

Introduction to Intelligent User Interfaces

Introduction and Motivation

Team



Prof. Sven Mayer



Thomas Weber



Jesse Grootjen



Xuedong Zhang

Organization

- **Lecture:** Wednesday 12-14 c.t.,
 - Thalkirchnerstr. 36 / Frauenlobstr. 7a, Room 151
- **Tutorials:** Thursday 12-14 c.t.,
 - Geschw.-Scholl-Pl. 1 (M), M 109

News

- **Website** <https://www.medien.ifi.lmu.de/lehre/ws2425/iui/>
- **Moodle** <https://moodle.lmu.de/course/view.php?id=35343>
 - Password: IUI2425

Exam

- A written exam about the content of the lectures and exercises
- 90 minutes exam
- Date: *TBD, it will be during the semester break*
- This lecture has 6 ETCS, which is equivalent to 180h of work

Lectures

Date	Topic
16.10.2024	Introduction to Intelligent User Interfaces
23.10.2024	Context Awareness Interaction in Smart Environments
30.10.2024	Text and Natural Language Processing I
06.11.2024	Text and Natural Language Processing II
13.11.2024	Software Development in the Age of LLMs with <u>Thomas Weber</u>
20.11.2024	Recommender Systems
27.11.2024	Voice User Interfaces
04.12.2024	Intelligent Text Entry
11.12.2024	Deceptive User Interfaces by <u>Prof. Dr. Butz</u>
18.12.2024	
15.01.2025	Human-Robot Interaction by <u>Jan Leusmann</u>
22.01.2025	Security and Privacy in the context of Intelligent User Interfaces by <u>Prof. Florian Alt</u>
29.01.2025	Explainable AI, Bias and Ethics, and Q&A
05.02.2025	Discussion of Future Directions

Tutorials

Date	Topic
24.10.24	Organization, Live Coding Session: Introduction to Python and ML
31.10.24	Live Coding Session (ML Intro) + Q&A
07.11.24	TBD
14.11.24	TBD
21.11.24	TBD
28.11.24	TBD
05.12.24	TBD
12.12.24	TBD
19.12.24	TBD
16.01.25	TBD
23.01.25	TBD
30.01.25	TBD
06.02.25	Q&A: Exam preparation

*Will be changed based on the
lecture changes to have them
match as best as possible.*

Introduction and Motivation

Ubiquitous Computing

Mark Weiser, 1991

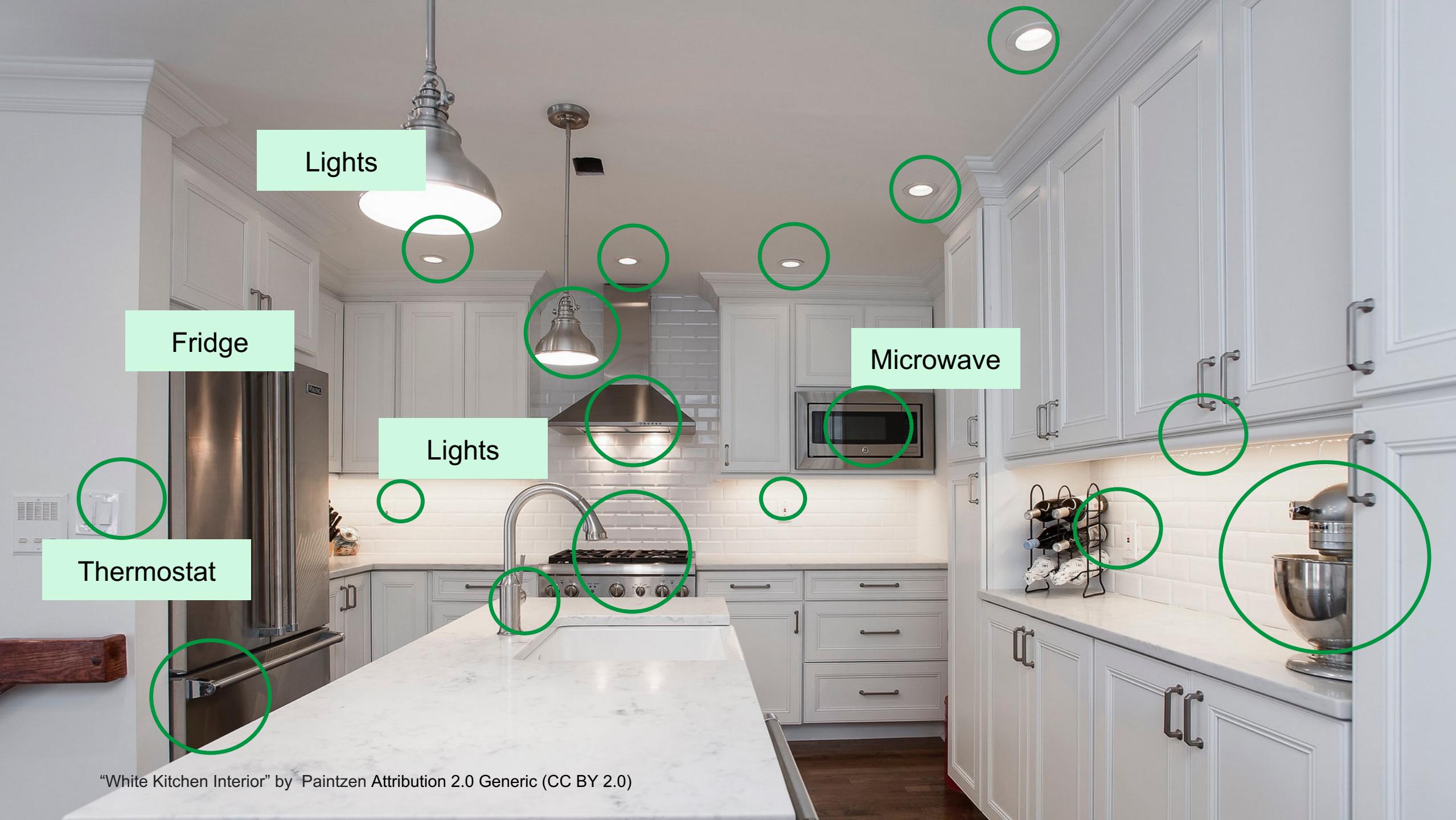
“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it”

“...Hundreds of computers in a room could seem intimidating at first, [...] these hundreds of computers will come to be invisible to common awareness. People will simply use them unconsciously to accomplish everyday tasks.”



