常被社会和基础研究。为了方便这个大但往往被边缘化的社区的研究，我们提出了一个完全的匿名数据发布（通过差分隐私）从一个大的同人网站的元数据（保护作者的隐私，故事的轮廓，和评论文本排除在外，而只提供元数据）。我们使用可视化分析技术从数据中提取一些有趣的见解，并展示未来研究的潜力。我们希望其他研究人员可以使用这些数据来探索在线同人社区相关的进一步的问题。 article link

518. Illumination Aesthetics: Light as a Creative Material within Computational Design

SESSION:Explorative Engineering

Recent digital fabrication tools have enabled new form-giving using a wide range of physical materials. However, light as a first class creative material has been largely ignored within the design of our electronic objects. Our work expands the illumination design space by treating light as a physical material. We introduce a digital design tool that simulates and visualizes physical light interactions with a variety of materials for creating custom luminaires. We further develop a computational design and fabrication process for creating custom secondary optics elements (SOEs), which provides additional handles for users to physically shape and redirect light to compose, fill, and evenly diffuse planar and volumetric geometries. Through a workshop study with novice electronic designers, we show how incorporating physical techniques to shape light alters how users view the role and function of LEDs and electronics. We produce example pieces that showcase how our approach expands the electronics aesthetic and discuss how viewing light as material can engender novel, expressive artifacts.

> 最近的数字制造工具使新的形式提供了广泛的物理材料。然而，作为一种一流的创意材料，光在我们的电子设计中却被忽略了。我们的工作是将光作为一种物理材料来扩展照明设计空间。我们介绍了模拟和可视化物理光的相互作用与创建自定义灯具各种材料的数字化设计工具。我们进一步开发了一种计算设计和制造过程，用于创建定制的二次光学元件，它为用户提供额外的处理，以物理地形成和重定向光，以形成、填充和均匀地扩散平面和体积几何体。通过与新手电子设计师的研讨会研究，我们将展示如何结合物理技术来塑造光线，改变用户如何看待LED和电子产品的作用和功能。我们制作示例产品，展示我们的方法如何扩展电子美学，并讨论如何视光作为材料可以产生新颖的，表达的工件。 article link

519. Transformative Appetite: Shape-Changing Food Transforms from 2D to 3D by Water Interaction through Cooking

SESSION:Explorative Engineering

We developed a concept of transformative appetite, where edible 2D films made of common food materials (protein, cellulose or starch) can transform into 3D food during cooking. This transformation process is triggered by water adsorption, and it is strongly compatible with the 'flat packaging' concept for substantially reducing shipping costs and storage space. To develop these transformable foods, we performed material-based design, established a hybrid fabrication strategy, and conducted performance simulation. Users can customize food shape transformations through a pre-defined simulation platform, and then fabricate these designed patterns using additive manufacturing. Three application techniques are provided - 2D-to-3D folding, hydration-induced wrapping, and temperature-induced self-fragmentation, to present the shape, texture, and interaction with food materials. Based on this concept, several dishes were created in the kitchen, to demonstrate the futuristic dining experience through materials-based interaction design.

> 我们提出了一种转化食欲的概念，即在普通食物原料（蛋白质、纤维素或淀粉）中可食用的2D薄膜可以在烹饪过程中转化为三维食物。这种转变过程是由水吸附引发的，它与“扁平包装”概念极为兼容，大大降低了运输成本和存储空间。发展这些变形的食物，我们进行材料设计，建立了一个混合制备的策略，并进行了性能仿真。用户可以通过预先定义的仿真平台定制食品形状转换，然后使用添加剂制造这些图案。三应用技术提供了2D到3D的折叠，水化引起的包皮，和温度引起的自我碎片，呈现的形状，纹理，和食品材料的相互作用。基于这个概念，在厨房里制作了几道菜，通过基于材料的交互设计来展示未来的就餐体验。 article link

520. Emotion Actuator: Embodied Emotional Feedback through Electroencephalography and Electrical Muscle Stimulation

SESSION:Explorative Engineering

The human body reveals emotional and bodily states through measurable signals, such as body language and electroencephalography. However, such manifestations are difficult

to communicate to others remotely. We propose EmotionActuator, a proof-of-concept system to investigate the transmission of emotional states in which the recipient performs emotional gestures to understand and interpret the state of the sender.We call this kind of communication embodied emotional feedback, and present a prototype implementation. To realize our concept we chose four emotional states: amused, sad, angry, and neutral. We designed EmotionActuator through a series of studies to assess emotional classification via EEG, and create an EMS gesture set by comparing composed gestures from the literature to sign-language gestures. Through a final study with the end-to-end prototype interviews revealed that participants like implicit sharing of emotions and find the embodied output to be immersive, but want to have control over shared emotions and with whom. This work contributes a proof of concept system and set of design recommendations for designing embodied emotional feedback systems.

> 人体通过可测量的信号，例如身体语言和脑电图，揭示情绪和身体状态。然而，这样的表现很难与他人进行远距离交流。我们提出了EmotionActuator，一个概念证明系统探讨情绪状态，受情感的手势进行理解和解释的发送者的传输状态，我们称这种沟通中体现的情感反馈，并提出了一个原型实现。为了实现我们的概念，我们选择了四种情绪状态：快乐、悲伤、愤怒和中性。我们设计了emotionactuator通过一系列的研究来评估通过脑电图的情感分类，并创建一个EMS通过手势手势集组成，从文学的手语手势。通过对终端到终端的原型访谈的最后研究显示，参与者喜欢含蓄地分享情绪，并发现体现出来的输出是身临其境的，但希望控制分享的情绪，并与谁一起。这项工作有助于证明概念系统和设计建议的设计体现情感反馈系统。 article link

521. Understanding the Role Fluidity of Stakeholders During Assistive Technology Research "In the Wild"

SESSION:Explorative Engineering

Deploying novel technologies requires the coordinated efforts of the research team, research participants, and a variety of community members and project stakeholders. To ensure that the project is completed successfully, these disparate groups of people engage in articulation work, which is the meta-work that supports the use of collaborative systems. In this paper, we examine the articulation work surrounding the deployment of systems that have found limited long-term adoption: assistive technology. Specifically, we examine three research deployments of a collaborative game for children with autism. Analysis of the articulation work performed during these studies demonstrates how research deployments of technologies create conditions in which stakeholders must take on additional roles to make the deployment work. By understanding the articulation work surrounding deployment studies engendered in this role fluidity, we can improve both research design and the analysis of data emergent from these studies.

> 部署新技术需要研究团队、研究参与者和各种社区成员和项目干系人的协调努力。为了确保项目顺利完成，这些不同群体的人员进行了衔接工作，这是支持协作系统使用的元工作。在本文中，我们研究了长期使用受限系统的部署工作：辅助技术。具体而言，我们研究了三个研究部署的合作游戏自闭症儿童。在这些研究中进行的铰接工作的分析表明，技术的研究部署如何创造条件，使利益相关者必须承担更多的角色，以便进行部署工作。通过理解围绕这一角色流动性所产生的衔接工作研究，我们可以改进研究设计和从这些研究中产生的数据分析。 article link

522. Video Consumption Patterns for First Time Smartphone Users: Community Health Workers in Lesotho

SESSION:Health Volunteers

There is already strong evidence that mobile videos are a good vehicle for public health information dissemination, but there remain open questions around sustainability, appropriate target users, consumption patterns, content, and usage models. We analyse log and interview data of 42 community health workers (who were first time smartphone users) from a longitudinal 17-month deployment to better understand how the utility of mobile videos played out over time in rural Lesotho. During the study period, videos were viewed at an average of 170 times per month, for a total of 2898 views. Through this data we draw these primary findings: a) pausing is not contextually necessary, b) age is not a barrier to usage, c) the primary predictor of popularity of a given video is topical relevance and national campaigns, d) there is no apparent relationship between video length, popularity and completion rates, and e) new videos have only a short-lived novelty effect. Furthermore, we affirm that regular engagement with CHWs has an impact on continued usage, in addition to being important for reducing attrition due to technical issues.

> 已经有强有力的证据表明移动视频是公共卫生信息传播的良好载体，但围绕可持续性、适当的目标用户、消费模式、内容和使用模式仍然存在着悬而未决的问题。我们分析了42个社区卫生工作者（谁是第一次使用智能手机用户）从纵向17个月部署的日志和访谈数据，以便更好地了解移动视频在莱索托农村的效用。在研究期间，每月平均观看170次视频，共观看2898次。通过这个数据，我们得出初步结论：这些一）暂停不是上下文需要，b）年龄是不使用的一个障碍，C）的主要预测流行的视频主题相关性和国家运动，D）之间的视频长度没有明显的关系，普及率和完成率，和E）新的视频只有一个短暂的新奇效应。此外，我们确认，CHWs经常接触对持续使用的影响，除了是重要的减少磨损，由于技术问题。 article link

523. Experiences of Delivering a Public Health Data Service

SESSION:Health Volunteers

The turn to in-the-wild within HCI has given rise to an increasing concern around designing technologies which are available at large scale. Uniquely, at the intersection of public health and HCI, our work has supported the deployment of a mobile application, FeedFinder, over the last three years. We delineate the ground-work that was required to sustain this mobile application over the long-term. Focussing in particular on efforts made to engage institutions in taking ownership over FeedFinder and the data it provides, we reflect on the tensions that arose between users and civic institutions, particularly around "what matters". We provide a reflection on key requirements when designing a health data service and provide three lessons learnt which can guide researchers toward their own successful and productive long-term research deployments.

> 人机交互中的“野性转向”引起了人们对设计技术的日益关注。与众不同的是，在公共卫生和HCI的交叉点上，我们的工作一直是支持移动应用，feedfinder部署，在过去的三年。我们描绘了维持长期移动应用所需的地面工作。特别是集中在以从事机构拥有超过feedfinder和它提供的数据所做的努力，我们反思，是用户和民间机构之间的紧张关系，尤其是“重要的”。我们在设计卫生数据服务时，对关键需求进行了反思，并提供了三个经验教训，可以指导研究人员朝着自己成功和富有成效的长期研究部署方向发展。 article link

524. Understanding Volunteer AT Fabricators: Opportunities and Challenges in DIY-AT for Others in e-NABLE

SESSION:Health Volunteers

We present the results of a study of e-NABLE, a distributed, collaborative volunteer effort to design and fabricate upper-limb assistive technology devices for limb-different users. Informed by interviews with 14 stakeholders in e-NABLE, including volunteers and clinicians, we discuss differences and synergies among each group with respect to motivations, skills, and perceptions of risks inherent in the project. We found that both groups are motivated to be involved in e-NABLE by the ability to use their skills to help others, and that their skill sets are complementary, but that their different perceptions of risk may result in uneven outcomes or missed expectations for end users. We offer four opportunities for design and technology to enhance the stakeholders' abilities to work together.

> 我们目前的研究结果e-nable，分布式，协作的志愿者的努力和制作肢体不同用户的上肢辅具设计。通过与e-nable 14利益相关者的访谈，包括志愿者和临床医生，我们讨论每一组关于动机、技能之间的差异性和协同性，以及项目风险的看法。我们发现，两者都必须要用自己的技能来帮助他人的能力在e-nable参与，而他们的技能是互补的，但他们的不同理解的风险可能会导致不均匀的结果还是错过了最终用户的期望。我们提供四个设计和技术机会，以增强利益相关者共同工作的能力。 article link

525. VITA: Towards Supporting Volunteer Interactions with Long-Term Care Residents with Dementia

SESSION:Health Volunteers

Volunteers are an important resource at long-term care homes because they can supply services, such as engagement activities, that over-burdened care staff struggle to provide. However, volunteers without sufficient training are often challenged in responding to dementia-linked behaviors, which can lead to frustrating difficulties during interaction. Additionally, short-staffed care homes have difficulties in training and maintaining volunteers. To better support volunteers in providing engagement activities for people with dementia without a high training burden, we created VITA, a tablet-based system that supplies carefully designed profiling and guidance using our dementia-appropriate engagement activity kit. Our evaluation indicated that the instructional guide supplied by VITA significantly improves volunteers' ability to facilitate engagement activities with people with dementia, approaching the level of engagement achievable by professional therapists.

> 志愿者是长期护理院的重要资源，因为他们可以提供服务，如参与活动，负担过重的护理人员难以提供。然而，没有足够训练的志愿者往往会对与痴呆相关的行为作出反应，这可能会导致交互过程中令人沮丧的困难。此外，人手不足的养老院在培训和维持志愿人员方面存在困难。为了更好地支持志愿者为那些没有高训练负担的痴呆症患者提供参与活动，我们创建了维塔，这是一个基于平板的系统，它提供了精心设计的分析和指导，使用我们的痴呆症适当的参与活动工具包。我们的评估表明，维塔提供的教学指导能显著提高志愿者与痴呆症患者进行接触活动的能力，接近专业治疗师所能达到的接触水平。 article link

526. Micro-Versioning Tool to Support Experimentation in Exploratory Programming

SESSION:Helping Software Developers

Experimentation plays an essential role in exploratory programming, and programmers apply version control operations when switching the part of the source code back to the past state during experimentation. However, these operations, which we refer to asmicro-versioning, are not well supported in current programming environments. We first examined previous studies to clarify the requirements for a micro-versioning tool. We then developed a micro-versioning tool that displays visual cues representing possible micro-versioning operations in a textual code editor. Our tool includes a history model that generates meaningful candidates by combining a regional undo model and tree-structured undo model. The history model uses code executions as a delimiter to segment text edit operations into meaning groups. A user study involving programmers indicated that our tool satisfies the above-mentioned requirements and that it is useful for exploratory programming.

> 实验在探索性编程中起着至关重要的作用，程序员在实验过程中将源代码的一部分返回到过去的状态时，应用版本控制操作。然而，这些操作，我们称之为微型版本，不支持当前的编程环境。我们首先研究了以前的研究，以阐明对微版本控制工具的需求。然后我们开发了一个微版本控制工具，它显示了文本代码编辑器中表示可能的微版本操作的视觉提示。我们的工具包括一个历史模型，通过结合区域撤消模型和树结构撤销模型，生成有意义的候选对象。历史模型使用代码执行作为分隔符，将文本编辑操作分割为意义组。涉及程序员的用户研究表明，我们的工具满足上述要求，它是有益的探索性编程。 article link

527. Codeon: On-Demand Software Development Assistance

SESSION:Helping Software Developers

Software developers rely on support from a variety of resources---including other developers---but the coordination cost of finding another developer with relevant experience, explaining the context of the problem, composing a specific help request, and providing access to relevant code is prohibitively high for all but the largest of tasks. Existing technologies for synchronous communication (e.g. voice chat) have high scheduling costs, and asynchronous communication tools (e.g. forums) require developers to carefully describe their code context to yield useful responses. This paper introduces Codeon, a system that enables more effective task hand-off between end-user developers and remote helpers by allowing asynchronous responses to on-demand requests. With Codeon, developers can request help by speaking their requests aloud within the context of their IDE. Codeon automatically captures the relevant code context and allows remote helpers to respond with high-level descriptions, code annotations, code snippets, and natural language explanations. Developers can then immediately view and integrate these responses into their code. In this paper, we describe Codeon, the studies that guided its design, and our evaluation that its effectiveness as a support tool. In our evaluation, developers using Codeon completed nearly twice as many tasks as those who used state-of-the-art synchronous video and code sharing tools, by reducing the coordination costs of seeking assistance from other developers.

