Fall 2019

CS6501: Topics in Human-Computer Interaction

http://seongkookheo.com/cs6501_fall2019

# Lecture 2: Intro to HCI Research

Seongkook Heo

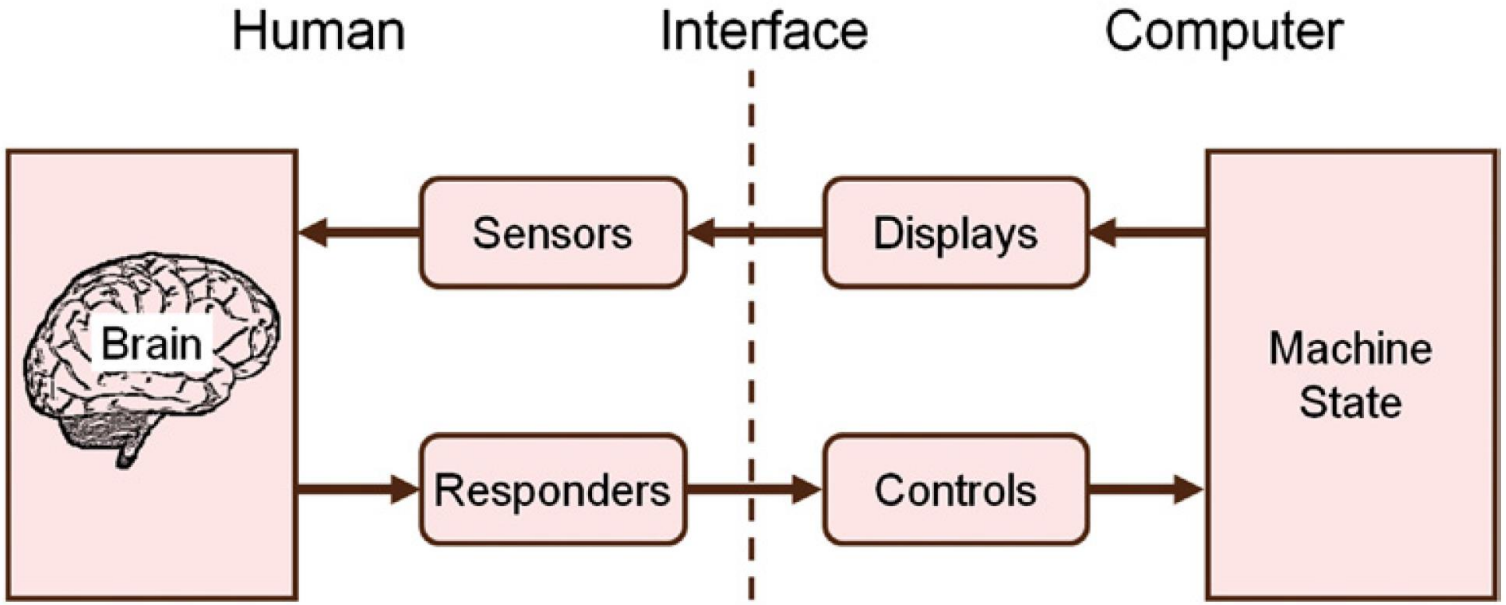
August 29, 2019

UNIVERSITY of VIRGINIA | SCHOOL of ENGINEERING & APPLIED SCIENCE

# Human-Computer Interaction?

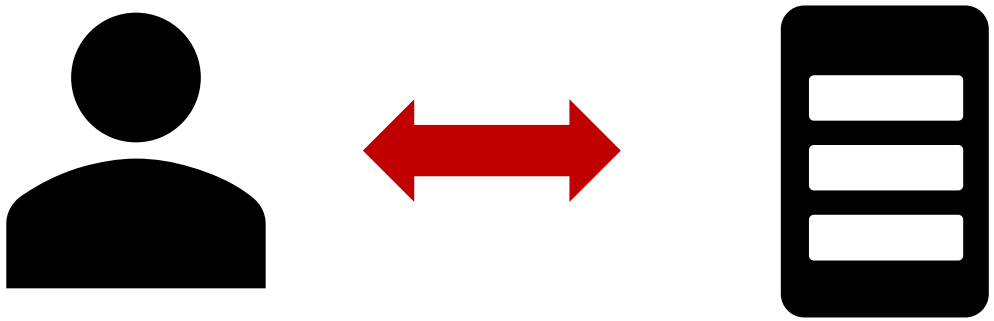
# What is Human-Computer Interaction?

*Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.*

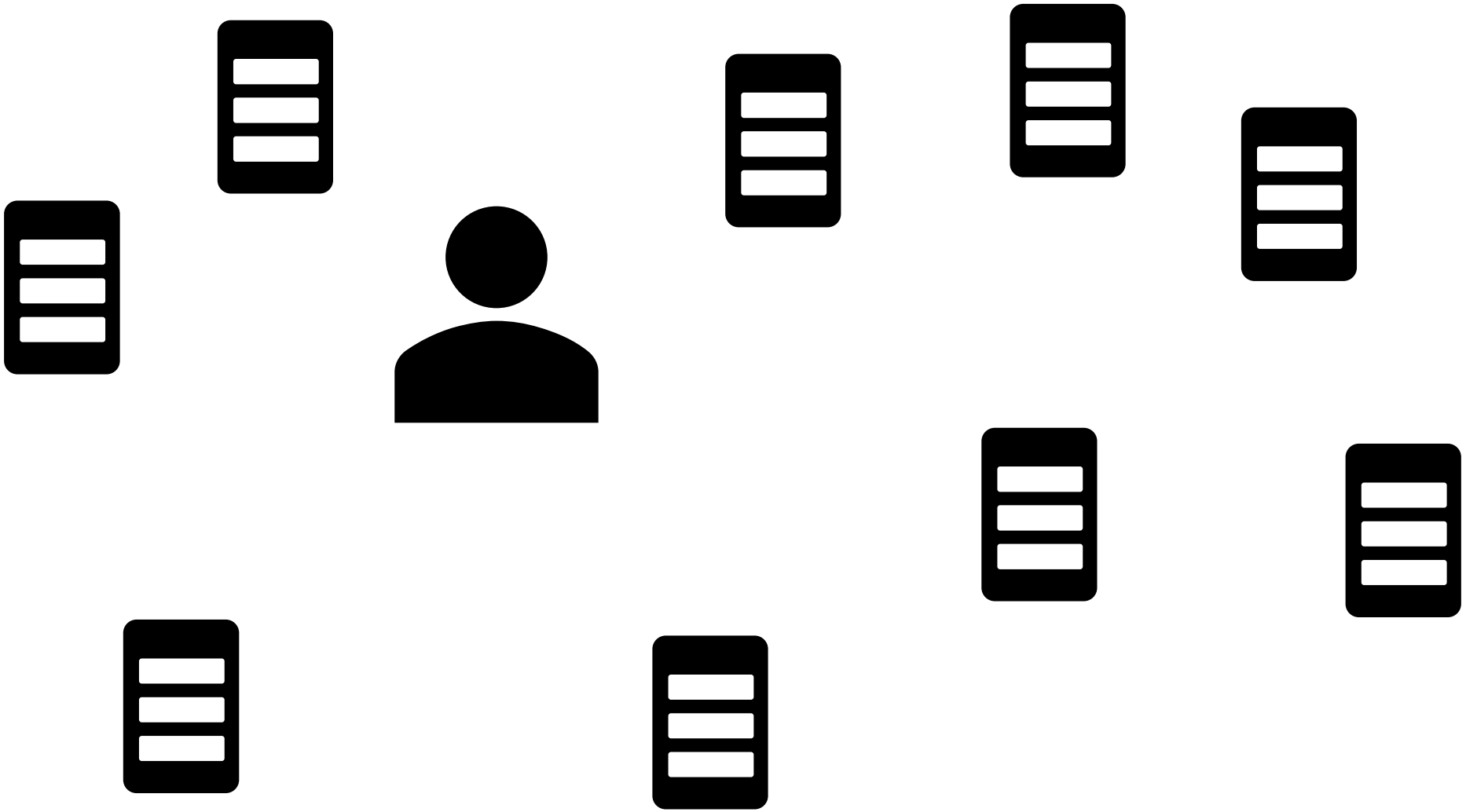



Kantowitz, B. H., & Sorkin, R. D. (1983).
*Human factors: Understanding People-System Relationships*