„Just Walk Out“ shopping experience at Amazon Go

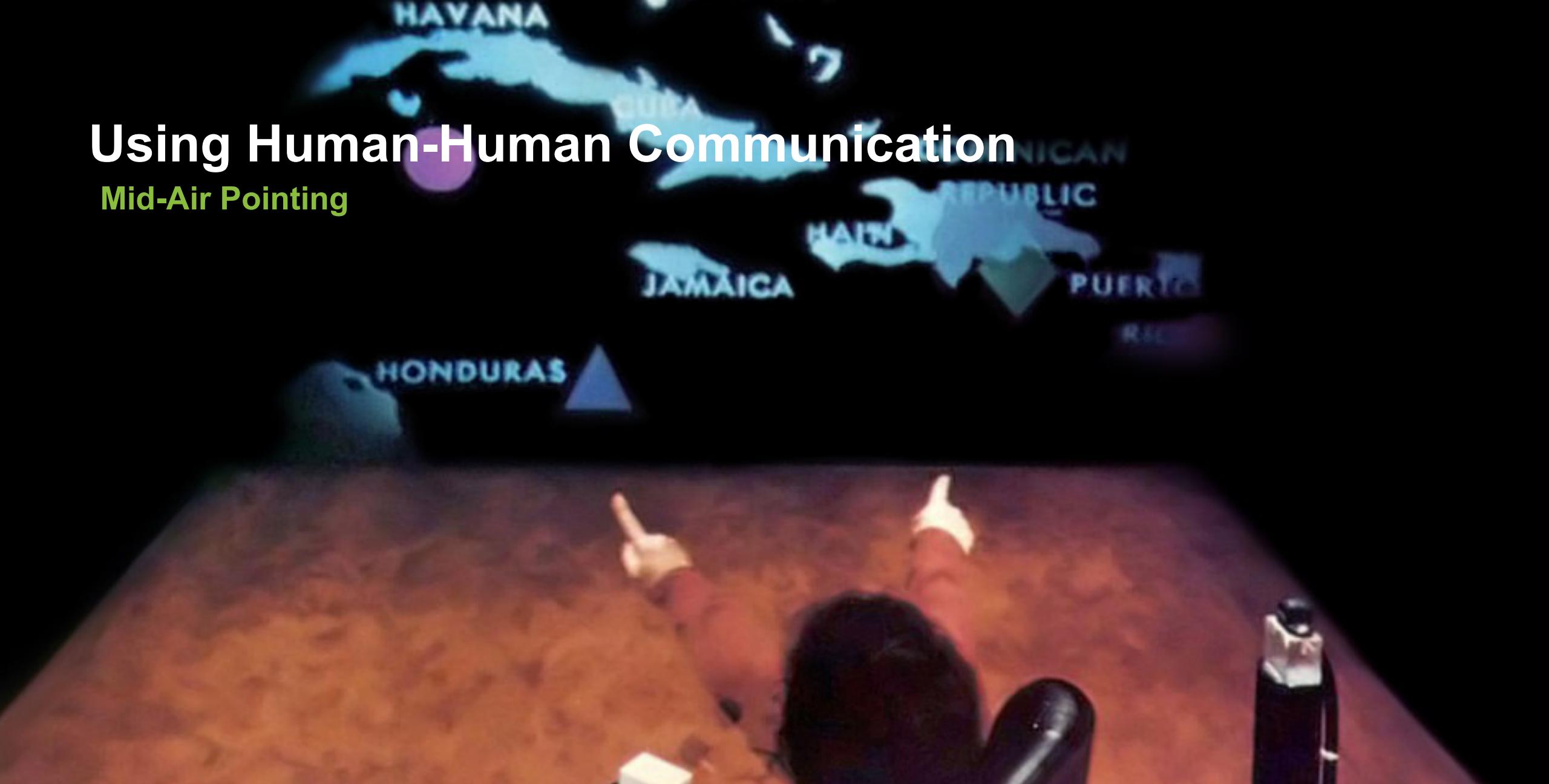




"White Kitchen Interior" by Paintzen Attribution 2.0 Generic (CC BY 2.0)