> 软件开发商依靠各种资源，包括其他开发商---而是寻找另一个开发者有相关经验的协调成本的支持，解释问题的背景下，构成一个特定的帮助请求，并提供相关的代码是高得惊人，除了最大的任务。现有的同步通信技术（如语音聊天）具有很高的调度成本，异步通信工具（如论坛）要求开发人员仔细描述其代码上下文以产生有用的响应。本文介绍了代码，一个系统，允许更有效的任务切换终端开发商和远程助手允许异步响应点播请求之间。用代码，开发者可以通过说他们大声要求在他们的IDE上下文请求帮助。代码自动捕获有关代码的上下文和允许远程助手回应与高层次的描述，代码注释，代码片段，和自然语言的解释。然后，开发人员可以立即查看并将这些响应集成到代码中。在本文中，我们描述了代码，研究引导设计，和我们的评价，作为一个支持工具的有效性。在我们的评估，开发人员使用代码完成了近两倍的任务，那些使用最先进的同步视频和代码共享的工具，通过减少从其他开发商寻求援助的协调成本。 article link

528. PFIS-V: Modeling Foraging Behavior in the Presence of Variants

SESSION:Helping Software Developers

Foraging among similar variants of the same artifact is a common activity, but computational models of Information Foraging Theory (IFT) have not been developed to take such variants into account. Without being able to computationally predict people's foraging behavior with variants, our ability to harness the theory in practical ways--such as building and systematically assessing tools for people who forage different variants of an artifact--is limited. Therefore, in this paper, we introduce a new predictive model, PFIS-V, that builds upon PFIS3, the most recent of the PFIS family of modeling IFT in programming situations. Our empirical results show that PFIS-V is up to 25% more accurate than PFIS3 in predicting where a forager will navigate in a variationed information space.

> 觅食的同一工件类似的变体中是一个常见的活动，但计算模型的信息觅食理论（IFT）还没有被开发，采取这种变异的考虑。如果不能够用变异的方式预测人们的觅食行为，我们就能够以实用的方式来处理这个理论——例如为不同类型的人工制品的人建立和系统地评估工具——是有限的。因此，在本文中，我们引入了一个新的预测模型，pfis-v，建立在pfis3，最近在编程的情况下，PFIS家族的IFT建模。我们的实证结果表明，pfis-v达25%更准确的预测比pfis3在觅食，在variationed信息空间导航。 article link

529. Improving Communication Between Pair Programmers Using Shared Gaze Awareness

SESSION:Helping Software Developers

Remote collaboration can be more difficult than collocated collaboration for a number of reasons, including the inability to easily determine what your collaborator is looking at. This impedes a pair's ability to efficiently communicate about on-screen locations and makes synchronous coordination difficult. We designed a novel gaze visualization for remote pair programmers which shows where in the code their partner is currently looking, and changes color when they are looking at the same thing. Our design is unobtrusive, and transparently depicts the imprecision inherent in eye tracking technology. We evaluated our design with an experiment in which pair programmers worked remotely on code refactoring tasks. Our results show that with the visualization, pairs spent a greater proportion of their time concurrently looking at the same code locations. Pairs communicated using a larger ratio of implicit to explicit references, and were faster and more successful at responding to those references.

> 远程协作可能比配置协作更困难，原因有很多，包括无法很容易地确定合作者所关注的是什么。这阻碍了一对有效地沟通屏幕上的位置，使同步协调困难的能力。我们为远程结对程序员设计了一种新的凝视可视化，它显示了他们的合作伙伴当前正在寻找的代码中的位置，并且当他们看到同一事物时改变颜色。我们的设计是不引人注目的，透明地描述了眼球跟踪技术固有的不精确性。我们评估了我们的设计，其中结对程序员远程工作的代码重构任务。我们的结果表明，随着可视化，成对花费了更多的时间同时查看相同的代码位置。成对使用隐式到显式引用的较大比例进行通信，在响应这些引用时更快更成功。 article link

530. Post-userism

SESSION:Interactive Design Methodologies

HCI is focused on improving the interactions we have with technology and innovating new types of interactions, as well as expanding the types of people for whom those interactions are designed. Central to these efforts is the simultaneously empowering and contested construct of the "user." This paper examines what the construct of the user highlights, as well as what it conceals. We introduce post-userism, a perspective that simultaneously acknowledges the limits of, and proposes alternatives to, the central construct of the user as proxy for the "human" in HCI. Drawing on developments across the historical trajectory of HCI, we articulate how the user is enacted across four different levels of representation-systems, interface, design process, and the ideology and identify situations where the user breaks down. Synthesizing prior work, we offer a series of strategies for grappling with such situations. In doing so, we seek to overcome the limitations imposed by the user and develop a language that will aid in evolving the foundations of HCI by asking what, exactly, we place at the center of our scholarship and design.

> HCI的重点是改进我们与技术的互动，创新新的交互类型，以及扩大那些交互设计的人的类型。这些努力的核心是“用户”的同时赋权和有争议的构建。我们介绍后userism，视角，同时承认的限制，并提出方案，中央构建用户代理的“人”的人机交互。根据人机交互历史轨迹的发展，我们阐述了用户是如何在四个不同级别的表示系统、接口、设计过程和意识形态中被制定出来的，并识别出用户崩溃的情况。综合以前的工作，我们提供了一系列的战略，以应付这种情况。在这样做的过程中，我们试图克服用户强加的限制，并开发一种语言，这将有助于我们通过我们的奖学金和设计的中心来确定HCI的基础。 article link

531. Tap the: A Design-Based Inquiry into Issue Advocacy and Digital Civics

SESSION:Interactive Design Methodologies

This paper examines the strategies of cycling advocates when deploying digital tools in their advocacy work as they support and create better cycling infrastructure and policies. Over the course of two years, we interviewed and conducted design-based fieldwork in two large U.S. cities with individuals and advocacy organizations, learning about the goals, motivations, and constraints that inform their work in their respective urban homes. Our design-based investigation and fieldwork advance a deeper, situated understanding of the role that computing technology plays when engaging across multiple sites of advocacy work. From this, we add detail to the connections across resources, identities, and issues and continue to advance the emerging area of digital civics, which seeks to design tools that support relational civic interactions across multiple categories of civic actors.

> 本文探讨了自行车倡导者的战略部署时，他们的宣传工作的数字工具，因为他们支持和创造更好的自行车基础设施和政策。在两年的时间里，我们采访了两个在美国的大城市，并与个人和宣传组织进行了实地的实地调查，了解了在各自城市的家庭中的工作目标、动机和制约因素。我们的设计为基础的调查和实地考察推进了一个更深层次的位置理解，计算技术的作用时，从事多个站点的宣传工作。由此，我们添加细节，在资源连接的身份，和问题，继续推进数字城市的新兴领域，旨在设计，支持公民之间的交互关系的公民演员多类工具。 article link

532. Enabling Polyvocality in Interactive Documentaries through "Structural Participation"

SESSION:Interactive Design Methodologies

Recent innovations in online, social and interactive media have led to the emergence of new forms of documentary, such as interactive documentaries ('i-Docs'), with qualities that lend themselves to more open and inclusive production structures. Still, little is known about the experience of making and/or participating-in these kinds of documentary. Our two-yearin-the-wildstudy engaged a large community-of-interest in the production of an i-Doc to explore the ethically-desirable yet challenging aim of enabling multiple subjects to have agency and control over their representation in a documentary. Our study reveals insights into the experiences of participating in an i-Doc and highlights key sociotechnical challenges. We argue that new sociotechnical infrastructure is needed, that frames both "executory" and "structural" forms of participation as symbiotic elements of a co-design process.

> 在网上最近的创新，社会与媒体互动导致新形式的纪录片的出现，如交互式纪录片（'i-docs '），品质本身更加开放和包容的生产结构。然而，关于制作和/或参与这些纪录片的经验却鲜为人知。我们的两年wildstudy从事大量的生产利益共同体I-doc探索道德理想而具有挑战性的目标使多个对象有机构和控制他们的纪录片中表示。我们的研究揭示了见解的经验参与，突出了关键技术挑战I-doc。我们认为，新的社会技术基础设施是必要的，这架“执行”和“结构”的形式参与的协同设计过程的共生元素。 article link

533. Supporting Expressive Procedural Art Creation through Direct Manipulation

SESSION:Interactive Design Methodologies

Computation is a powerful artistic medium. Artists with experience in programming have demonstrated the unique creative opportunities of using code to make art. Currently, manual artists interested in using procedural techniques must undergo the difficult process of learning to program, and must adopt tools and practices far removed from those to which they are accustomed. We hypothesize that, through the rightdirect manipulation interface, we can enableaccessible and expressiveprocedural art creation. To explore this,

we developed Para, a digital illustration tool that supports the creation of declarative constraints in vector artwork. Para's constraints enable procedural relationships while facilitating live manual control and non-linear editing. Constraints can be combined with duplication behaviors and ordered collections of artwork to produce complex, dynamic compositions. We use the results of two open-ended studies with professional artists and designers to provide guidelines for accessible tools that integrate manual and procedural expression.

> 计算是一种强有力的艺术媒介。有编程经验的艺术家展示了使用代码制作艺术的独特创造性机会。目前，对使用程序技术感兴趣的手工艺术家必须经历学习编程的艰难过程，必须采用与他们习惯的方法相去甚远的工具和实践。我们假设，通过rightdirect操作界面，我们可以enableaccessible和expressiveprocedural艺术创作。为了探究这一点，我们开发了Para，一个数字插图工具，支持在矢量艺术品中创建声明性约束。Para的限制使程序关系，同时促进现场手动控制和非线性编辑。约束可以与复制行为和有序的艺术品集合相结合，以产生复杂、动态的组合。我们使用两个开放式研究的结果，与专业的艺术家和设计师提供指导，方便的工具，集成了手工和程序的表达。 article link

534. Crowd Diversity and Performance in Wikipedia: The Mediating Effects of Task Conflict and Communication

SESSION:Motivation in Peer-production Communities

Crowd diversity is a key attribute that impacts crowd performance in online collaboration systems. As a structural composition of a crowd, diversity is likely to influence crowd performance through communication processes during collaboration. This study examined how diversity influenced crowd performance under different conditions of task conflict and communication in Wikipedia article production. With a sample of 5,899 articles, we found that contribution diversity positively predicted crowd performance, whereas experience diversity was negatively related to performance. In addition, task communication and conflict partially mediated the relationship between crowd diversity and performance. Task communication positively predicted performance for both forms of diversity. Task conflict, on the other hand, was positively predicted by expertise diversity, but had negative associations with contribution diversity and performance. The findings help unpack the reasons for differential effects of diversity on crowd performance, and demonstrate the importance of including communication variables when studying online crowd collaboration.

> 群体多样性是影响在线协作系统人群性能的关键因素。作为人群的结构组成，多样性很可能通过协作中的通信过程影响人群的性能。本研究旨在探讨在维基百科文章制作过程中，不同的任务冲突与沟通条件下，多样性对群体绩效的影响。在5899篇文章中，我们发现，贡献多样性对群体绩效有正向预测作用，而经验多样性与绩效呈负相关。此外，任务沟通和冲突部分中介了群体多样性与绩效之间的关系。任务沟通正向预测两种多样性的表现。另一方面，任务冲突是由专业知识多样性的积极预测，但与贡献的多样性和性能负相关。这些发现有助于揭示多样性对人群表现的不同影响的原因，并论证了在研究网络人群协作时包含传播变量的重要性。 article link

535. Freedom versus Standardization: Structured Data Generation in a Peer Production Community

SESSION:Motivation in Peer-production Communities

In addition to encyclopedia articles and software, peer production communities produce structured data, e.g., Wikidata and OpenStreetMap's metadata. Structured data from peer production communities has become increasingly important due to its use by computational applications, such as CartoCSS, MapBox, and Wikipedia infoboxes. However, this structured data is usable by applications only if it follows standards. We did an interview study focused on OpenStreetMap's knowledge production processes to investigate how -- and how successfully -- this community creates and applies its data standards. Our study revealed a fundamental tension between the need to produce structured data in a standardized way and OpenStreetMap's tradition of contributor freedom. We extracted six themes that manifested this tension and three overarching concepts, correctness, community, and code, which help make sense of and synthesize the themes. We also offered suggestions for improving OpenStreetMap's knowledge production processes, including new data models, sociotechnical tools, and community practices (e.g. stronger leadership).

> 除了百科全书文章和软件，大众生产社区产生的结构化数据，例如，wikidata和OpenStreetMap的元数据。结构化数据从大众生产社区已经由于计算其应用变得越来越重要，如CartoCSS、MAPbox，和维基百科方程式。然而，只有在遵循标准的情况下，这种结构化的数据才能被应用程序使用。我们做了一个访谈的研究主要集中在OpenStreetMap的知识生产过程的探讨--如何成功--这个社区创建和应用数据标准。我们的研究显示，需要在一个标准化的方法和自由的传统生产贡献OpenStreetMap结构化数据之间的根本冲突。我们提取了六个主题，展示了这种张力和三个总体概念，正确性，社区和代码，这有助于理解和综合主题。我们也为改善OpenStreetMap的知识生产过程提出建议，包括新的数据模型，社会技术工具和社区实践（如强领导）。 article link

536. Commitment of Newcomers and Old-timers to Online Health Support Communities

SESSION:Motivation in Peer-production Communities

For online communities to be successful, they must retain an adequate number of members who contribute to the community. The amount and type of communication members receive can play an important role in generating and sustaining members' commitment to it. However, the communication that members find valuable may change with their tenure in the community. This paper examines how the communication members receive in an health support community influences their commitment and how this influence changes with their tenure in the community. Commitment was operationalized with three measures: self-reported attachment, continued participation in the community, and responding to others. Results show that receiving communication was generally associated with increased commitment across the three measures, with its impact increasing with members' tenure. However, the average amount of informational and emotional support members received per message was associated with decreased commitment. Results have implications for interventions to encourage members' commitment to their communities throughout their history in the community.

> 为了使网上社区获得成功，他们必须保留足够数量的社区成员。通信成员收到的数量和类型可以在产生和维持成员对它的承诺方面发挥重要作用。然而，成员们发现有价值的交流可能会随着他们在社区中的任期而改变。本文探讨了如何在健康支持社区的通信成员接受影响他们的承诺，以及这种影响如何改变他们的任期在社会上。承诺是具有可操作性的三项措施：自我报告的附件，在社区的持续参与，并回应他人。结果表明，接受沟通通常与三个措施中增加的承诺有关，其影响随着成员的任期而增加。然而，每个邮件收到的信息和情感支持成员的平均数量与承诺的减少有关。研究结果对鼓励社区成员在社区历史上对其社区的承诺的干预措施产生了影响。 article link

537. Starting Online Communities: Motivations and Goals of Wiki Founders

SESSION:Motivation in Peer-production Communities

Why do people start new online communities? Previous research has studied what helps communities to grow and what motivates contributors, but the reasons that people create new communities in the first place remain unclear. We present the results of a survey of over 300 founders of new communities on the online wiki hosting site Wikia.com. We analyze the motivations and goals of wiki creators, finding that founders have diverse reasons for starting wikis and diverse ways of defining their success. Many founders see their communities as occupying narrow topics, and neither seek nor expect a large group of contributors. We also find that founders with differing goals approach community building

differently. We argue that community platform designers can create interfaces that support the diverse goals of founders more effectively.

> 为什么人们开始建立新的在线社区？以前的研究已经研究了什么有助于社区成长和激励贡献者，但是人们最初创建新社区的原因还不清楚。我们提出了一个调查，结果300以上的创始人新社区网站wikia.com在线wiki。我们分析了Wiki的创造者的目的和动机，发现创始人已经开始维基和定义他们的成功不同的方式不同的原因。许多创始人把他们的社区视为狭隘的话题，既不寻求也不期望有大量的贡献者。我们还发现不同目标的创始人对社区建设的态度不同。我们认为社区平台设计者可以更有效地创建支持创始人不同目标的界面。 article link

538. Investigating the Motivational Paths of Peer Production Newcomers

SESSION:Motivation in Peer-production Communities

Maintaining participation beyond the initial period of engagement is critical for peer production systems. Theory suggests that an increase in motivation is expected with contributors' movement from the community periphery to the core. Less is known, however, about how specific motivations change over time. We fill this gap by focusing on individual motivational paths in the formative periods of engagement, exploring which motivations change and how. We collected data on various instrumental and non-instrumental motivations at two points in study participants? Wikipedia career: when they started editing and again after six months. We found that non-instrumental motivations (including collective and intrinsic motives) decreased significantly over time, in contrast with socially-driven motivations such as norm-oriented motivates which did not change and social motives which increased marginally. The findings offer new insights into newcomers' evolving motivations, with implications for designing and managing peer-production systems.