Using Human-Human Communication

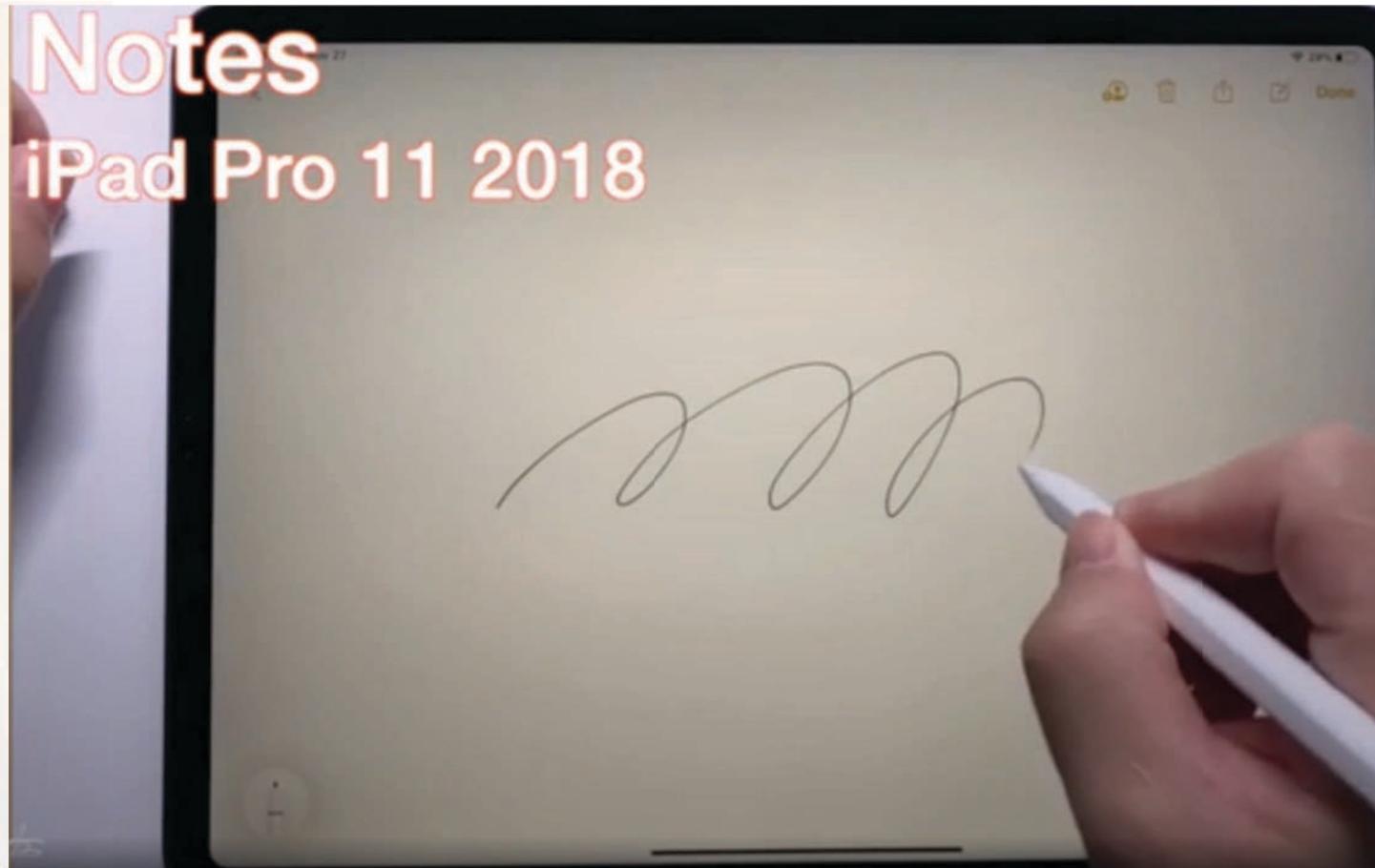
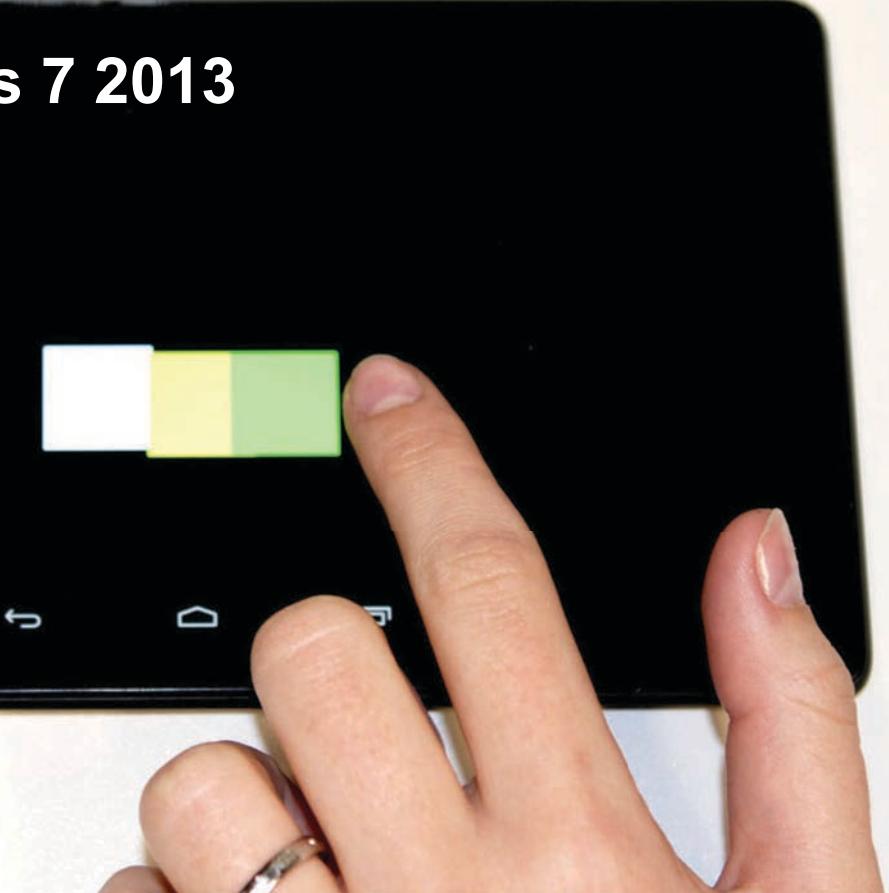
Mid-Air Pointing



Intelligent Touch

Why are we so precise with our fingers on a screen?

Nexus 7 2013



Henze, N., Mayer, S., Le, H.V. and Schwind, V. Improving software-reduced touchscreen latency. *Proc. MobileHCI '17* <https://doi.org/10.1145/3098279.3122150>

<https://www.youtube.com/watch?v=l6Nz8wVUU74>

Natural Language Translation

Female historians and male nurses do not exist?

The screenshot shows the Google Translate interface. The source language is set to English (ENGLISCH) and the target language is set to German (DEUTSCH). The input text is "the historian". The output is "der Historiker". There are two small speaker icons at the bottom left, a character count of 13/5000, and three icons (copy, edit, share) at the bottom right.

Google Translate

The screenshot shows the Google Translate interface. The source language is set to English (ENGLISCH) and the target language is set to German (DEUTSCH). The input text is "the nurse". The output is "die Krankenschwester". A blue checkmark icon is next to the output text. There are two small speaker icons at the bottom left, a character count of 9/5000, and three icons (copy, edit, share) at the bottom right.

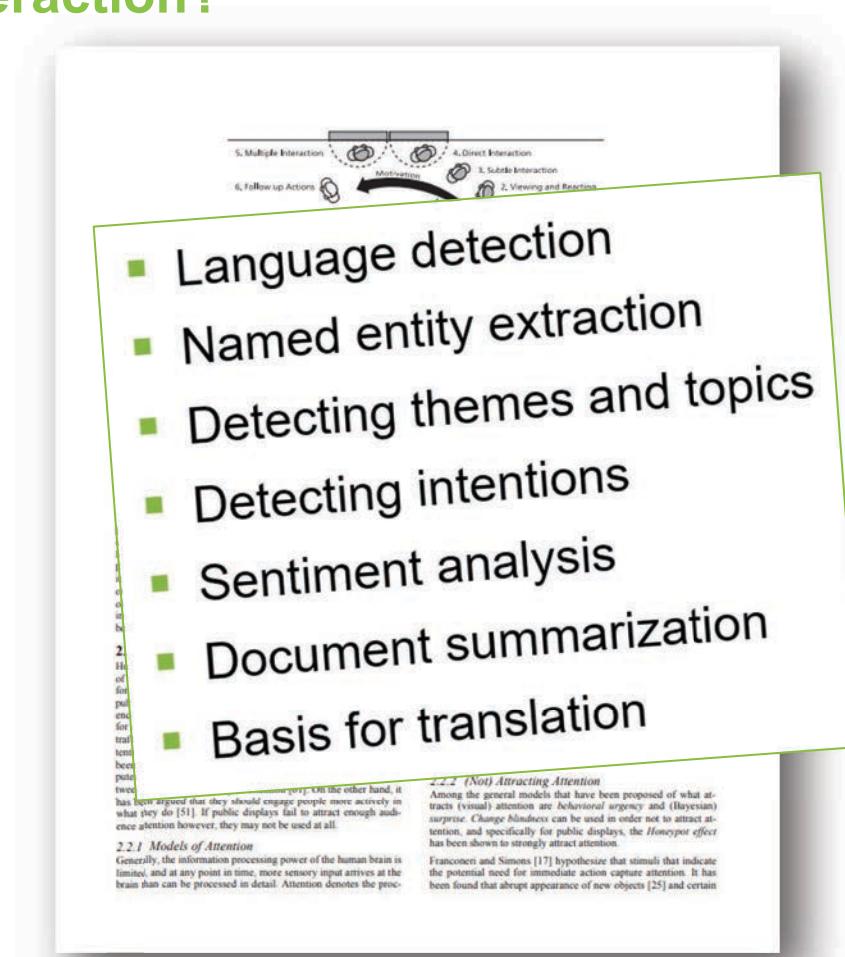
<https://translate.google.com>

<https://algorithmwatch.org/en/story/google-translate-gender-bias/>

Text analytics

Where can we use it and how can it improve interaction?

- Answering questions like
 - What is this text about?
 - What did the person communicate?
 - What is the key information in this document?
 - What feelings are communicated?
 - Is this different from what was said before?
- Application areas
 - Social media analytics, e.g. twitter
 - Communication and reading interfaces
 - Customer reviews and feedback
 - Chat bots
 - Text Forensics



<http://www.medien.ifi.lmu.de/pubdb/publications/pub/mueller2010mm/mueller2010mm.pdf>



Tell me topics that I would typically learn about in a master lecture on intelligent user interfaces



A master lecture on intelligent user interfaces (IUI) typically covers a range of advanced topics related to the design, development, and evaluation of user interfaces that leverage artificial intelligence and other advanced technologies. Here are some topics you might expect to learn about in such a lecture:



1. Introduction to Intelligent User Interfaces: An overview of the field, its history, and its importance in modern user experience design.
2. Human-Computer Interaction (HCI): Fundamentals of HCI, including user-centered design principles and usability testing.
3. AI Technologies in IUI: An exploration of the various AI technologies used in intelligent user interfaces, including natural language processing (NLP), machine learning, and computer vision.
4. User Modeling: How to create and use user models to personalize and enhance user interactions with interfaces.
5. Adaptive and Responsive Interfaces: Designing interfaces that can adapt to user preferences and dynamically respond to changing user needs.
6. Multimodal Interfaces: Integrating multiple modes of interaction, such as touch, voice, and gesture recognition, into user interfaces.
7. Recommender Systems: How recommendation algorithms work and their application in

Recommender Systems

How do recommender systems impact the user experience?



Carlos A. Gomez-Uribe and Neil Hunt. 2015. The Netflix Recommender System: Algorithms, Business Value, and Innovation. ACM Trans. Manage. Inf. Syst. 6, 4, Article 13 (December 2015), 19 pages. DOI: <https://doi.org/10.1145/2843948>

Why are recommender systems used?

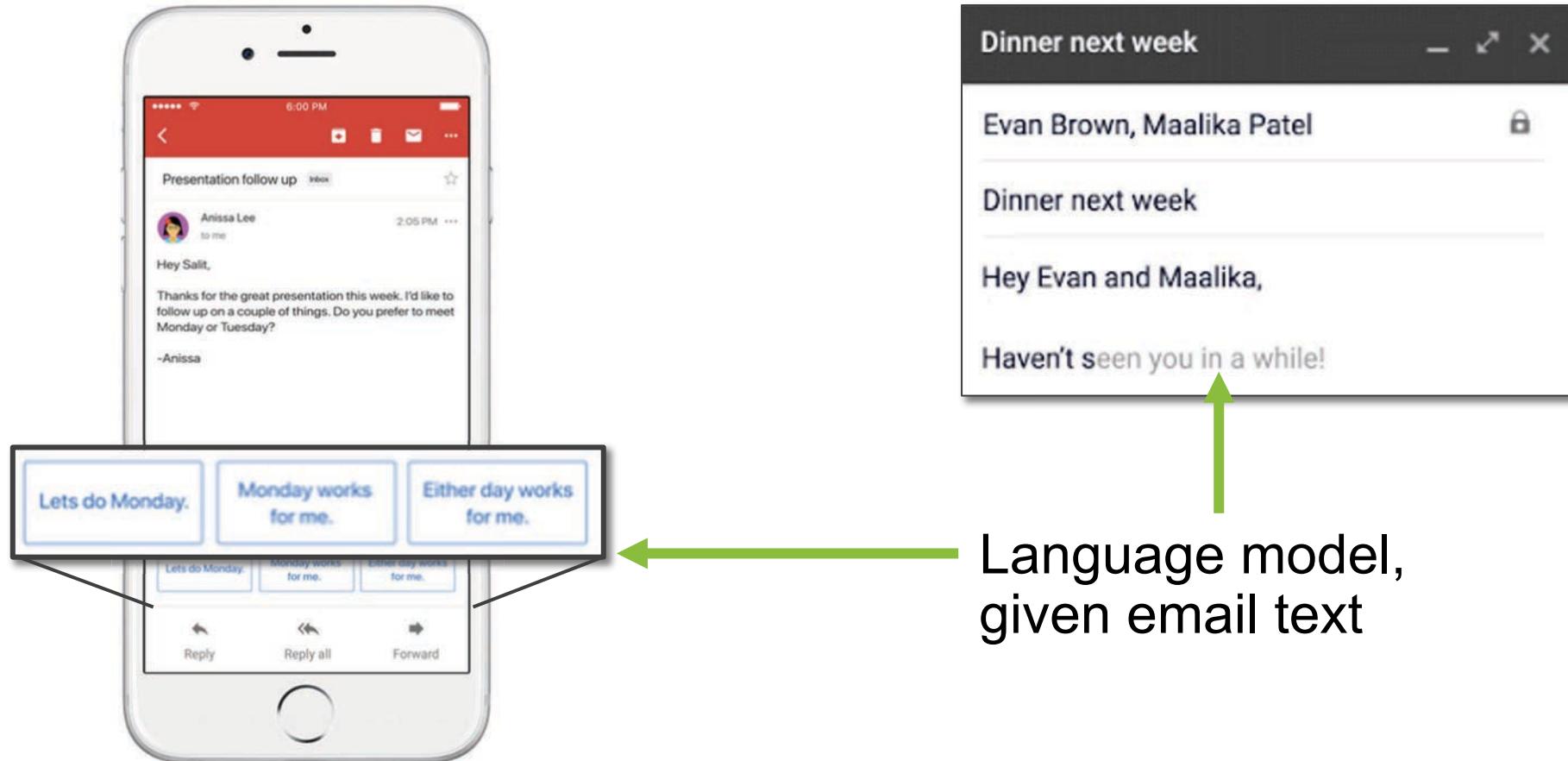
How do recommender work?