> 在参与的初始阶段内保持参与是对等生产系统的关键。理论表明，动机的增加是预期的，从社区边缘到核心的贡献者的运动。然而，很少有人知道具体动机是如何随着时间而变化的。我们专注于个人的动机路径，在接触的形成阶段，探索动机的变化和如何填补这一空白。我们收集了不同的工具性和非工具性动机在研究参与者的两个点上的数据。维基百科生涯：当他们六个月后开始编辑的时候。我们发现，非工具性动机（包括集体动机和内在动机）随着时间的推移显著减少，与社会驱动的动机相反，如没有改变的规范导向动机和社会动机，后者略有增加。这一发现为新来者不断发展的动机提供了新的见解，对设计和管理对等生产系统具有启发意义。 article link

539. Traversing Boundaries: Understanding the Experiences of Ageing Saudis

SESSION:Older Adults and Computers

This is a methods paper that draws from our fieldwork conducted in Saudi Arabia to understand ageing people's experiences. This paper focuses on insights gained when using qualitative methods to understand the experiences of ageing Saudis. The aim is to highlight some of the cultural considerations, opportunities, challenges, and issues that influenced our approach and deployment of interviews and probes. Influences of social-cultural practices and religion led to interesting challenges for recruitment, conducting cross-gender communications, and how participants reported their experiences. This paper offers methodological considerations that include the influences of local culture, gender, religion, etc. We also discuss how we shaped our fieldwork tools based upon considerations of local cultural and religious contexts. In particular, we highlight the usefulness of probes in traversing cultural boundaries.

> 这是一份从我们在沙特阿拉伯进行的实地调查中了解老年人经历的方法文件。本文侧重于使用定性的方法来了解沙特老龄化的经验。其目的是强调一些文化因素、机会、挑战和影响我们采访和调查的方法和部署的问题。社会文化习俗和宗教的影响导致征聘、进行跨性别交流、以及参加者如何报告他们的经历等方面的有趣挑战。本文提供了包括当地文化、性别、宗教等因素影响的方法学考虑，我们还讨论了如何根据当地文化和宗教背景考虑如何塑造我们的实地调查工具。特别是，我们强调探针在跨越文化边界方面的作用。 article link

540. Transitions in Digital Personhood: Online Activity in Early Retirement

SESSION:Older Adults and Computers

We present findings from a qualitative study about how Internet use supports self-functioning following the life transition of retirement from work. This study recruited six recent retirees and included the deployment of OnLines, a design research artifact that logged and visualized key online services used by participants at home over four-weeks. The deployment was supported by pre- and post-deployment interviews. OnLines prompted participants' reflection on their patterns of Internet use. Position Exchange Theory was used to understand retirees' sense making from a lifespan perspective, informing the design of supportive online services. This paper delivers a three-fold contribution to the field of human-computer interaction, advancing a lifespan-oriented approach by conceptualizing the self as a dialogical phenomenon that develops over time, advancing the ageing discourse by reporting on retirees' complex identities in the context of their life histories, and advancing discourse on research through design by developing OnLines to foster participant-researcher reflection informed by Self Psychology.

> 我们从一个定性研究中发现了互联网使用如何支持退休后生活过渡的自我功能。这项研究招募了六名近期退休人员，包括网上部署，设计研究的神器，记录和可视化关键在线服务的参与者在家超过四周。部署是在部署前和部署后的访谈中得到支持的。网上提示参与者反思自己的互联网使用模式。运用位置交换理论从寿命的角度来理解退休人员的意义感，并告知支持性在线服务的设计。本文提供了一个三倍的贡献在人机交互领域，概念化自我发展随着时间的推进对话现象的寿命为导向的方法，通过报道对退休人员的复杂身份在其生活史的背景下推进老龄化的话语，话语和推进研究通过设计开发网上培养参与者研究者反思了解自我心理学。 article link

541. Dissecting Spear Phishing Emails for Older vs Young Adults: On the Interplay of Weapons of Influence and Life Domains in Predicting Susceptibility to Phishing

SESSION:Older Adults and Computers

Spear phishing emails are key in many cyber attacks. Successful emails employ psychological weapons of influence and relevant life domains. This paper investigates spear phishing susceptibility as a function of Internet user age (old vs young), weapon of influence, and life domain. A 21-day study was conducted with 158 participants (younger and older Internet users). Data collection took place at the participants' homes to increase ecological validity. Our results show that older women were the most vulnerable group to phishing attacks. While younger adults were most susceptible to scarcity, older adults were most susceptible to reciprocation. Further, there was a discrepancy, particularly among older users, between self-reported susceptibility awareness and their behavior during the intervention. Our results show the need for demographic personalization for warnings, training and educational tools in targeting the specifics of the older adult population.

> 鱼叉式网络钓鱼电子邮件是许多网络攻击的关键。成功的电子邮件使用心理武器和相关的生活领域。本文研究了鱼叉式网络钓鱼的易感性，它是互联网用户年龄（旧与年轻）、影响力武器和生活领域的函数。进行了为期21天的研究，共有158名参与者（较年轻和年长的互联网用户）。与会者收集数据以提高生态效度。我们的研究结果表明，老年妇女

> 是最容易受到网络钓鱼攻击的群体。虽然年轻人最易受匮乏的影响，但老年人最容易受到回报的影响。此外，有一个差异，特别是在老年人之间，自我报告的易感性意识和他们在干预过程中的行为。我们的研究结果表明，针对老年人的具体情况，需要进行人口个性化的警告、培训和教育工具。 article link

542. Privacy Considerations when Designing Social Network Systems to Support Successful Ageing

SESSION:Older Adults and Computers

A number of interventions exist to support older adults in ageing well and these typically involve support for an active and sociable ageing process. We set out to examine the privacy implications of an intervention that would monitor mobility and share lifestyle and health data with a community of trusted others. We took a privacy-by-design approach to the system in the early stages of its development, working with older adults to firstly understand their networks of trust and secondly understand their privacy concerns should information be exchanged across that network. We used a Johari Windows framework in the thematic analysis of our data, concluding that the social sharing of information in later life carried significant risk. Our participants worried about the social signaling associated with data sharing and were cautious about a system that had the potential to disrupt established networks.

> 有许多干预措施支持老年人的老龄化，这些措施通常包括支持积极和有利于社会的老龄化进程。我们着手研究一个干预的隐私问题，它将监测流动性，并与受信任的其他人分享生活方式和健康数据。在开发的早期阶段，我们采用了设计方法对系统进行隐私保护，与老年人合作首先了解他们的信任网络，其次了解他们的隐私问题，信息是否应该通过该网络交换。我们用一个篮球的Windows框架在我们的数据主题分析，认为在以后的生活中进行重大风险信息的社会共享。我们的参与者担心与数据共享相关的社会信号，对可能破坏已建立网络的系统持谨慎态度。 article link

543. Malleable Embodiment: Changing Sense of Embodiment by Spatial-Temporal Deformation of Virtual Human Body

SESSION:Spatial & Temporal Design

We hypothesize that replacing the visual perception of one's body with a spatial-temporal deformed state would change sensations associated with the body. We developed a system that captures full-body movement and generates estimated past and future body movement by deformation. With a head mounted display, people could see their bodies as slightly deformed. We then investigated 1) how human movement is physically changed, and 2) how humans feel about the change in physical and emotional views of the body due to virtual body deformation. Our results show that spatial-temporal deformation of a virtual body actually changes the sense of body as well as physical movement. For instance, a body image generated at approximately 25-100 ms in the future induced a "lighter weight" sensation. On the basis of our findings, we discuss the design implication of computational control for the physical and emotional sense of body.

> 我们假设用时空变形状态代替身体的视觉感知会改变与身体相关的感觉。我们开发了一个系统，捕捉全身运动，并产生估计过去和未来身体运动的变形。通过头戴式显示器，人们可以看到他们的身体轻微变形。然后，我们调查了1）人体运动是如何变化的，2）人类如何感受到身体由于虚拟身体变形而产生的身体和情绪上的变化。我们的研究结果表明，虚拟物体的时空变形实际上改变了身体的感觉和身体的运动。例如，一个身体形象的产生在未来大约25-100 MS引起的“轻”的感觉。在研究结果的基础上，我们讨论了计算控制对人体物理和情感意义的设计意义。 article link

544. Sensitizing Concepts for Socio-spatial Literacy in HCI

SESSION:Spatial & Temporal Design

People inherently share spaces with other people. Congenitally, interactive technologies and ubiquitous environments shape our opportunities for enacting social relations. Proxemics and Spatial Sharing have been suggested as foundations for our understanding of the socio-spatial aspects of computing. By tandeming these theoretical perspectives in a set of cases in the office domain, we develop a contribution comprised of 3 key sensitizing concepts:Proxemic Malleability, Proxemic Threshold and Proxemic Gravityarticulating socio-spatial qualities at the interplay between interactive systems, spaces, interior elements and co-located people. The sensitizing concepts qualify interaction designers in considering proxemic consequences of technology design; they serve both as analytic lenses and as generative instruments in a design process. The proposed sensitizing concepts and the theoretical work of the paper contribute to enhanced Socio-spatial literacy in HCI.

> 人们天生与他人共享空间。先天的、互动的技术和无处不在的环境塑造了我们制定社会关系的机会。空间关系和空间共享已被建议作为我们计算的社会空间方面的认识基础。通过这些理论观点在tandeming在办公领域一套的情况下，我们开发了一个由3个关键概念：Proxemic Malleability，敏贡献空间关系的阈值和Proxemic Gravityarticulating的社会空间品质的交互系统，空间之间的相互作用，内部因素和合作的人。敏化概念限定交互设计师在考虑技术设计空间关系的后果；他们既是分析镜头和生成工具在设计过程。本文提出的敏化概念和理论工作有助于提高人机交互中的社会空间素养。 article link

545. Situational When: Designing for Time Across Cultures

SESSION:Spatial & Temporal Design

We propose the concept of "Situational When", an approach to understanding time in interface design not as a point on a calendar or clock, but as a set of converging circumstances that constitute "the time" for happenings to take place. Time is encoded both explicitly and implicitly in designed products. However, many technologies propagate business-centric, modernist values such as scheduling and efficiency, and marginalize broader socio-cultural aspects on which many activities are nonetheless contingent, e.g. the right people, the right weather conditions, and the right vibe. We derive our reflections from a case study of a cross-cultural digital noticeboard designed with an Australian Aboriginal community. Attention to the situational when opens up new possibilities for design that put greater emphasis on the social and relational aspects of time, the situational insights embodied in local narratives, and the tangible (e.g. people) and intangible (e.g. energy) circumstances that together make up the "right" time.

> 我们提出“情境时”的概念，这种方法是将界面设计中的时间理解为日历或时钟上的一个点，而是作为一组趋同的环境，构成事件发生的“时间”。在设计的产品中，时间是显式地和隐式地编码的。然而，许多技术传播商务中心，现代主义价值观如调度和效率，以及更广泛的社会文化方面的边缘化，很多活动仍然是偶然的，如有合适的人，合适的天气条件，和正确的感觉。我们得到了我们的思考，从跨文化的数字布告栏设计了一个澳大利亚土著社区的个案研究。关注情境时，开辟了设计，放在当时的社会和关系方面更加重视新的可能性，在乡土叙事体现情境的见解，和有形的（人）和无形的（如能量）的情况下，共同组成了“正确”的时间。 article link

546. Modeling Sub-Document Attention Using Viewport Time

SESSION:Spatial & Temporal Design

Website measures of engagement captured from millions of users, such as in-page scrolling and viewport position, can provide deeper understanding of attention than possible with simpler measures, such as dwell time. Using data from 1.2M news reading sessions, we examine and evaluate three increasingly sophisticated models of sub-document attention computed fromviewport time, the time a page component is visible on the user display. Our modeling incorporates prior eye-tracking knowledge about onscreen reading, and we validate it by showing how, when used to estimate user reading rate, it aligns with known empirical measures. We then show how our models reveal an interaction between article topic and attention to page elements. Our approach supports refined large-scale measurement of user engagement at a level previously available only from lab-based eye-tracking studies.

> 网站从数以百万计的用户，如在页面滚动和视口位置捕获的参与措施，可以提供更简单的理解，如停留时间，更深入地了解注意。使用从120新闻阅读会话数据，我们研究和评价三越来越复杂的子文档关注模型计算fromviewport时间，时间的页面组件在用户显示。我们的模型结合了关于屏幕阅读的事先眼睛跟踪知识，我们通过显示如何使用用户阅读速率来验证它，它与已知的经验度量相吻合。然后，我们将展示我们的模型是如何揭示文章主题与页面元素注意之间的相互作用的。我们的方法支持在以前仅基于实验室的眼动跟踪研究的水平上对用户参与度进行精细的大规模测量。 article link

547. Remote Collaboration With Mixed Reality Displays: How Shared Virtual Landmarks Facilitate Spatial Referencing

SESSION:Spatial & Temporal Design

HCI research has demonstrated Mixed Reality (MR) as being beneficial for co-located collaborative work. For remote collaboration, however, the collaborators' visual contexts do not coincide due to their individual physical environments. The problem becomes apparent when collaborators refer to physical landmarks in their individual environments to guide each other's attention. In an experimental study with 16 dyads, we investigated how the provisioning of shared virtual landmarks (SVLs) influences communication behavior and user experience. A quantitative analysis revealed that participants used significantly less ambiguous spatial expressions and reported an improved user experience when SVLs were provided. Based on these findings and a qualitative video analysis we provide implications for the design of MRs to facilitate remote collaboration.

> HCI研究表明混合现实（MR）有利于共同协作的工作。然而，对于远程协作，合作者的视觉环境由于各自的物理环境不一致。当合作者提到他们各自环境中的物理地标来引导彼此的注意力时，问题就变得明显了。在实验研究中有16对，我们研究了共享虚拟地标配置（SVLs）和用户体验的沟通行为的影响。定量分析显示，参与者使用较少的模棱两可的空间表达和报道的一种改进的用户体验时，SVLs提供了。基于这些发现和定性的视频分析，我们为MRS的设计提供了便利，以促进远程协作。 article link

548. Growing the Blockchain Information Infrastructure

SESSION:The Infrastructure of Trust

In this paper, we present ethnographic data that unpacks the everyday work of some of the many infrastructuring agents who contribute to creating, sustaining and growing the Blockchain information infrastructure. We argue that this infrastructuring work takes the form of entrepreneurial actions, which are self-initiated and primarily directed at sustaining or increasing the initiator's stake in the emerging information infrastructure. These entrepreneurial actions wrestle against the affordances of the installed base of the Blockchain infrastructure, and take the shape of engaging or circumventing activities. These activities purposefully aim at either influencing or working around the enablers and constraints afforded by the Blockchain information infrastructure, as its installed base is gaining inertia. This study contributes to our understanding of the purpose of infrastructuring, seen from the perspective of heterogeneous entrepreneurial agents. It supplements existing accounts of the "when" and "how" of infrastructure, with a lens for examining the "why" of infrastructure.