What data do recommender systems require?



Text Suggestions

Google's Smart Reply & Smart Compose

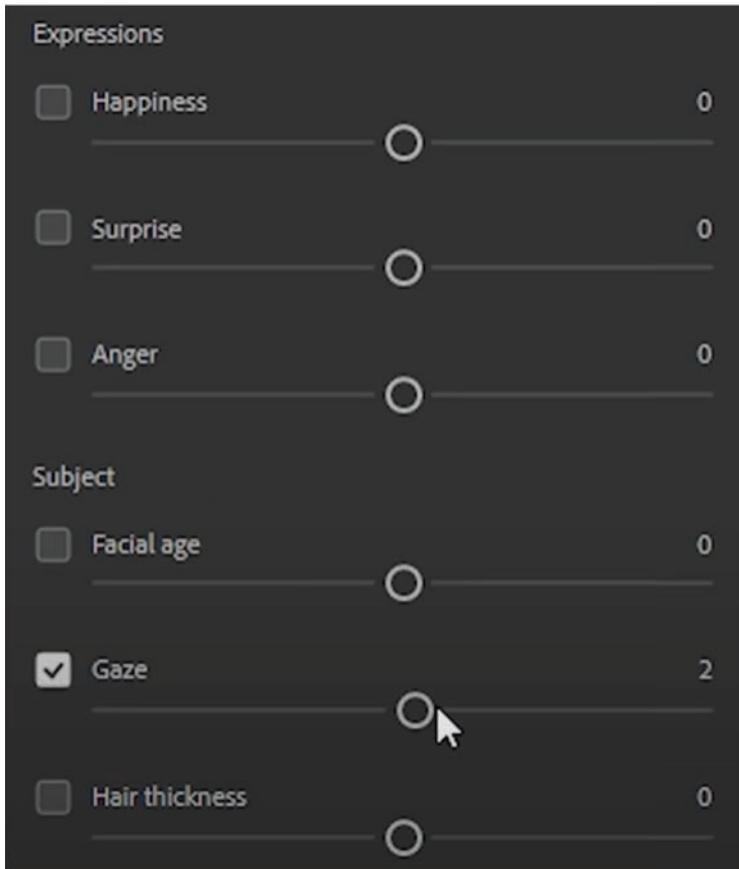


<https://blog.google/products/gmail/save-time-with-smart-reply-in-gmail/>

<https://ai.googleblog.com/2018/05/smart-compose-using-neural-networks-to.html>

Semantic Image Manipulation

„Smart Portrait Filters“ in Adobe's Photoshop

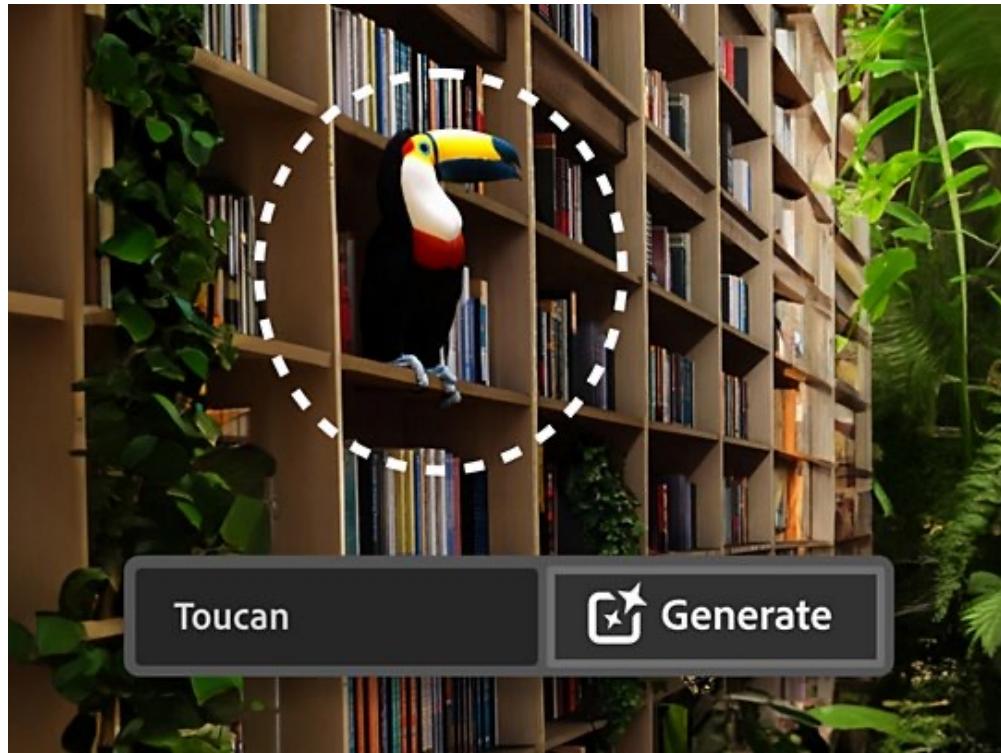


Generative model,
learned from many portraits

<https://blog.adobe.com/en/2020/10/20/photoshop-the-worlds-most-advanced-ai-application-for-creatives.html>

<https://blogs.nvidia.com/blog/2020/10/20/adobe-max-ai/>, <https://github.com/NVlabs/stylegan2>

Generative Fill – Photoshop



Source: <https://www.adobe.com/products/photoshop/generative-fill.html>

VUI design process

How to design a dialog structure?