> 在本文中，我们提出了民族志资料，揭示一些infrastructuring代理人有利于创造的日常工作，维持及增加blockchain信息基础设施。我们认为，这infrastructuring工作以创业行动的形式，这是自我发起的，主要针对维持或增加在新兴的信息基础设施，发起人的股份。这些创业行动摔跤在blockchain基础设施的安装基础的启示，并以形接合或规避活动。这些活动有目的的目的，影响或工作在引擎和约束的blockchain信息基础设施提供，其安装基础获得惯性。这项研究有助于我们对infrastructuring目的的认识，从异构的创业主体的角度看。它补充了现有的关于“何时”和“如何”的基础设施的账目，并用一个镜头来检查基础设施的“为什么”。 article link

549. Design for Trust: An Exploration of the Challenges and Opportunities of Bitcoin Users

SESSION:The Infrastructure of Trust

Bitcoin is a cryptocurrency which has received increasing interest over the last five years. Built upon a decentralized peer to peer system, it supports transparent, fast, cost effective, and irreversible transactions, without the need for trusting third party financial institutions. We know however little about people's motivation and experience with bitcoin currency. This paper reports on interviews with 20 bitcoin users in Malaysia about their experience and trust challenges. Findings show that bitcoins are used more as store of value for speculative investment or savings' protection. The paper advances the HCI theories on trust by identifying main bitcoin characteristics and their impact on trust, such as decentralization, unregulation, embedded expertise, and reputation, as well as transactions' transparency, low cost, and easiness to complete. We discuss insecure transactions, the risk of dishonest traders and its mitigating strategies. The paper concludes with design implications including support for the transparency of two-way transactions, tools for materializing trust, and tools for supporting reversible transactions.

> 比特币是一个cryptocurrency已受到越来越多的关注，在过去的五年。它建立在分散的点对点系统之上，它支持透明、快速、成本效益和不可逆交易，而不需要信任第三方金融机构。我们很少知道人们对比特币的动机和经验。本文报告了马来西亚20位比特币用户对他们的经验和信任挑战的采访。研究结果表明，比特币被用作投机性投资或储蓄保护的价值储备。本文提出了在信任的人机交互理论的识别及其影响信任的主要比特币的特性，比如简政放权、放松管制、嵌入式技术、信誉，以及交易的透明度、低成本、易完成。我们讨论不安全交易、不诚实交易者的风险及其减轻策略。本文设计的影响，包括双向交易透明度的支持，实现信托工具和工具支持双向交易。 article link

550. Infrastructure as Creative Action: Online Buying, Selling, and Delivery in Phnom Penh

SESSION:The Infrastructure of Trust

This paper describes a complex global sales and logistics network based in Phnom Penh, Cambodia, which utilizes Internet tools (particularly Facebook) as well as a suite of offline tools such as feature phones, paper receipts, and motorcycles to facilitate the buying and selling of clothes and other commodities. Against the gap or import models that sometimes limit HCI understandings of computational change in non-Western environments, we argue that the consumers, business owners, delivery drivers, and call center staff play active and formative roles in producing this infrastructure, integrating new tools into older cultural practices and determining how they work within the limits and conventions of the environment. We argue that resourceful and imaginative activities such as these constitute a form of creative infrastructural action and are central to the ways that new tools circulate in the world, though they often go unrecognized by HCI as innovation.

> 本文介绍了一种复杂的全球销售，总部在金边，柬埔寨的物流网络，利用互联网工具（特别是脸谱网）以及一套离线工具如功能手机，票据，和摩托车方便购买和出售的衣服和其他商品。对间隙或进口车型，有时限HCI的理解在非西方环境中计算的变化，我们认为，消费者、企业主、送货司机和呼叫中心员工发挥积极和形成的生产基础设施的作用，整合新工具为古老的文化实践和确定他们的工作范围内和环境公约。我们认为，像这样的资源丰富、想象力丰富的活动构成了创造性基础设施行动的一种形式，对新工具在世界上流通的方式至关重要，尽管它们常常作为创新而被人认不出来。 article link

551. Supporting Cultures of Making: Technology, Policy, Visions, and Myths

SESSION:The Infrastructure of Trust

Recent HCI research has linked social policy to design, e.g., in issues such as public safety, privacy, and social justice. One area where policy, technology, and design intersect is in the vision of the creative economy. In that vision, creativity, distinct local/regional cultural practices, technology, and entrepreneurship synergistically produce social innovation on a scale sufficient to drive economies. Culture and creative industries (CCI) policy specifies how governments intervene to support such clusters. Maker cultures are seen as central to this vision, but comparatively little is known about how makers produce culture. We offer a critical analysis of several encounters between CCI policy in Taiwan and its maker scene. These encounters reveal misalignments that undercut efforts intended to support making. We propose that supporting any creative culture, including making, entails a serious commitment to understanding its culture, including its cultural contents and their means of production. We further argue that scholarly rigor in cultivating cultural appreciation is just as fundamental as scholarly rigor in empirically representing cultural practices when it comes to pursuing such a cultural understanding.

> 最近的HCI研究把社会政策与设计联系起来，例如在公共安全、隐私和社会公正等问题上。政策、技术和设计交叉的一个领域是创意经济的视野。在这一构想中，创造力、独特的地方/区域文化习俗、技术和企业家精神协同产生了足以推动经济的社会创新。文化创意产业（CCI）政策规定政府如何干预以支持这种集群。制造商文化被视为这一愿景的核心，但对制造商如何生产文化却知之甚少。我们对CCI政策在台湾及其制造商场景中的几次遭遇进行了批判性分析。这些遭遇揭示偏差，削弱旨在支持努力。我们建议，支持任何创造性文化，包括制作，都必须认真理解其文化，包括其文化内容和生产手段。我们进一步认为，在培养文化鉴赏力方面，学术严谨与学术严谨同样重要，因为在追求文化理解的过程中，经验代表了文化实践。 article link

552. EgoScanning: Quickly Scanning First-Person Videos with Egocentric Elastic Timelines

SESSION:Video "Smart" Viewers

This work presents EgoScanning, a novel video fast-forwarding interface that helps users to find important events from lengthy first-person videos recorded with wearable cameras continuously. This interface is featured by an elastic timeline that adaptively changes playback speeds and emphasizes egocentric cues specific to first-person videos, such as hand manipulations, moving, and conversations with people, based on computer-vision techniques. The interface also allows users to input which of such cues are relevant to events of their interests. Through our user study, we confirm that users can find events of interests quickly from first-person videos thanks to the following benefits of using the EgoScanning interface: 1) adaptive changes of playback speeds allow users to watch fast-forwarded videos more easily; 2) Emphasized parts of videos can act as candidates of events actually significant to users; 3) Users are able to select relevant egocentric cues depending on events of their interests.

> 这项工作提出了一个新的EgoScanning，视频快进的界面，帮助用户找到重要事件从漫长的第一人称视频与可穿戴式摄像机连续记录。该接口具有弹性的时间表，自适应地改变播放速度，强调以自我为中心线索，具体到第一人称视频，如手的操作，移动，和与人交谈，基于计算机视觉技术。该接口还允许用户输入这些提示中的哪些与他们感兴趣的事件相关。通过我们的用户研究，我们确认，用户可以找到事件的利益迅速从第一人称视频感谢以下好处使用egoscanning接口：1）播放速度自适应变化允许用户观看快进视频更容易；2）视频强调的部分可以作为候选事件用户实际意义；3）用户可以选择相关的以自我为中心线索，根据他们的利益的事件。 article link

553. Retargeting Video Tutorials Showing Tools With Surface Contact to Augmented Reality

SESSION:Video "Smart" Viewers

A video tutorial effectively conveys complex motions, but may be hard to follow precisely because of its restriction to a predetermined viewpoint. Augmented reality (AR) tutorials have been demonstrated to be more effective. We bring the advantages of both together by interactively retargeting conventional, two-dimensional videos into three-dimensional AR tutorials. Unlike previous work, we do not simply overlay video, but synthesize 3D-registered motion from the video. Since the information in the resulting AR tutorial is registered to 3D objects, the user can freely change the viewpoint without degrading the experience. This approach applies to many styles of video tutorials. In this work, we concentrate on a class of tutorials which alter the surface of an object.

> 视频教程有效地传达复杂的运动，但可能很难准确地遵循，因为它的限制，以预定的观点。增强现实（AR）教程已被证明是更有效的。我们把这两者的优点通过交互重定向传统二维到三维的AR，视频教程。与以前的工作不同，我们不简单地覆盖视频，而是从视频合成3D注册运动。由于所生成的AR教程中的信息被注册到3D对象，用户可以自由地改变视图而不降低经验。这种方法适用于多种风格的视频教程。在这项工作中，我们专注于一类教程，它改变了物体的表面。 article link

554. Close to the Action: Eye-Tracking Evaluation of Speaker-Following Subtitles

SESSION:Video "Smart" Viewers

The incorporation of subtitles in multimedia content plays an important role in communicating spoken content. For example, subtitles in the respective language are often preferred to expensive audio translation of foreign movies. The traditional representation of subtitles displays text centered at the bottom of the screen. This layout can lead to large distances between text and relevant image content, causing eye strain and even that we miss visual content. As a recent alternative, the technique of speaker-following subtitles places subtitle text in speech bubbles close to the current speaker. We conducted a controlled eye-tracking laboratory study (n= 40) to compare the regular approach (center-bottom subtitles) with content-sensitive, speaker-following subtitles. We compared different dialog-heavy video clips with the two layouts. Our results show that speaker-following subtitles lead to higher fixation counts on relevant image regions and reduce saccade length, which is an important factor for eye strain.

> 字幕在多媒体内容中的应用对口语内容的传达起着重要作用。例如，在各自的语言字幕往往是昂贵的外国电影音频翻译首选。传统的字幕表示方式显示在屏幕底部居中的文本。这种布局会导致文本和相关的图像内容之间的距离过大，造成眼睛紧张，甚至我们会忽略视觉内容。作为一种新的替代方法，说话人跟随字幕技术将字幕文本置于接近当前扬声器的语音泡中。我们进行了受控眼动跟踪实验室研究（N = 40），比较常规方法（中心底部字幕）与内容敏感的、以下发言者的字幕。我们比较了不同的对话框重视频剪辑与这两个布局。我们的研究结果表明，扬声器跟随字幕导致较高的固定计数相关的图像区域，并减少扫视长度，这是一个重要的因素，眼应变。 article link

555. Responsive Action-based Video Synthesis

SESSION:Video "Smart" Viewers

We propose technology to enable a new medium of expression, where video elements can be looped, merged, and triggered, interactively. Like audio, video is easy to sample from the real world, but hard to segment into clean reusable elements. Reusing a video clip means non-linear editing, and compositing with novel footage. The new context dictates how carefully a clip must be prepared, so our end-to-end approach enables previewing and easy iteration. We convert static-camera videos into loopable sequences, synthesizing them in response to simple end-user requests. This is hard because a) users want essentially semantic-level control over the synthesized video content, and b) automatic loop-finding is brittle and leaves users limited opportunity to work through problems. We propose a human-in-the-loop system where adding effort gives the user progressively more creative control. Artists help us evaluate how our trigger interfaces can be used for authoring of videos and video-performances.

> 我们提出了一种新的表达方式，即视频元素可以循环、合并和触发。像音频一样，视频很容易从现实世界中抽取，但很难分割成干净的可重用元素。重用视频剪辑意味着非线性编辑，并与新的镜头合成。新的上下文决定如何精心剪辑必须做好准备，所以我们的端到端的方法使预览和简单的迭代。我们将静止的摄像机视频loopable序列，合成简单的最终用户请求的响应。这是很困难的，因为A）用户希望对合成视频内容进行实质性的语义控制，B）自动循环查找是脆弱的，留给用户有限的机会来解决问题。我们提出了一个在循环系统中，添加努力，使用户逐步更具创造性的控制。艺术家帮助我们评估我们的触发接口如何被用来创作视频和视频表演。 article link

556. Co-3Deator: A Team-First Collaborative 3D Design Ideation Tool

SESSION:3D Tangibles

We present Co-3Deator, a sketch-based collaborative 3D modeling system based on the notion of "team-first" ideation tools, where the needs and processes of the entire design team come before that of an individual designer. Co-3Deator includes two specific team-first features: aconcept component hierarchywhich provides a design representation suitable for multi-level sharing and reusing of design information, and acollaborative design explorerfor storing, viewing, and accessing hierarchical design data during collaborative design activities. We conduct two controlled user studies, one with individual designers to elicit the form and functionality of the collaborative design explorer, and the other with design teams to evaluate the utility of the concept component hierarchy and design explorer towards collaborative design ideation. Our results support our rationale for both of the proposed team-first collaboration mechanisms and suggest further ways to streamline collaborative design.

> 我们目前的co-3deator，基于草图的协同三维建模系统基于“团队第一”的思维工具的概念，哪里需要和整个设计团队过程来之前，设计师。co-3deator包括两个特定团队的第一特点：分层次的概念提供了一个设计表示适合多层次的设计信息的共享和重用，并协同设计explorerfor存储、查看和访问数据的分层设计中的协同设计活动。我们进行两个控制用户的研究，一个与个别设计师引出的形式和功能的协同设计资源管理器，和其他设计团队评估的概念组件层次结构和设计资源管理器的合作设计思想的效用。我们的研究结果支持我们提出的团队第一协作机制的基本原理，并提出进一步简化协同设计的方法。 article link

557. EdiPulse: Investigating a Playful Approach to Self-monitoring through 3D Printed Chocolate Treats

SESSION:3D Tangibles

Self-monitoring offers benefits in facilitating awareness about physical exercise, but such data-centric activity may not always lead to an enjoyable experience. We introduce EdiPulse a novel system that creates activity treats to offer playful reflections on everyday physical activity through the appealing medium of chocolate. EdiPulse translates self-monitored data from physical activity into small 3D printed chocolate treats. These treats (< 20 grams of chocolate in total) embody four forms: Graph, Flower, Slogan and Emoji. We deployed our system across 7 households and studied its use with 13 participants for 2 weeks per household. The field study revealed positive aspects of our approach along with some open challenges, which we disseminate across five themes: Reflection, Positivity, Determination, Affection, and Co-experience. We conclude by highlighting key implications of our work for future playful food-based technology design in supporting the experience of being physically active

> 自我监控有助于促进人们对体育锻炼的认识，但这种以数据为中心的活动可能并不总能带来愉快的体验。我们介绍一种系统edipulse创建活动将提供有趣的思考日常体力活动通过吸引媒体的巧克力。edipulse转化自我监测的数据，从体育活动到小型3D打印巧克力。这些治疗（＜20克巧克力总）体现了四种形式：图、花、口号和表情符号。我们在7个家庭中部署了我们的系统，并对每个家庭2个星期的13名参与者进行了研究。实地研究揭示了我们的方法的积极方面以及一些开放的挑战，我们在五个主题上传播：反思、积极、决心、情感和共同经验。最后，我们强调我们的工作对未来好玩的以食物为基础的技术设计，以支持体力活动的经验所带来的关键影响。 article link

558. Investigating Cross-Device Interaction between a Handheld Device and a Large Display

SESSION:3D Tangibles

There is a growing interest in HCI research to explore cross-device interaction, giving rise to an interest in different approaches facilitating interaction between handheld devices and large displays. Contributing to this, we have investigated the use of four existing approaches combining touch and mid-air gestures,pinching, swiping, swingingandflicking. We look specifically at their relative efficiency, effectiveness and accuracy in bi-directional interaction between a smartphone and large display in a point-click context. We report findings from two user studies, which show that swiping is both most effective, fastest and most accurate, closely followed by swinging. What these two approaches have in common is the ability to keep the pointer steady on the large display, unaffected by concurrent gestures or body movements used to complete the interaction, suggesting that this is an important factor for designing effective cross-device interaction with large displays.