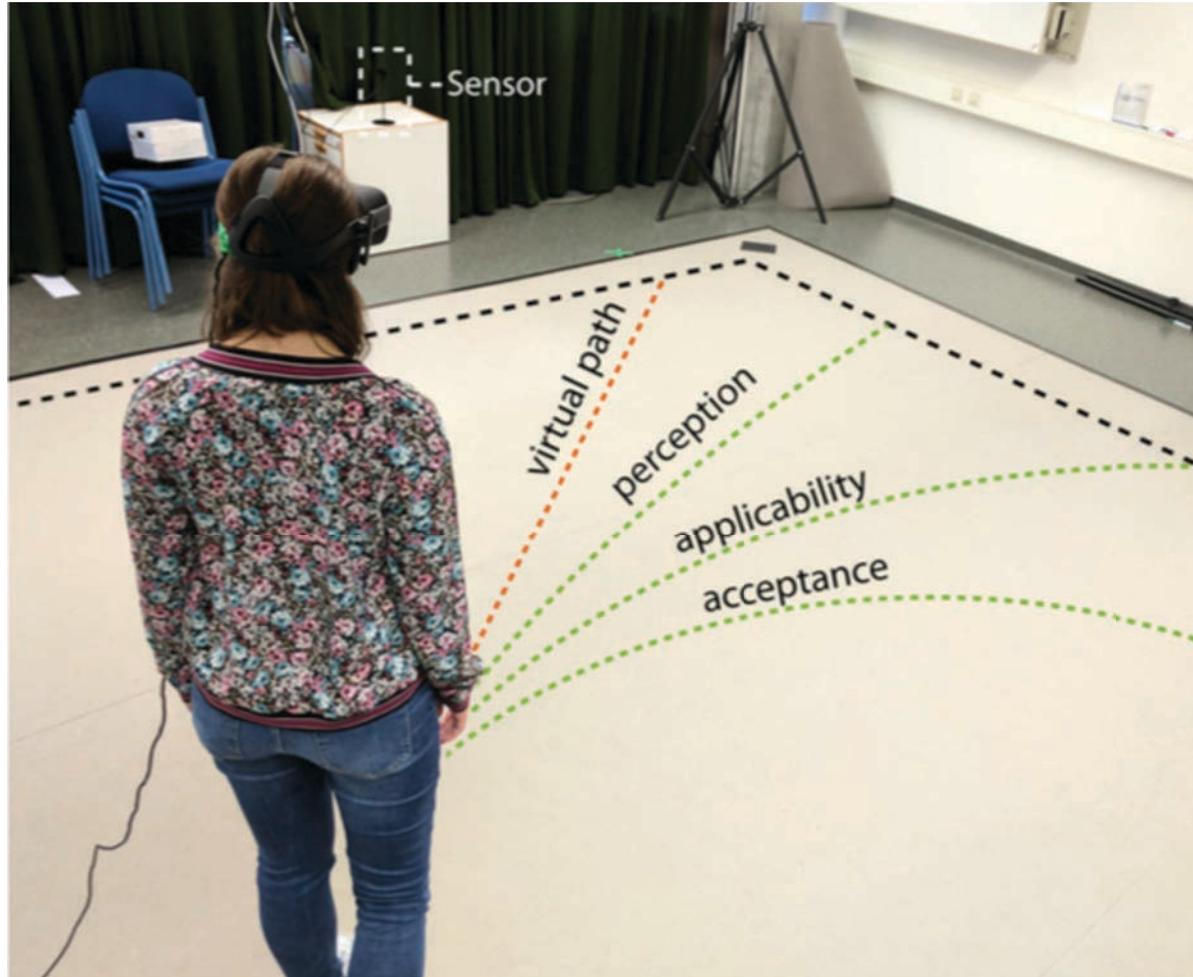
- Think of alternatives
 - structure
 - wording
- Try out your dialog
 - wizard of Oz technique!
 - use outside people
- Refine, Revise, Repeat



Image by Gregory Varnum, CC BY-SA 4.0 via Wikimedia Commons
[https://commons.wikimedia.org/wiki/File:Amazon_Echo_Dot_-_June_2018_\(1952\).jpg](https://commons.wikimedia.org/wiki/File:Amazon_Echo_Dot_-_June_2018_(1952).jpg)

A Deceptive UI: redirected Walking

What is real in an intelligent UI?



M. Rietzler, J. Gugenheimer, T. Hirzle, M. Deubzer, E. Langbehn and E. Rukzio, "Rethinking Redirected Walking: On the Use of Curvature Gains Beyond Perceptual Limitations and Revisiting Bending Gains," *2018 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)*, Munich, Germany, 2018, pp. 115-122, doi: 10.1109/ISMAR.2018.00041.

Image from <https://ieeexplore.ieee.org/abstract/document/8613757>

Facial Recognition

Convenient biometric or overly powerful?

- Unlock your phone
 - Hands-free identification
 - What are the major issues?
- Surveillance
 - Privacy
 - Tricks to „hide“ from facial recognition technology



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Met Police to deploy facial recognition cameras

© 30 January

<https://www.bbc.com/news/uk-51237665>



(a) Near infrared LED not lit (detection successful)



(b) Near infrared LED lit (detection failed)

<http://research.nii.ac.jp/~iechizen/official/research-e.html#research2c>

HCI Replacing HHI in Stores

„Just Walk Out“ shopping experience at Amazon Go

- Surveillance-powered shopping
 - Does not use facial recognition
- How does it work?
 - Is it „intelligent“? How so?

Image by SounderBruce, CC BY-SA 4.0 via Wikimedia Commons
https://commons.wikimedia.org/wiki/File:Amazon_Go_in_Seattle,_December_2016.jpg



AI Recruiting

Is an AI a “fairer“ recruiter?



Goal:
Design Human-machine systems
outperform humans as well as machines

Intuitive cooperation between humans and computers is the key challenge

Cyborg chess - centaur chess' advanced chess - freestyle chess

- People play and use computer assistance

... not sure about this in chess,
however in open problems this is
the way forward



<https://labs.sogeti.com/decision-support-better-than-machine-intelligence/>

Definition

An Interactive Human Centered Artificial Intelligence is an Artificial Intelligence that enables interactive exploration and manipulation in real time and is designed with a clear purpose for human benefit while being transparent about who has control over data and algorithms.

Interactive Human Centered Artificial Intelligence: A Definition and Research Challenges

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München, Germany



Figure 1: Is AI and ML a new material to name an epoch? Will it impact live as the "stone age" or "bronze age" did?

ABSTRACT

Artificial intelligence (AI) has become the buzzword of the last decade. Advances so far have been largely technical with a focus on machine learning (ML). Only recently have we begun seeing a shift towards focusing on the human aspects of artificial intelligence, centered on the narrow view of making AI interactive and explainable. In this paper I suggest a definition for Interactive Human Centered Artificial Intelligence and outline the required properties. Staying in control is essential for humans to feel safe and have self-determination. Hence, we need to find ways for humans to understand AI based systems and how they allow human control and oversight. We also want to make sure that levels of transparency and granularity of control are a general solution to this. Furthermore, it is essential that we make explicit why we want AI and what are the goals of AI research and development. We need to state the properties that we expect of future intelligent systems and who will benefit from them. In the same way that stone and bronze were very much comparable to raw materials (like stone, iron, or bronze), historical periods are named after these materials as they fundamentally changed what we can do with them. What we need to do now is to argue that in the AI age we need to shift the focus from the material (e.g. the AI algorithms, as there will be plenty of material) towards the tools and infrastructures that are employed which support the material. It is apparent that AI will allow automation of mental routine tasks. It makes sense to extend our ability to perceive the world and forecast events. For me the central question is how to create these tools for amplifying the human mind without compromising human values.

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<https://doi.org/10.1145/3399713.3400873>

CCS CONCEPTS

• Human-centered computing → Human-computer interaction (HCI); Ubiquitous and mobile computing theory, concepts and paradigms; Computing methodologies → Artificial intelligence; Machine learning

KEYWORDS

Interactive Human Centered Artificial Intelligence, Human Computer Interaction, Artificial Intelligence

ACM Reference Format:

Albrecht Schmidt. 2020. Interactive Human Centered Artificial Intelligence: A Definition and Research Challenges. In *International Conference on Advanced Visual Interfaces (AVI '20)*, September 29–October 2, 2020, Salerno, Italy. ACM, New York, NY, USA, 4 pages. <https://doi.org/10.1145/3399713.3400873>

1 INTRODUCTION

Artificial Intelligence (AI) has become the buzzword of the last decade. With strong growth in Machine Learning (ML), a range of new applications have become possible and many others appear to be within reach in the near future. Speech interaction, intelligent assistants, and autonomous driving are just some examples. In contrast to the evolution in size and cost of AI and ML, have demonstrated technical feasibility (e.g. fast and accurate face recognition techniques) and celebrated major scientific advances with regard to gains in speed, recognition performance and precision sometimes even under real world conditions. The applications that are enabled by these technologies are numerous and diverse. On one side there is great excitement about new applications (e.g. personal image search including names), but also fear about the use of this technology against individuals and society (e.g. face recognition for surveillance). This has stirred up the old question of whether a technology is good or bad and raises concerns about the bigger picture of responsibility.

There is an understanding that the advances seen in AI and ML are only the beginning and that there will be more to come as our

<https://uni.ubicomp.net/as/iHCAI2020.pdf>

Properties (1/2)

Interactive Human Centered Artificial Intelligence

1. Individuals can **interact in real time** with the **algorithms, models**, and **data** and can manipulate and control all relevant parameters.
2. The impact of changes and **manipulations** made by the user can be **observed in real time**.
3. In fast processes the speed **can be reduced to allow interactions**, interventions, and manipulation.
4. Individuals can **interactively explore** why and **how specific decisions** are made and find out how changes in the parameters, data, and models impact outcomes.

Properties (2/2)

Interactive Human Centered Artificial Intelligence

5. It states **how humans can benefit** from the artificial intelligence.
6. It explains **what risks the artificial intelligence** poses for individuals as well as on societal level.
7. It is visible **who has control** of the artificial intelligence, in particular who has the **power over data, models, and algorithms**.
8. It is visible **what data, knowledge base, and information** is used or has been used **to create and inform** the artificial intelligence.