> 人们越来越感兴趣的人机交互研究，探索跨设备的互动，引起人们的兴趣在不同的方法，促进手持设备和大型显示器之间的互动。为这个，我们已经调查了使用现有的四个方法结合触摸和空中姿态，捏，刷卡，swingingandflicking。我们特别关注在点点击上下文中智能手机和大屏幕之间双向交互的相对效率、有效性和准确性。我们的报告发现了两个用户研究，这表明，刷卡是最有效、最快、最准确的，紧随其后的是摆动。这两种方法有什么共同点是使指针稳定在大的显示能力，通过并行的手势或身体动作来完成交互作用的影响，表明这是有效的跨设备和大型显示器设计的一个重要因素。 article link

559. Competent Men and Warm Women: Gender Stereotypes and Backlash in Image Search Results

SESSION:Appropriation and Individuation

There is much concern about algorithms that underlie information services and the view of the world they present. We develop a novel method for examining the content and strength of gender stereotypes in image search, inspired by the trait adjective checklist method. We compare the gender distribution in photos retrieved by Bing for the query "person" and for queries based on 68 character traits (e.g., "intelligent person") in four regional markets. Photos of men are more often retrieved for "person," as compared to women. As predicted, photos of women are more often retrieved forwarmtraits (e.g., "emotional") whereasagentictraits (e.g., "rational") are represented by photos of men. A

backlash effect, where stereotype-incongruent individuals are penalized, is observed. However, backlash is more prevalent for "competent women" than "warm men." Results underline the need to understand how and why biases enter search algorithms and at which stages of the engineering process.

> 人们关注的是信息服务的算法和他们所呈现的世界观。我们提出了一种新的方法来检查图像检索中的性别刻板印象的内容和强度，灵感来自于特质形容词检查表方法。我们比较了由Bing检索的照片中的性别分布，用于查询“人”和基于68个字符特征（例如“智能人”）在四个区域市场中的查询。与女人相比，男人的照片通常被检索为“人”。据预测，女人的照片经常检索forwarmtraits（例如，“情感”）whereasagentictraits（例如，“理性”）是由代表男性的照片。反弹效应，在刻板印象不一致的个人的惩罚，是观察。然而，对于“能干的女人”比“暖男人”更为普遍。结果强调了理解如何和为什么偏见进入搜索算法以及在工程过程的哪个阶段的必要性。 article link

560. Technology Individuation: The Foibles of Augmented Everyday Objects

SESSION:Appropriation and Individuation

This paper presents the concept of technology individuation and explores its role in design. Individuation expresses how, over time, a technology becomes personal and intimate, unique in purpose, orchestrated in place, and how people eventually come to rely on it to sustain connection with others. We articulate this concept as a critical vantage point for designing augmented everyday objects and the Internet of Things. Individuation foregrounds aspects of habituation, routines and arrangements that through everyday practices reveal unique meaning, reflect self-identity and support agency.The concept is illustrated through three long term case studies of technology in use, involving tangible and embodied interaction with devices that afford communication, monitoring, and awareness in the home setting. The cases are analysed using Hornecker and Buur's Tangible Interaction Framework. We further extend upon this framework to better reveal the role played by personal values, history of use, and arrangements, as they develop over time in the home setting, in shaping tangible and embodied interaction with individuated technologies.

> 本文提出了技术个性化的概念，并探讨了其在设计中的作用。个性化表达了随着时间的推移，一种技术如何变得个人化和亲密，独特的目的，精心安排，以及人们最终如何依靠它来维持与他人的联系。我们将这一概念表述为设计增强的日常物品和物联网的一个关键的优势点。个性化的前景方面的习惯，程序及安排，通过每天的实践揭示了独特的意义，反映了自我认同和支持机构的概念说明通过三长期案例研究技术的使用，包括有形的体现与设备的互动，提供通信，监控，和意识的家庭环境。本例使用的是霍内克与和的有形互动框架分析。我们进一步扩大在这个框架来更好地揭示个人价值的作用，使用的历史，和安排，为他们发展到在家里设置时间，在塑造有形体现互动与个性化技术。 article link

561. Social Consequences of Grindr Use: Extending the Internet-Enhanced Self-Disclosure Hypothesis

SESSION:Appropriation and Individuation

Grindr, a location-based real-time dating application, provides sexual-minority men (SMM) a space through which they can identify, access, and communicate with one another. Although previous research has examined user motivations and public self-disclosure patterns on Grindr, we investigate the effects intimate self-disclosure and sexting via the application's private messaging on internalized homophobia and loneliness. Using the Internet-enhanced self-disclosure hypothesis (ISDH) as a framework, we conducted an online survey of 274 Grindr users. Serial mediation analysis showed support for the ISDH, suggesting that Grindr use was negatively associated with loneliness. Intimate self-disclosure and internalized homophobia mediated the relationship between Grindr use and loneliness, but sexting had no relationship with internalized homophobia or loneliness. We discuss implications for the ISDH, Grindr, self-disclosure, and sexting.

> Grindr，基于位置的实时约会应用，提供了性少数人（SMM）的空间，通过它们可以识别，访问，和与别人沟通。虽然以前的研究已经研究用户的动机和Grindr公共自我披露模式，探讨亲密的自我表露和短信通过应用私人短信内化的同性恋恐惧症和孤独。利用网络增强自我披露假说（ISDH）作为一个框架，我们进行了一项在线调查274 Grindr用户。串行调解分析显示为ISDH支持，表明Grindr使用呈负相关，与孤独。亲密的自我表露和内化的同性恋恐惧症Grindr使用与孤独感之间的关系介导，但短信与内化的同性恋恐惧或寂寞没有关系。我们讨论的ISDH，影响Grindr，自我表露，还有sexting。 article link

562. Gender-Inclusiveness Personas vs. Stereotyping: Can We Have it Both Ways?

SESSION:Appropriation and Individuation

Personas often aim to improve product designers' ability to "see through the eyes of" target users through the empathy personas can inspire - but personas are also known to promote stereotyping. This tension can be particularly problematic when personas (who, of course as "people" have genders) are used to promote gender inclusiveness - because reinforcing stereotypical perceptions can run counter to gender inclusiveness. In this paper we explicitly investigate this tension through a new approach to personas: one that includes multiple photos (of males and females) for a single persona. We compared this approach to an identical persona with only one photo using a controlled laboratory study and an eye-tracking study. Our goal was to answer the following question: is it possible for personas to encourage product designers to engage with personas while at the same avoiding promoting gender stereotyping? Our results are encouraging about the use of personas with multiple pictures as a way to expand participants' consideration of multiple genders without reducing their engagement with the persona.

> 人物角色通常旨在通过移情角色的启发来提高产品设计师“看穿目标用户的眼睛”的能力，但人们也知道人物角色会促进定型观念。当人物角色（当然是“人”有性别）被用来促进性别包容性时，这种紧张就特别有问题，因为强化陈规定型观念与性别包容性背道而驰。在本文中，我们通过一种新的人物角色的方法来明确地探讨这种张力：一个角色包括一个角色的多张照片（男性和女性）。我们使用一个受控的实验室研究和一项眼睛跟踪研究，将这种方法与只有一张照片的同一个人进行比较。我们的目标是回答以下问题：人物角色是否有可能鼓励产品设计师接触人物角色，同时避免推广性别陈规定型观念？我们的结果是令人鼓舞的是，使用多幅图片的人物角色作为一种扩展参与者对多种性别的考虑，而不减少他们与角色的接触。 article link

563. SEER: Auto-Generating Information Extraction Rules from User-Specified Examples

SESSION:Data Extraction

Time-consuming and complicated best describe the current state of the Information Extraction (IE) field. Machine learning approaches to IE require large collections of labeled datasets that are difficult to create and use obscure mathematical models, occasionally returning unwanted results that are unexplainable. Rule-based approaches, while resulting in easy-to-understand IE rules, are still time-consuming and labor-intensive. SEER combines the best of these two approaches: a learning model for IE rules based on a small number of user-specified examples. In this paper, we explain the design behind SEER and present a user study comparing our system against a commercially available tool in which users create IE rules manually. Our results show that SEER helps users complete text extraction tasks more quickly, as well as more accurately.

> 耗时复杂，最能描述信息抽取（IE）领域的现状。机器学习方法，即要求标记集，难以创建和使用模糊数学模型大集合，偶尔还意外的结果是无法解释的。基于规则的方法，虽然容易理解IE规则，但仍然费时费力。先见结合了这两种方法中最好的一种：基于少数用户指定示例的IE规则学习模型。在本文中，我们解释了先知背后的设计，并提出了一个用户研究比较我们的系统对商业上可用的工具，用户手动创建IE规则。我们的研究结果表明，先知帮助用户更快地完成文本提取任务，以及更准确。 article link

564. Leveraging Human Routine Models to Detect and Generate Human Behaviors

SESSION:Data Extraction

An ability to detect behaviors that negatively impact people's wellbeing and show people how they can correct those behaviors could enable technology that improves people's lives. Existing supervised machine learning approaches to detect and generate such behaviors require lengthy and expensive data labeling by domain experts. In this work, we focus on the domain of routine behaviors, where we model routines as a series of frequent actions that people perform in specific situations. We present an approach that bypasses labeling each behavior instance that a person exhibits. Instead, we weakly label instances using people's demonstrated routine. We classify and generate new instances based on the probability that they belong to the routine model. We illustrate our approach on an example system that helps drivers become aware of and understand their aggressive driving behaviors. Our work enables technology that can trigger interventions and help people reflect on their behaviors when those behaviors are likely to negatively impact them.

> 一种能够发现影响人们健康的行为，并告诉人们如何纠正这些行为的能力，可以使人们的生活得到改善。现有的监督机器学习方法来检测和生成这样的行为需要领域专家冗长而昂贵的数据标记。在这项工作中，我们专注于日常行为的领域，我们把例程建模为人们在特定情况下执行的一系列频繁行动。我们提出了一种方法，绕过标签，每个行为实例，一个人的展品。相反，我们弱标记实例使用人的演示例程。我们根据它们属于常规模型的概率对新实例进行分类和生成。我们举例说明我们的方法，帮助司机了解并了解他们的攻击性驾驶行为。我们的工作使技术能够触发干预措施，并帮助人们反思他们的行为，当这些行为有可能对他们产生负面影响时。 article link

565. Interactive Vectorization

SESSION:Data Extraction

Vectorization turns photographs into vector art. Manual vectorization, where the artist traces over the image by hand, requires skill and time. On the other hand, automatic approaches allow users to generate a result by setting a few global parameters. However, global settings often leave too much detail/complexity in some parts of the image while missing important details in others. We propose interactive vectorization tools that offer more local control than automatic systems, but are more powerful and high-level than simple curve editing. Our system enables novices to vectorize images significantly faster than even experts with state-of-the-art tools.

> 矢量化将照片变成矢量艺术。手工矢量化，艺术家手工跟踪图像，需要技巧和时间。另一方面，自动方法允许用户通过设置几个全局参数来生成结果。然而，全局设置常常在图像的某些部分留下太多的细节/复杂性，而忽略了其他部分中的重要细节。我们提出交互式矢量化工具，提供比自动系统更多的本地控制，但比简单的曲线编辑功能更强大和更高级。我们的系统使新手矢量化图像甚至比专家与国家的最先进的工具明显快。 article link

566. ChartSense: Interactive Data Extraction from Chart Images

SESSION:Data Extraction

Charts are commonly used to present data in digital documents such as web pages, research papers, or presentation slides. When the underlying data is not available, it is necessary to extract the data from a chart image to utilize the data for further analysis or improve the chart for more accurate perception. In this paper, we present ChartSense, an interactive chart data extraction system. ChartSense first determines the chart type of a given chart image using a deep learning based classifier, and then extracts underlying data from the chart image using semi-automatic, interactive extraction algorithms optimized for each chart type. To evaluate chart type classification accuracy, we compared ChartSense with ReVision, a system with the state-of-the-art chart type classifier. We found that ChartSense was more accurate than ReVision. In addition, to evaluate data extraction performance, we conducted a user study, comparing ChartSense with WebPlotDigitizer, one of the most effective chart data extraction tools among publicly accessible ones. Our results showed that ChartSense was better than WebPlotDigitizer in terms of task completion time, error rate, and subjective preference.

> 图表通常用于显示数字文档中的数据，如网页、研究论文或演示幻灯片。当基础数据不可用时，有必要从图表图像中提取数据，以便利用数据进行进一步分析或改进图表以获得更准确的感知。在本文中，我们提出了chartsense，交互式图表数据提取系统。chartsense首先确定给定图的图像使用深度学习分类器的图表类型，然后提取底层数据使用半自动图表，每个图表类型优化的交互式提取算法。对图表类型的分类精度，我们chartsense版本相比，与国家的最先进的图表类型分类系统。我们发现ChartSense比修改更准确。此外，评估数据提取的性能，我们进行了用户研究，比较chartsense WebPlotDigitizer，公开访问的最有效的图表数据提取工具。我们的研究结果表明，ChartSense是比WebPlotDigitizer任务的完成时间，错误率，和主观偏好。 article link

567. CamRay: Camera Arrays Support Remote Collaboration on Wall-Sized Displays

SESSION:Displays and Collaboration

Remote collaboration across wall-sized displays creates a key challenge: how to support audio-video communication among users as they move in front of the display. We present CamRay, a platform that uses camera arrays embedded in wall-sized displays to capture video of users and present it on remote displays according to the users' positions. We investigate two settings: in Follow-Remote, the position of the video window follows the position of the remote user; in Follow-Local, the video window always appears in front of the local user. We report the results of a controlled experiment showing that with Follow-Remote, participants are faster, use more deictic instructions, interpret them more accurately, and use fewer words. However, some participants preferred the virtual face-to-face created by Follow-Local when checking for their partners' understanding. We conclude with design recommendations to support remote collaboration across wall-sized displays.

> 跨墙显示器的远程协作创造了一个关键的挑战：如何支持用户在显示器前面移动时的视听通信。我们目前的camray，平台使用相机阵列嵌入墙壁大小的显示屏捕获视频的用户，目前它在远程显示根据用户的位置。我们研究了两种设置：在远程跟踪中，视频窗口的位置跟随远程用户的位置；在后续的地方，视频窗口总是出现在本地用户前面。我们报告一个对照实验显示，遵循远程结果，参加者更快，使用更多的指示说明，更准确地理解他们，并使用更少的话。然而，一些参与者更喜欢在检查他们同伴的理解时，由当地人创造的虚拟面对面。最后，我们提出了设计建议，以支持跨墙显示器的远程协作。 article link

568. CoReach: Cooperative Gestures for Data Manipulation on Wall-sized Displays

SESSION:Displays and Collaboration

Multi-touch wall-sized displays afford collaborative exploration of large datasets and re-organization of digital content. However, standard touch interactions, such as dragging to move content, do not scale well to large surfaces and were not designed to support collaboration, such as passing an object around. This paper introducesCoReach, a set of collaborative gestures that combine input from multiple users in order to manipulate content, facilitate data exchange and support communication. We conducted an observational study to inform the design ofCoReach, and a controlled study showing that it reduced physical fatigue and facilitated collaboration when compared with traditional multi-touch gestures. A final study assessed the value of also allowing input through a handheld tablet to manipulate content from a distance.

> 多触摸墙尺寸显示器提供协作的大数据集和数字内容重组的探索。然而，标准的触摸交互，如拖动移动内容，并不能很好地扩展到大的表面，而不是设计来支持协作，例如传递对象。本文introducescoreach，一套协同动作，将输入为多用户操作的内容，方便数据交换和通讯支持。我们进行了告知设计ofcoreach观察性研究，并对照研究显示，减少身体疲劳和促进合作与传统的多点触控手势相比。最后一项研究评估了通过手持平板电脑输入距离的内容的价值。 article link

569. Turbulent Touch: Touchscreen Input for Cockpit Flight Displays

SESSION:Displays and Collaboration

Touchscreen input in commercial aircraft cockpits offers potential advantages, including ease of use, modifiability, and reduced weight. However, tolerance to turbulence is a challenge for their deployment. To better understand the impact of turbulence on cockpit input methods we conducted a comparative study of user performance with three input methods -- touch, trackball (as currently used in commercial aircraft), and a touchscreen stencil overlay designed to assist finger stabilization. These input methods were compared across a variety of interactive tasks and at three levels of simulated turbulence (none, low, and high). Results showed that performance degrades and subjective workload increases as vibration increases. Touch-based interaction was faster than the trackball when precision requirements were low (at all vibrations), but it was slower and less accurate for more precise pointing, particularly at high vibrations. The stencil did not improve touch selection times, although it did reduce errors on small targets at high vibrations, but only when finger lift-off errors had been eliminated by a timeout. Our work provides new information on the types of tasks affected by turbulence and the input mechanisms that perform best under different levels of vibration.

> 在商业飞机驾驶舱的触摸屏输入提供了潜在的优势，包括使用、修改方便，并减少重量。然而，对湍流的容忍是它们部署的一个挑战。为了更好地了解在驾驶舱的输入方法进行用户的性能比较研究三种输入方式--触摸湍流的影响，轨迹球（目前商用飞机使用），和一个触摸屏模板覆盖设计协助手指稳定。这些输入方法在各种交互任务和三个模拟湍流（无、低、高）水平上进行了比较。结果表明，随着振动的增加，性能下降，主观工作量增加。基于触摸的交互比球快精度要求低时（在所有的振动），但它是更精确的指向慢和不准确的，特别是在高振动。该模版没有提高触摸选择时间，虽然它确实减少了小目标在高振动时的误差，但只有当手指脱落错误被超时消除时。我们的工作提供了新的资料，说明受湍流影响的任务类型和在不同振动水平下发挥最佳作用的输入机制。 article link

570. AlterNail: Ambient, Batteryless, Stateful, Dynamic Displays at your Fingertips

SESSION:Displays and Collaboration

Beyond phones, watches, and activity tracking devices, a new ecosystem of functional and fashionable wearable technologies can easily, safely, and economically be designed, prototyped, and integrated directly on the body. In this paper, we present AlterNail, a fingernail form factor, ambient, low-power, stateful, wireless, dynamic display with onboard vibrational sensing. AlterNail integrates a batteryless design using inductive coupling with e-ink technology to enable both quick dynamic and long-term static fingernail based visual designs without the need for power. We also detail the use of simple vibrational signals to uniquely identify everyday objects as they are handled using AlterNails. The intentionally limited interactional functionality of AlterNails, coupled with the rich personal and dynamic expressive potential, combine to present a compelling range of opportunities for designers of new interactive wearable technologies. We detail a range of practical and playful applications using this technology.

> 除了手机、手表、和活动跟踪设备，一个新的功能和时尚的可穿戴技术可以很容易地、生态安全、经济的设计，制作了样机，并直接集成在身。在本文中，我们提出了alternail，指甲形状因子、环境、低功耗状态，无线，机载振动传感动态显示。AlterNail将一个无电池设计采用电感耦合与电子墨水技术使快速的动态和静态的指甲长期基础的视觉设计不需要电源。我们还详细简单的振动信号识别日常物品为他们处理使用alternails使用。对alternails故意有限的互动功能，再加上个人的丰富和动态的表现潜力，并提出一个令人信服的范围为新的互动的可穿戴技术设计师的机会。我们详细介绍了一系列实用和好玩的应用程序使用这项技术。 article link

571. Subtle and Personal Workspace Requirements for Visual Search Tasks on Public Displays

SESSION:Displays and Collaboration

We explore how users approach and define personal space on large, public displays. Our results show that users of public displays use one of two strategies for visual search tasks: minimizers create a small window and work up close to the display, and maximizers expand content to its full resolution and work at a distance. We show that these interaction styles match predicted 'personal' and 'subtle' interaction zones, characterize typical width and height requirements for these interactions, and show that these requirements are independent of the on-screen content's dimensions. Finally, we suggest practical guidelines for defining workspaces during personal and subtle interaction on large, public displays.

> 我们将探讨用户如何在大型公共显示器上定义和定义个人空间。我们的研究结果表明，公共显示器的用户使用的视觉搜索任务的两种策略：极小的创建一个小窗口和工作接近的显示，并最大化的扩大内容的全分辨率和工作在一个距离。我们表明，这些交互风格符合预测的“个人”和“微妙”的互动区，典型的宽度和高度的要求，这些互动，并显示这些要求是独立于屏幕内容的尺寸。最后，我们建议在大型公共展示的个人和微妙互动中定义工作空间的实用指南。 article link

572. Spiders in the Sky: User Perceptions of Drones, Privacy, and Security

SESSION:Drones

Drones are increasingly being used for various purposes from recording footage in inaccessible areas to delivering packages. A rise in drone usage introduces privacy and security concerns about flying boundaries, what data drones collect in public and private spaces, and how that data is stored and disseminated. However, commercial and personal drone regulations focusing on privacy and security have been fairly minimal in the USA. To inform privacy and security guidelines for drone design and regulation, we need to understand users' perceptions about drones, privacy and security. In this paper, we describe a laboratory study with 20 participants who interacted with a real or model drone to elicit user perceptions of privacy and security issues around drones. We present our results, discuss the implications of our work and make recommendations to improve drone design and regulations that enhance individual privacy and security.

> 无人机越来越多地被用于各种目的，从无法进入的区域录制录像传送包裹。无人驾驶飞机的使用增加了对飞行边界的隐私和安全问题，在公共和私人空间收集了什么数据无人机，以及这些数据是如何存储和传播的。然而，商业和个人无人驾驶飞机的法规侧重于隐私和安全在美国相当少，告知隐私和安全准则的无人驾驶飞机的设计和管理，我们需要了解用户对无人机，隐私和安全的看法。在本文中，我们描述了一个实验室研究，有20名参与者与一个真正的或模型雄蜂互动，以引起用户对无人驾驶飞机周围隐私和安全问题的看法。我们提出我们的结果，讨论我们的工作的影响，并提出建议，以改善无人驾驶飞机的设计和法规，提高个人隐私和安全性。 article link

573. Privacy Mechanisms for Drones: Perceptions of Drone Controllers and Bystanders

SESSION:Drones

Drones pose privacy concerns such as surveillance and stalking. Many technology-based or policy-based mechanisms have been proposed to mitigate these concerns. However, it is unclear how drone controllers and bystanders perceive these mechanisms and whether people intend to adopt them. In this paper, we report results from two rounds of online survey with 169 drone controllers and 717 bystanders in the U.S. We identified respondents' perceived pros and cons of eight privacy mechanisms. We found thatowner registrationandautomatic face blurringindividually received most support from both controllers and bystanders. Our respondents also suggested using varied combinations of mechanisms under different drone usage scenarios, highlighting their context-dependent preferences. We outline a set of important questions for future privacy designs and public policies of drones.

> 无人驾驶飞机构成隐私问题，如监视和跟踪。已经提出了许多基于技术或政策的机制来减轻这些关切。然而，目前还不清楚无人驾驶飞机控制器和旁观者如何看待这些机制，以及人们是否打算采用这些机制。在本文中，我们报告了两轮在线调查的结果，在美国有169名无人机控制器和717名旁观者，我们确定了受访者对八种隐私机制的感知利弊。我们发现thatowner registrationandautomatic脸blurringindividually接到控制器和旁观者最多支持。我们的受访者还建议在不同的雄蜂使用场景下使用不同的机制组合，突出它们的上下文相关偏好。我们概述了未来无人机隐私设计和公共政策的一系列重要问题。 article link

574. Free to Fly in Public Spaces: Drone Controllers' Privacy Perceptions and Practices

SESSION:Drones

Prior research has discovered various privacy concerns that bystanders have about drones. However, little is known about drone controllers' privacy perceptions and practices of drones. Understanding controllers' perspective is important because it will inform whether controllers' current practices protect or infringe on bystanders' privacy and what mechanisms could be designed to better address the potential privacy issues of drones. In this paper, we report results from interviews of 12 drone controllers in the US. Our interviewees treated safety as their top priority but considered privacy issues of drones exaggerated. Our results also highlight many significant differences in how controllers and bystanders think about drone privacy, for instance, how they determine public vs. private spaces and whether notice and consent of bystanders are needed.

> 之前的研究发现了旁观者对无人驾驶飞机的各种隐私关注。然而，对无人驾驶飞机的无人驾驶飞机的隐私感知和实践知之甚少。了解管制员的观点是很重要的，因为它将告知管制员目前的做法是否保护或侵犯了旁观者的隐私，哪些机制可以更好地解决无人驾驶飞机潜在的隐私问题。在本文中，我们报告的结果，在美国的12名无人驾驶飞机控制器访谈。我们的受访者认为安全是他们的首要任务，但他们认为无人机的隐私问题被夸大了。我们的研究结果也强调了管制员和旁观者如何看待无人机隐私的许多重大区别，例如，它们如何确定公共空间和私人空间，以及是否需要旁观者的通知和同意。 article link

575. Drone & Wo: Cultural Influences on Human-Drone Interaction Techniques

SESSION:Drones

As drones become ubiquitous, it is important to understand how cultural differences impact human-drone interaction. A previous elicitation study performed in the USA illustrated how users would intuitively interact with drones. We replicated this study in China to gain insight into how these user-defined interactions vary across the two cultures. We found that as per the US study, Chinese participants chose to interact primarily using gesture. However, Chinese participants used multi-modal interactions more than their US counterparts. Agreement for many proposed interactions was high within each culture. Across cultures, there were notable differences despite similarities in interaction modality preferences. For instance, culturally-specific gestures emerged in China, such as a T-shape gesture for stopping the drone. Participants from both cultures anthropomorphized the drone, and welcomed it into their personal space. We describe the implications of these findings on designing culturally-aware and intuitive human-drone interaction.

> 随着无人机的普及，了解文化差异对人类无人机交互的影响是很重要的。之前在美国进行的一项启发式研究说明了用户如何直观地与无人机交互。我们复制本研究在中国深入了解这些用户定义不同的两种文化相互作用。我们发现，根据美国的研究，中国参与者选择主要使用手势进行交互。然而，中国参与者比美国同行更多地使用了多模态交互。许多提议的相互作用的协议在每种文化中都很高。在跨文化中，尽管交互方式偏好有相似之处，但仍有显著差异。例如，在中国特定的文化姿态出现，如T形手势停止无人机。从文化人格化的无人机的参与者，并欢迎他到他们的个人空间。我们描述了这些发现对设计文化感知和直观的人机交互的影响。 article link

576. Citizen Science Opportunities in Volunteer-Based Online Experiments

SESSION:Online Experiments

Online experimentation with volunteers could be described as a form of citizen science in which participants take part in behavioral studies without financial compensation. However, while citizen science projects aim to improve scientific understanding, volunteer-based online experiment platforms currently provide minimal possibilities for research involvement and learning. The goal of this paper is to uncover opportunities for expanding participant involvement and learning in the research process. Analyzing comments from 8,288 volunteers who took part in four online experiments on LabintheWild, we identified six themes that reveal needs and opportunities for closer interaction between researchers and participants. Our findings demonstrate opportunities for research involvement, such as engaging participants in refining experiment implementations, and learning opportunities, such as providing participants with possibilities to learn about research aims. We translate these findings into ideas for the design of future volunteer-based online experiment platforms that are more mutually beneficial to citizen scientists and researchers.

> 志愿者的在线实验可以说是公民科学的一种形式，参与者在没有经济补偿的情况下参加行为研究。然而，虽然公民科学项目的目的是提高科学的理解，志愿为基础的在线实验平台目前提供了最小的可能性，研究的参与和学习。本文的目的是发现在研究过程中扩大参与者参与和学习的机会。从8288名志愿者参与了四在线实验labinthewild分析评论，我们确定了六个主题展示的需求和机会，为研究人员和参与者之间的密切互动。我们的发现显示了参与研究的机会，例如参与细化实验实现的参与者和学习机会，例如为参与者提供了解研究目标的可能性。我们将这些发现转化为未来志愿在线实验平台的设计思路，这些平台对公民科学家和研究人员更为有利。 article link

577. Differences in Crowdsourced vs. Lab-based Mobile and Desktop Input Performance Data

SESSION:Online Experiments

Research on the viability of using crowdsourcing for HCI performance experiments has concluded that online results are similar to those achieved in the lab---at least for desktop interactions. However, mobile devices, the most popular form of online access today, may be more problematic due to variability in the user's posture and in movement of the device. To assess this possibility, we conducted two experiments with 30 lab-based and 303 crowdsourced participants using basic mouse and touchscreen tasks. Our findings show that: (1) separately analyzing the crowd and lab data yields different study conclusions-touchscreen input was significantly less error prone than mouse input in the lab butmoreerror prone online; (2) age-matched crowdsourced participants were significantly faster and less accurate than their lab-based counterparts, contrasting past work; (3) variability in mobile device movement and orientation increased as experimenter control decreased--a potential factor affecting the touchscreen error differences. This study cautions against assuming that crowdsourced data for performance experiments will directly reflect lab-based data, particularly for mobile devices.

> 利用众包进行人机交互性能实验的可行性研究得出结论：在线结果与实验室中实现的结果相似——至少在桌面交互中是如此。然而，移动设备是当今最流行的在线访问方式，由于用户的姿态和设备的移动，可能会出现更多的问题。为了评估这种可能性，我们进行了两个实验30实验室和303众包的参与者使用鼠标和触摸屏的基本任务。我们的研究结果表明：（1）分别对人群和实验室数据产生不同的研究结论，触摸屏输入明显减少出错比在实验室butmoreerror容易在线鼠标输入；（2）年龄匹配的众包的参与者明显更快，比基于实验室的同行不太准确，对比过去的工作；（3）在移动装置运动和方向的变异性增加实验者控制降低误差影响触摸屏的潜在因素。这项研究告诫假设性能实验的众包数据将直接反映基于实验室的数据，特别是对于移动设备。 article link

578. Gut Instinct: Creating Scientific Theories with Online Learners

SESSION:Online Experiments

Learners worldwide collectively spend millions of hours per week testing their skills on assignments with known answers. Might some of this time fruitfully be spent posing and exploring novel questions? This paper investigates an approach for learners to contribute scientific ideas. The Gut Instinct system embodies this approach, hosting online learning materials and invites learners to collaboratively brainstorm potential influences on people's microbiome. A between-subjects experiment compared the performance of participants who engaged in just learning, just contributing, or a combination. Participants in the learning condition scored highest on a summative test. Participants in both the contribution and combined conditions generated novel, useful questions; there was not a significant difference between the two. Though participants in the combined condition both learned and contributed, this setting did not exhibit an additive benefit, such as better learning in the combined condition. These results highlight the promise and difficulty of double-bottom-line learning experiences.

> 全世界的学生每周都要花上数百万小时测试他们掌握已知答案的作业技能。也许这一些时间花在冒充卓有成效和探索新的问题吗？本文探讨了一种学习者贡献科学思想的方法。直觉系统体现了这一做法，举办网上学习材料和学习者协作攻关邀请潜在影响人们的微生物。一个实验对象比较了刚参加学习的学生，只做贡献或组合的表现。学习状况的参与者在总结性测验中得分最高。参与者在贡献和组合条件下产生了新颖有用的问题；两者之间没有显著差异。尽管合并条件的参与者既学到了知识又贡献了知识，但这种设置并没有表现出附加的好处，例如在综合条件下更好的学习。这些结果凸显了双重底线学习经验的前景和困难。 article link

579. Self-Experimentation for Behavior Change: Design and Formative Evaluation of Two Approaches

SESSION:Online Experiments

Desirable outcomes such as health are tightly linked to behaviors, thus inspiring research on technologies that support people in changing those behaviors. Many behavior-change technologies are designed by HCI experts but this approach can make it difficult to personalize support to each user's unique goals and needs. This paper reports on the iterative design of two complementary support strategies for helping users create their own personalized behavior-change plans via self-experimentation: One emphasized the use of interactive instructional materials, and the other additionally introduced context-aware computing to enable user creation of "just in time" home-based interventions. In a formative trial with 27 users, we compared these two approaches to an unstructured sleep education control. Results suggest great promise in both strategies and provide insights on how to develop personalized behavior-change technologies.