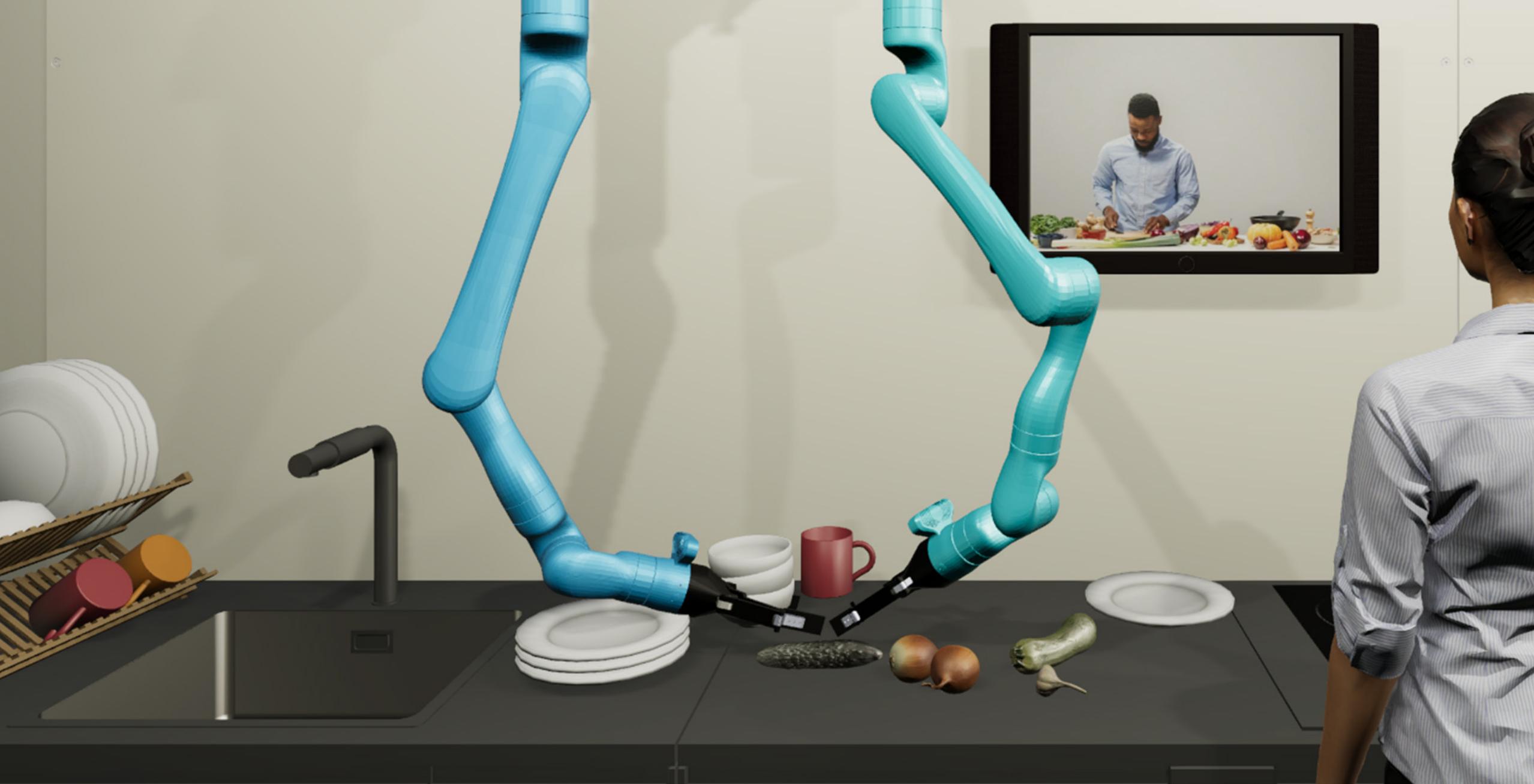
Is the Twitter-Algorithm a iHCAI?

1. Individuals can **interact in real time** with the **algorithms, models, and data** and can manipulate and control all relevant parameters.
2. The impact of changes and **manipulations** made by the user can be **observed in real time**.
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8. It is visible **what data, knowledge base, and information** is used or has been used **to create and inform** the artificial intelligence.

The screenshot shows a Twitter interface with several tweets. At the top, a user asks "What's happening?". Below are three tweets:

- Anna Maria Feit** (@AnnaFeit) · Sep 7
Back at work after 6 mo parental leave. Now my husband and I stay home alternating days. My biggest challenge is not leaving the baby or pumping at work but to keep my ambitions and expectations at 50% working hours. How do others deal with part-time research? @womenintech
- SFB-TRR 161** (@SfbTrr161) · 10m
Yesterday, our project group C01's research on #Interactive Dashboards in #AR was presented in @mucConf's #MixedReality session. In their study, the researchers combined a head-mounted display with the familiar interaction of a smartphone. @HCGroupKN youtube.com/watch?v=i4P6K2...
- Mensch und Computer** (@mucConf) · 18h
In session 4, we learned more about the lastest research on "Mixed Reality".

At the bottom, a user says "Andrew Kun and MyounghoonJeon (전영훈) liked Diana Tosca (@toscadiana) · 10h First day of gradschool at @nyutandon and I'm already having fun!" followed by a photo of a hand holding a green cable connected to a white circular device.



How can humans stay in control?

In the future, we believe that a large class of automated and **autonomous systems** allow for **joint control**, where the majority of decisions are automated but where users can **intervene**.

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Thomas Herrmann, Ruhr-University of Bochum

Intervention User Interfaces: A New Interaction Paradigm for Automated Systems

Insights

- Machine learning and artificial intelligence enable devices, applications, and systems that act with great autonomy.
- Interaction design for autonomous systems inherently requires joint control, which is not well addressed by classical user interface design.
- We introduce the intervention user interface paradigm to address challenges for creating novel user interfaces in autonomous systems.

Computer science has been driving automation in the workplace and the home. Automated processes and autonomous systems are having an impact on our experience with technology. Will we still need humans in the loop? Will HCI as a discipline be sidelined? In a 2015 keynote, Yvonne Rogers raised the question "User less or User full interfaces?" discussing the consequences of leaving the user out of the loop (<https://dl.acm.org/citation.cfm?doid=2945125.2945126>). We introduce the intervention user interface paradigm to address challenges for creating novel user interfaces in autonomous systems.

more cognitively challenging tasks. Recent breakthroughs in machine learning and artificial intelligence imply that more and more tasks can be automated. This leads to the fundamental question "What can humans do better than computers and robots?" being discussed in both the science community and greater society. In our view, this is the wrong question!

It is not about machines replacing humans. We see a major paradigm shift in how we as humans use technology and what types of interactions are appropriate. The crucial question is how a team of humans and machines collaborating is better than either humans or

INTERACTIONS.ACM.ORG

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Design Principles for Intervention user interfaces

- Ensure **expectability** and predictability.
- Communicate **options** for interventions.
- Allow easy **exploration** of interventions.
- Easy **reversal** of automated and intervention actions.
- Minimize required **attention**.
- **Communicate** how control is shared.

For more details and a set of rules see:

The image shows the cover of a research paper titled "Intervention User Interfaces: A New Interaction Paradigm for Automated Systems". The authors are Albrecht Schmidt and Thomas Herrmann. The cover includes a small logo of a person, the names of the authors, and their respective universities. Below the title, there is a brief abstract or introduction. The right side of the cover features two columns of text under the heading "Insights". The left column discusses the impact of machine learning and artificial intelligence on user interfaces. The right column discusses the interaction design for autonomous systems and the shift from "User less or User full Interface?" to "User in the loop". There is also a small note at the bottom right about the journal's website.

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Thomas Herrmann, Ruhr University of Bochum

Intervention User Interfaces: A New Interaction Paradigm for Automated Systems

Computer science has been driving automation in the workplace and the home. Machine learning and artificial intelligence enable devices, applications, and systems that act with great autonomy. This leads to the fundamental question "What can humans do better than computers and robots?" being discussed in both the science community and general society. In our view, this is the wrong question! It is not about machines replacing humans. We see a major paradigm shift in how we as humans use technology and what types of technologies we are using. The crucial question is how a team of humans and machines collaborating is better than either humans or

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Open Questions?

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