> 理想的结果，如健康与行为紧密相关，从而激励人们研究改变人们行为的技术。许多行为改变技术是由HCI专家设计的，但这种方法很难个性化支持每个用户的独特目标和需求。本文报道了两个互补的帮助用户创建自己的个性化行为改变计划，通过自我实验支持策略迭代的设计：一个强调互动教学材料的使用，和其他另外介绍了上下文感知计算允许用户创建的“及时”的以家庭为基础的干预措施。在27名用户的形成性试验中，我们比较了这两种方法对非结构化睡眠教育的控制。结果表明这两种策略都有很大的希望，并提供了关于如何开发个性化行为改变技术的见解。 article link

580. TummyTrials: A Feasibility Study of Using Self-Experimentation to Detect Individualized Food Triggers

SESSION:Personal Informatics & Self-Tracking

Diagnostic self-tracking, the recording of personal information to diagnose or manage a health condition, is a common practice, especially for people with chronic conditions. Unfortunately, many who attempt diagnostic self tracking have trouble accomplishing their goals. People often lack knowledge and skills needed to design and conduct scientifically rigorous experiments, and current tools provide little support. To address these shortcomings and explore opportunities for diagnostic self tracking, we designed, developed, and evaluated a mobile app that applies a self experimentation framework to support patients suffering from irritable bowel syndrome (IBS) in identifying their personal food triggers. TummyTrials aids a person in designing, executing, and analyzing self experiments to evaluate whether a specific food triggers their symptoms. We examined the feasibility of this approach in a field study with 15 IBS patients, finding that participants could use the tool to reliably undergo a self-experiment. However, we also discovered an underlying tension between scientific validity and the lived experience of self experimentation. We discuss challenges of applying clinical research methods in everyday life, motivating a need for the design of self experimentation systems to balance rigor with the uncertainties of everyday life.

> 诊断自我跟踪，记录个人信息，以诊断或管理健康状况，是一种常见的做法，特别是对患有慢性疾病的人。不幸的是，许多尝试诊断自我追踪的人很难实现他们的目标。人们往往缺乏设计和进行科学严谨实验所需的知识和技能，而目前的工具提供的支持很少。为了解决这些缺陷和探索诊断自我追踪的机会，我们设计、开发并评估了一个移动应用程序，该应用程序应用了一个自我实验框架来支持肠易激综合征（IBS）患者识别他们的个人食物触发器。tummytrials艾滋病人在设计、执行和分析自我实验来评估是否有特定的食品引发的症状。我们在15名IBS患者的实地研究中研究了这种方法的可行性，发现参与者可以使用该工具可靠地进行自我实验。然而，我们也发现了科学有效性与自我实验生活经验之间的潜在关系。我们讨论了在日常生活中应用临床研究方法的挑战，激发了设计自我实验系统的需要，以平衡日常生活中的不确定性和不确定性。 article link

581. Making Sense of Sleep Sensors: How Sleep Sensing Technologies Support and Undermine Sleep Health

SESSION:Personal Informatics & Self-Tracking

Sleep is an important aspect of our health, but it is difficult for people to track manually because it is an unconscious activity. The ability tosensesleep has aimed to lower the barriers of tracking sleep. Although sleep sensors are widely available, their usefulness and potential to promote healthy sleep behaviors has not been fully realized. To understand people's perspectives on sleep sensing devices and their potential for promoting sleep health, we surveyed 87 and interviewed 12 people who currently use or have previously used sleep sensors, interviewed 5 sleep medical experts, and conducted an in-depth qualitative analysis of 6986 reviews of the most popular commercial sleep sensing technologies. We found that the feedback provided by current sleep sensing technologies affects users' perceptions of their sleep and encourages goals that are in tension with evidence-based methods for promoting good sleep health. Our research provides design recommendations for improving the feedback of sleep sensing technologies by bridging the gap between expert and user goals.

> 睡眠是我们健康的一个重要方面，但人们很难手动跟踪，因为这是一种无意识的活动。能力tosensesleep旨在降低跟踪睡眠障碍。虽然睡眠传感器被广泛使用，但它们对促进健康睡眠行为的作用和潜力尚未完全实现。理解人的视角对睡眠的传感装置和促进睡眠健康的潜力，我们调查了87个采访了12人目前正在使用或已使用睡眠传感器，采访了5位睡眠医学专家，并进行了6986对最受欢迎的商业睡眠传感技术进行深入的定性分析。我们发现，当前睡眠传感技术提供的反馈影响了用户对睡眠的感知，并鼓励与基于证据的方法相结合的目标促进良好的睡眠健康。我们的研究提供了改善睡眠感知技术反馈的设计建议，弥补了专家和用户目标之间的差距。 article link

582. Examining Menstrual Tracking to Inform the Design of Personal Informatics Tools

SESSION:Personal Informatics & Self-Tracking

We consider why and how women track their menstrual cycles, examining their experiences to uncover design opportunities and extend the field's understanding of personal informatics tools. To understand menstrual cycle tracking practices, we collected and analyzed data from three sources: 2,000 reviews of popular menstrual tracking apps, a survey of 687 people, and follow-up interviews with 12 survey respondents. We find that women track their menstrual cycle for varied reasons that include remembering and predicting their period as well as informing conversations with healthcare providers. Participants described six methods of tracking their menstrual cycles, including use of technology, awareness of their premenstrual physiological states, and simply remembering. Although women find apps and calendars helpful, these methods are ineffective when predictions of future menstrual cycles are inaccurate. Designs can create feelings of exclusion for gender and sexual minorities. Existing apps also generally fail to consider life stages that women experience, including young adulthood, pregnancy, and menopause. Our findings encourage expanding the field's conceptions of personal informatics.

> 我们考虑为什么和如何跟踪妇女月经周期，检查他们的经验，以发现设计机会和扩大领域的个人信息学工具的理解。为了了解月经周期追踪的实践，我们收集并分析了来自三个来源的数据：2000份流行月经追踪应用程序的回顾，687人的调查，以及12位受访者的后续访谈。我们发现，妇女的月经周期有多种原因，其中包括回忆和预测月经周期，以及与保健提供者进行交谈。参与者描述了六种追踪月经周期的方法，包括技术的使用，对月经前生理状态的认识，以及简单的记忆。尽管女性发现应用程序和日历很有用，但对未来月经周期的预测不准确时，这些方法是无效的。设计可以产生性别和性少数群体的排斥感。现有的应用程序通常也不能考虑女性经历的生活阶段，包括年轻的成年期、怀孕期和更年期。我们的发现鼓励扩大领域的个人信息学的概念。 article link

583. Quantifying the Body and Caring for the Mind: Self-Tracking in Multiple Sclerosis

SESSION:Personal Informatics & Self-Tracking

Consumer health technologies have an enormous potential to transform the self-management of chronic conditions. However, it is unclear how individuals use self-tracking technologies to manage them. This in-depth interview study explores self-tracking practices in multiple sclerosis (MS), a complex neurological disease that causes physical, cognitive, and psychological symptoms. Our findings illustrate that when faced the unpredictable and degenerative nature of MS, individuals regained a sense of control by intertwining self-care practices with different self-tracking technologies. They engaged in disease monitoring, fitness tracking, and life journaling to quantify the body and care for the mind. We focus attention on the role of emotional wellbeing and the experience of control in self-tracking and managing MS. Finally, we discuss in which ways self-tracking technologies could support the experiential nature of control and foster mindful experiences rather than focusing only on tracking primary disease indicators.

> 消费者健康技术具有改变慢性病自我管理能力的巨大潜力。然而，目前还不清楚个人如何使用自跟踪技术来管理它们。这项深入访谈研究探讨了多发性硬化症（MS）的自我追踪实践，这是一种复杂的神经系统疾病，导致身体、认知和心理症状。我们的研究结果表明，当面临不可预知的，退行性MS，个人恢复控制感的交织的自理习惯不同的自跟踪技术。他们从事疾病监测、健身跟踪和生活日记为心灵和身体护理量化。我们专注于对情绪健康和自我跟踪和管理女士最后控制经验的作用，我们讨论在哪些方面自跟踪技术可以支持控制体验自然和培育正念的体验而不是只注重跟踪原发疾病指标。 article link

584. Share First, Save Later: Performance of Self through Snapchat Stories

SESSION:Presentation in Online Communities

As the third most popular social network among millennials, Snapchat is well known for its picture and video messaging system that deletes content after it is viewed. However, the Stories feature of Snapchat offers a different perspective of ephemeral content sharing, with pictures and videos that are available for friends to watch an unlimited number of times for 24 hours. We conduct-ed an in-depth qualitative investigation by interviewing 18 participants and reviewing 14 days of their Stories posts. We identify five themes focused on how participants perceive and use the Stories feature, and apply a Goffmanesque metaphor to our analysis. We relate the Stories medium to other research on self-presentation and identity curation in social media.

> 作为第三最受欢迎的社交网络之间的千禧一代，Snapchat的图片和视频通讯系统，删除后的内容是众所周知的。然而，这个故事的Snapchat提供了一个不同的短暂的内容共享的视角，用图片和视频，供朋友观看次数不限24小时。我们进行了深入的定性调查，采访了18名参与者，并回顾了他们的故事文章的14天。我们确定了五个主题集中在如何看待和使用的故事，并用goffmanesque隐喻分析。我们与故事中其他的自我展示和社会媒体的身份管理研究。 article link

585. Situated Anonymity: Impacts of Anonymity, Ephemerality, and Hyper-Locality on Social Media

SESSION:Presentation in Online Communities

Anonymity, ephemerality, and hyper-locality are an uncommon set of features in the design of online communities. However, these features were key to Yik Yak's initial success and popularity. In an interview-based study, we found that these three features deeply affected the identity of the community as a whole, the patterns of use, and the ways users committed to this community. We conducted interviews with 18 Yik Yak users on an urban American university campus and found that these three focal design features contributed

to casual commitment, transitory use, and emergent community identity. We describesituated anonymity, which is the result of anonymity, ephemerality, and hyper-locality coexisting as focal design features of an online community. This work extends our understanding of use and identity-versus-bond based commitment, which has implications for the design and study of other atypical online communities.

> 一位不愿透露姓名的，短命的，和超地域特点是一种罕见的集在线社区的设计。然而，这些功能键的奕牦牛的初始的成功和声望。在一项基于访谈的研究中，我们发现这三个特征深刻地影响了整个社区的身份、使用模式以及用户对这个社区的承诺方式。我们进行了18的用户在一个美国城市奕牦牛大学校园采访，发现这三个焦点的设计特点有助于随意的承诺，短暂的使用，和新兴的社区认同。我们describesituated匿名，这是匿名的，短命的结果，和超本地共存作为一个在线社区焦点的设计特点。这项工作扩展了我们对使用和身份与基于承诺的承诺的理解，这对其他非典型在线社区的设计和研究也有影响。 article link

586. Relational Distancing and Termination between Online Friends: An Application of the Investment Model

SESSION:Presentation in Online Communities

This research examined the relational maintenance versus termination of online friendships in Facebook. Guided by Rusbult's [33] investment model (IM), the study constructed a model to examine 55 matched pairs of Facebook friends consisting of one "primary user" and one "annoyer." Results indicated that primary users' judgments of relational satisfaction with annoyers were influenced by annoyers' narcissistic personality and their overall propensity for posting overly self-focused content. Commitment affected primary users' use of both passive "unfollowing" and active "unfriending" in response to annoyers' behavior. Decisions to maintain or terminate online friendships are related to judgments and actions of both partners. Overall, these results emphasize the dyadic nature of relational maintenance and termination processes in online environments, and the importance of studying them as such.

> 本研究探讨脸谱网线上友谊的维持与终止关系。通过鲁斯布尔特的[33]投资模型指导（IM），构建了一个模型来检测55对配对的脸谱网的朋友组成的一个“初级用户”和一个“烦恼”。结果表明，annoyers关系满足初级用户的判断受到annoyers自恋人格和整体倾向于发布过度自我关注的内容。承诺影响初级用户使用被动“无关”和“名”的积极响应annoyers行为。维持或终止网上友谊的决定与双方的判断和行动有关。总的来说，这些结果强调了联机环境中关系维护和终止过程的二元性，以及研究它们的重要性。 article link

587. Enhancing Personal Informatics Through Social Sensemaking

SESSION:Presentation in Online Communities

Personal informatics practices are increasingly common, with a range of consumer technologies available to support, largely individual, interactions with data (e.g., performance measurement and activity/health monitoring). In this paper, we explore the concept ofsocial sensemaking. In contrast to high-level statistics, we posit that social networking and reciprocal sharing offine-grainedself-tracker data can provide valuable context for individuals in making sense of their data. We present the design of an online platform called Citizense Makers (CM), which facilitates group sharing, annotating and discussion of self-tracker data. In a field trial of CM, we explore design issues around willingness to share data reciprocally; the importance of familiarity between individuals; and understandings of common activities in contextualising one's own data.

> 个人信息学实践越来越普遍，有一系列的消费技术可以支持，主要是个人与数据的交互（例如，性能测量和活动/健康监测）。在本文中，我们探讨概念的社会意义建构。相反，高层次的统计，我们认为社交网络和互惠共享的细grainedself跟踪数据可以利用自己的个人数据上提供有价值的背景。我们的网上平台“citizense制造商设计（厘米），这有利于集团共享，注释和自我跟踪数据的讨论。在CM的田间试验，探讨设计问题愿意分享数据相互；熟悉个人之间的重要性；并在认为自己数据的共同活动的认识。 article link

588. Sizing Up the Troll: A Quantitative Characterization of Moderator-Identified Trolling in an Online Forum

SESSION:Presentation in Online Communities

A few troublemakers often spoil online environments for everyone else. An extremely disruptive type of abuser is the troll, whose malicious activities are relatively non-obvious, and thus difficult to detect and contain -- particularly by automated systems. A growing corpus of qualitative research focuses on trolling, and differentiates it from other forms of abuse; however, its findings are not directly actionable into automated systems. On the other hand, quantitative research uses definitions of "troll" that mostly fail to capture what moderators and users consider trolling. We address this gap by giving a quantitative analysis of posts, conversations, and users, specifically sanctioned for trolling in an online forum. Although trolls (unlike most other abusers) hardly stand out in a conversation e.g. in terms of vocabulary, textit{how} they interact, rather than textit{what} they contribute, provides cues of their malicious intent.

> 几人经常破坏网络环境的其他人。施暴者极其颠覆性的类型是巨魔的恶意活动比较不明显，和-尤其是通过自动化系统来检测和控制难度大。增长主体的定性研究主要集中在控制，区别于其他形式的虐待；然而，其结果是不能直接操作的自动系统。另一方面，定量研究采用“巨魔”定义大多未能捕获什么版主和用户考虑曳。我们解决这个差距的帖子，一个定量分析的对话，和用户，特别是批准控制在一个在线论坛。虽然巨魔（不像其他大多数滥用者）几乎站在一个会话在词汇系统{有}，他们的互动，而不是系统{什么}他们的贡献，提供了他们的恶意的线索。 article link

589. Building a Maker Community Around an Open Hardware Platform

SESSION:Sharing, People and Communities

This paper reflects on the dynamics and practices of building a maker community around a new hardware platform. We examine the factors promoting the successful uptake of a maker platform from two perspectives: first, we investigate the technical and user experience considerations that users identify as the most important. Second, we explore the specific activities that help attract a community and encourage sustained participation. We present an inductive approach based on the case study of Bela, an embedded platform for creating interactive audio systems. The technical design and community building processes are detailed, culminating in a successful crowdfunding campaign. To further understand the community dynamics, the paper also presents an intensive three-day workshop with eight digital musical instrument designers. From observations and interviews, we reflect on the relationship between the platform and the community and offer suggestions for HCI researchers and practitioners interested in establishing their own maker communities.

> 本文围绕一个新的硬件平台，建立一个制造商社区的动态和实践。我们从两个角度研究了促进制造商平台成功吸收的因素：首先，我们调查了用户认为最重要的技术和用户体验方面的考虑。第二，我们探索有助于吸引社区和鼓励持续参与的具体活动。我们提出了基于Bela的案例分析归纳的方法，创建交互式的音频系统的嵌入式平台。技术设计和社

> 区建设的过程很详细，最终在一个成功的众筹活动。为了进一步了解社区的动态，本文还提供了八个数字乐器设计师的为期三天的讲习班。从观察和访谈中，我们反思了平台与社区之间的关系，并为有兴趣建立自己的制造社区的HCI研究人员和实践者提供建议。 article link

590. Celebratory Technology to Orchestrate the Sharing of Devices and Stories during Family Mealtimes

SESSION:Sharing, People and Communities

While the idea of "celebratory technologies" during family mealtimes to support positive interactions at the dinner table is promising, there are few studies that investigate how these technologies can be meaningfully integrated into family practices. This paper presents the deployment of Chorus - a mealtime technology that orchestrates the sharing of personal devices and stories during family mealtimes, explores related content from all participants' devices, and supports revisiting previously shared content. A three-week field deployment with seven families shows that Chorus augments family interactions through sharing contents of personal and familial significance, supports togetherness and in-depth discussion by combining resources from multiple devices, helps to broach sensitive topics into familial conversation, and encourages participation from all family members including children. We discuss implications of this research and reflect on design choices and opportunities that can further enhance the family mealtime experience.

> 而“庆祝”技术在家庭用餐时间来支持积极的互动在餐桌上是很有前途的想法，很少有研究探讨这些技术可以有意义地融入家庭的做法。本文介绍了合唱团，进餐时间技术编排的个人设备和故事分享在家庭用餐时间的部署，探讨相关的内容，从所有参与者的设备，并支持重新审视以前的共享内容。七个家庭三周的实地部署表明，合唱增强家庭互动通过个人和家族性意义的共享内容，支持团结和结合从多个设备资源进行了深入的探讨，有助于把敏感话题为家族性的谈话，并鼓励所有的家庭成员包括儿童参与。我们讨论了本研究的启示和反思设计的选择和机会，可以进一步提高家庭进餐体验。 article link

591. Exploring Topic-Based Sharing Mechanisms

SESSION:Sharing, People and Communities

General-purpose content-sharing platforms make it difficult for users to limit sharing to people interested in particular topics. Additional topic-based controls may allow users to better reach desired audiences. Designing such tools requires understanding current interest-based targeting techniques and the potential impact of additional mechanisms. We present an exploratory, interview-based study (n = 16) that addresses these dynamics for Facebook. We use diary-driven probes to explore general topic-based sharing across applications. We then use Facebook-based mockups to probe use cases and design tensions around adding topic-based sharing mechanisms to Facebook. We find that participants currently draw on various audience-limiting and reaching strategies to target interest-based audiences. Participants felt additional topic-based sharing mechanisms on Facebook might allow them to avoid oversharing or offending others and allow them to target improved audiences or share improved content. Usable topic-based sharing tools would also need to account, however, for participants' varied desired engagement strategies.

> 通用内容共享平台使用户难以限制共享给特定主题感兴趣的人。附加的基于主题的控件可能允许用户更好地达到期望的受众。设计这样的工具需要了解当前基于兴趣的目标技术和额外机制的潜在影响。我们提出了一个探索性的，以访谈为基础的研究（N = 16），解决这些动态的脸谱网。我们使用日记驱动的探针来探索基于主题的跨应用程序共享。然后我们使用脸谱网基础模型探讨用例设计的紧张局势增加了基于共享机制，脸谱网主题。我们发现，参加者目前吸引各种受众限制和达到战略，以利益为基础的受众。与会者认为，额外的话题基于脸谱网共享机制可以让他们避免过度分享或冒犯他人，让他们的目标受众或分享改进改进的内容。然而，基于主题的共享工具也需要考虑到参与者不同的期望参与策略。 article link

592. HCI and Environmental Public Policy: Opportunities for Engagement

SESSION:Sharing, People and Communities

This note discusses opportunities for the HCI community to engage with environmental public policy. It draws on insights and observations made during the primary author's recent work for a policy unit at Global Affairs Canada, which is a federal ministry of the Government of Canada. During that work, the primary author identified several domains of environmental public policy that are of direct relevance to the HCI community. This note contributes a preliminary discussion of how, why, with whom, and in what capacity HCI researchers and practitioners might engage with three types of environmental public policy: climate change, waste electrical and electronic equipment, and green ICT procurement policies. This builds on existing public policy and environmental knowledge within the HCI community and responds directly to calls from some members to engage with environmental public policy.

> 本说明讨论了HCI社区参与环境公共政策的机会。它借鉴了主要作者最近在加拿大加拿大联邦事务部全球事务政策股工作的见解和意见。在这项工作中，主要作者确定了几个与HCI社区直接相关的环境公共政策领域。本说明就如何、为什么、以及与谁、以及在何种程度上研究HCI研究人员和从业人员可能参与三种环境公共政策：气候变化、废弃电气和电子设备以及绿色信息和通信技术采购政策进行了初步讨论。这是建立在HCI社区现有的公共政策和环境知识的基础上，直接响应一些成员的呼吁，参与环境公共政策。 article link

593. Utilizing Experience Goals in Design of Industrial Systems

SESSION:Technology in the Workplace

The core idea of experience-driven design is to define the intended experience before functionality and technology. This is a radical idea for companies that have built their competences around specific technologies. Although many technology companies are willing to shift their focus towards experience-driven design, reports on real-life cases about the utilization of this design approach are rare. As part of an industry-led research program, we introduced experience-driven design to metal industry companies with experience goals as the key technique. Four design cases in three companies showed that the goals are useful in keeping the focus on user experience, but several challenges are still left for future research to tackle. This exploratory research lays ground for future research by providing initial criteria for assessing experience design tools. The results shed light on utilizing experience goals in industrial design projects and help practitioners in planning and managing the product design process with user experience in mind.

> 体验驱动设计的核心思想是在功能和技术之前定义预期的体验。对于那些围绕特定技术建立自己能力的公司来说，这是一个激进的想法。虽然许多科技公司愿意将注意力转移到经验驱动的设计上，但关于使用这种设计方法的实际案例的报道很少。作为一个以工业为主导的研究计划的一部分，我们将体验驱动设计引入到以经验目标为关键技术的金属工业公司中。三家公司的四个设计案例表明，这些目标在保持用户体验方面是有用的，但仍有一些挑战有待于今后的研究来解决。这一探索性的研究为未来的研究奠定了基础，为评估经验设计工具提供了初始标准。这一结果揭示了在工业设计项目中利用经验目标，并帮助从业者规划和管理产品设计过程中的用户体验。 article link

594. Evaluating Digital Creativity Support To Improve Health-and-Safety in a Manufacturing Plant

SESSION:Technology in the Workplace

This paper reports an evaluation of digital support for human creativity to improve health-and-safety in one manufacturing plant. It reports the use of this support as part of the plant's risk management process over 66 working days. Results revealed that this use led to more complete, more useful and more novel risk resolutions, compared with the original paper process, and informed how digital creativity support can be rolled out across manufacturing plants, as well as to other domains not recognized as creative.

> 本文报告了一个数字支持的人类创造力，以改善一个制造厂的健康和安全。报告将这种支持作为工厂风险管理过程的一部分，用了66个工作日。结果表明，与原纸工艺相比，这种使用导致了更完整、更有用和更新颖的风险解决方案，并告知数字创意支持如何在制造工厂以及其他未被承认为创新的领域推出。 article link

595. The Design Fictions of Philanthropic IT: Stuck Between an Imperfect Present and an Impossible Future

SESSION:Technology in the Workplace

In this paper, we examine the stories about philanthropic IT that circulate via product websites, marketing materials, and third-party news articles. Through a series of product-centered case studies, we surface these texts' implicit and explicit visions about the (near) future of philanthropy. We detail their prescriptions about how, why, and in service of what ends nonprofit organizations could, should, and ought to leverage IT. We also examine their underlying assumptions about philanthropy: how social good is accomplished, how philanthropic organizations are - and might be more - effective, to whom organizations and beneficiaries should be accountable, and the terms of that accountability. Analyzing these visions as design fictions, we argue that they help cultivate unrealistic anticipatory relationships to the present and entail concomitantly unrealistic imperatives for the philanthropic sector. We conclude by arguing for the crucial role of HCI scholars in disrupting these impossible futures, and by highlighting areas needing further, re-imagined, research.

> 在本文中，我们研究了通过产品网站、营销材料和第三方新闻文章传播慈善新闻的故事。通过一系列以产品为中心的案例研究，我们展示了这些文本关于慈善事业（近）未来的隐含和明确的愿景。我们详细说明了他们如何、为什么以及服务于非营利组织的目的、应该以及应该利用它的处方。我们还审查了他们关于慈善事业的基本假设：社会福利如何实现，慈善组织如何——可能更有效，组织和受益人应对此负责，以及问责制的条款。分析这些设想作为设计小说，我们认为，他们有助于培养不切实际的预期关系到目前，并伴随着不切实际的必要性的慈善部门。最后，我们讨论HCI学者在破坏这些不可能的未来中所起的关键作用，并强调需要进一步研究的领域，重新设想、研究。 article link

596. Proxemic Transitions: Designing Shape-Changing Furniture for Informal Meetings

SESSION:Technology in the Workplace

The field of Shape-Changing Interfaces explores the qualities of physically dynamic artifacts. At furniture-scale, such artifacts have the potential of changing the ways we collaborate and engage with interiors and physical spaces. Informed by theories of proxemics, empirical studies of informal meetings and design work with shape-changing furniture, we develop the notion of proxemic transitions. We present three design aspects of proxemic transitions: transition speed, stepwise reconfiguration, and radical shifts. The design aspects focus on how to balance between physical and digital transformations in designing for proxemic transitions. Our contribution is three-fold: 1) the notion of proxemic transitions, 2) three design aspects to consider in designing for proxemic transitions, and 3) initial exploration of how these design aspects might generate designs of dynamic furniture. These contributions outline important aspects to consider when designing shape-changing furniture for informal workplace meetings.

> 形状变化界面的领域探索物理动态工件的质量。在家具尺度上，这些艺术品有可能改变我们合作的方式，并与室内和物理空间相联系。通过理论的空间关系，非正式会议和改变形状的家具设计工作的实证研究，我们发展的空间关系的转换的概念。我们现在的空间关系的转换三设计方面：转变速度，逐步重构，与自由基的变化。设计方面，重点研究如何在空间关系的转换设计的物理和数字之间的转换平衡。我们的贡献有三个方面：1）的空间关系的转换的概念，2）三设计方面在设计考虑空间关系的转换，和3）初步探索如何将这些设计方面可能产生动态的家具设计。这些贡献概述了在为非正式工作场所会议设计形状变化的家具时要考虑的重要方面。 article link

597. Successful Leisure in Independent Living Communities: Understanding Older Adults' Motivations to Engage in Leisure Activities

SESSION:Technology Use Challenges for Older Adults

Leisure activities are a source of meaning and enjoyment for individuals across the lifespan. In this study, we conducted interviews with twenty-four older adults living in four different independent living communities. We present societal and ecological factors and motivations that influenced the way people participated in and decided what constitutes leisure activities. The goal of maintaining physical and cognitive health was often intertwined with motivations to engage in leisure activities. We discuss how this fits into the broader framework of successful aging and implications for technology design. We also provide an example of how findings from this study can be applied to a specific leisure activity: watching television.

> 休闲活动是个人一生中意义和享受的源泉。在这项研究中，我们对居住在四个不同的独立生活社区的二十四名老年人进行了访谈。我们提出了影响人们参与方式和决定什么是休闲活动的社会生态因素和动机。维持身体和认知健康的目标常常与从事休闲活动的动机交织在一起。我们将讨论如何融入更广泛的成功老龄化框架以及对技术设计的影响。我们还提供了一个例子，说明这项研究的结果可以应用到一个特定的休闲活动：看电视。 article link

598. Navigating Relationships and Boundaries: Concerns around ICT-uptake for Elderly People

SESSION:Technology Use Challenges for Older Adults

Despite a proliferation of research in the use of ICTs to support active and healthy ageing, few have considered the privacy and security concerns particular to the elderly. We investigated the appropriation of tablet devices and a neighborhood portal as well as emerging privacy and security issues through ethnographic and action research in a long-term participatory design (PD) project with elderly participants. We discuss two major themes: a) the tensions related to perceived digital threats and the social pressures of online disclosure to the social environment; and b) the relation of these issues to the ICT appropriation process and the referring challenges we encountered. We argue that there is a need to understand the interleaving of physical and virtual habitats, the various ways resulting in discomfort and the senior citizens' actions -- which at first glance appear contradictory. We consider the implications of the issues observed for examining privacy and security concerns more broadly as well as discussing implications for the design of the portal and the shaping of social measures for appropriation support.

> 尽管在信息和通信技术，支持积极健康老龄化的使用扩散的研究，很少有人认为是隐私和安全问题，特别是老年人。我们通过一项长期参与设计（PD）项目，对老年人参与的

> 平板设备和邻里门户以及新兴的隐私和安全问题进行了调查。我们讨论了两个主要主题：（a）与数字威胁和社会披露对社会环境的社会压力有关的紧张局势；以及b）这些问题与信息和通信技术拨款过程的关系以及我们遇到的提及挑战。我们认为，有必要了解物理和虚拟生境的交错，造成不适的各种方式和老年人的行动——乍看起来似乎矛盾。我们考虑更广泛地研究隐私和安全问题所涉及的问题，以及讨论门户设计的影响和社会支持拨款措施的形成。 article link

599. Older Adults Learning Computer Programming: Motivations, Frustrations, and Design Opportunities

SESSION:Technology Use Challenges for Older Adults

Computer programming is a highly in-demand skill, but most learn-to-code initiatives and research target some of the youngest members of society: children and college students. We present the first known study of older adults learning computer programming. Using an online survey with 504 respondents aged 60 to 85 who are from 52 different countries, we discovered that older adults were motivated to learn to keep their brains challenged as they aged, to make up for missed opportunities during youth, to connect with younger family members, and to improve job prospects. They reported frustrations including a perceived decline in cognitive abilities, lack of opportunities to interact with tutors and peers, and trouble dealing with constantly-changing software technologies. Based on these findings, we propose a learner-centered design of techniques and tools for motivating older adults to learn programming and discuss broader societal implications of a future where more older adults have access to computer programming -- not merely computer literacy -- as a skill set.

> 计算机编程是一项很有需求的技能，但大多数人都会为一些最年轻的社会成员——儿童和大学生学习编码倡议和研究目标。我们提出了老年人学习计算机编程的第一项已知研究。使用的一项网上调查，504的受访者年龄在60到85人来自52个不同的国家，我们发现老年人学习的动力来保持大脑随着年龄的挑战，以弥补错过的机会在青年，与年轻的家庭成员连接，并改善就业前景。他们报告了挫折感，包括认知能力下降，缺乏与导师和同事交流的机会，以及处理不断变化的软件技术的问题。基于这些发现，我们提出了一个以学习者为中心的设计技术和工具，以激励老年人学习编程，并讨论未来更广泛的社会影响，因为更多的老年人可以使用计算机编程（不仅仅是计算机知识）作为一种技能集。 article link