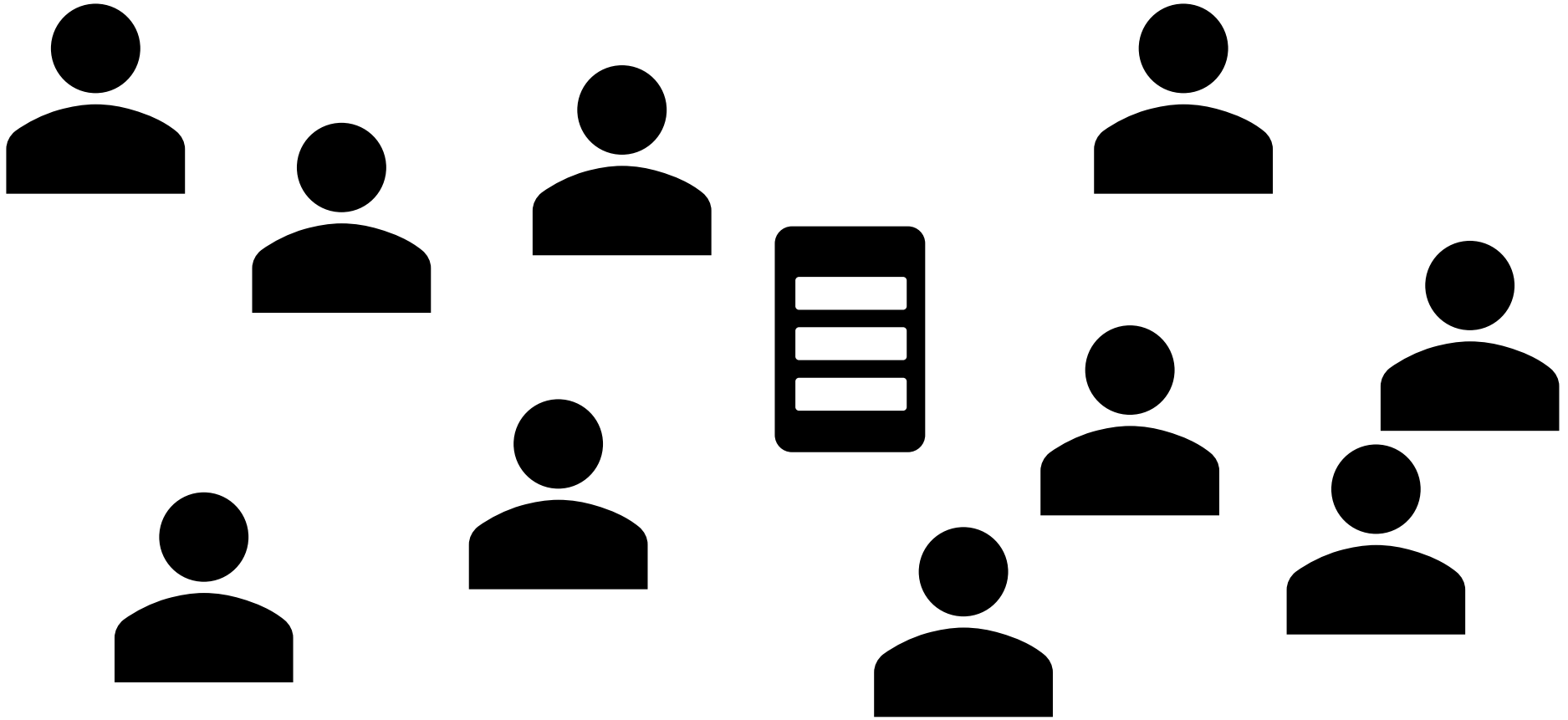
# What is Human-Computer Interaction?



# Ubiquitous Computing, Internet of Things



# Social Computing, Crowdsourcing

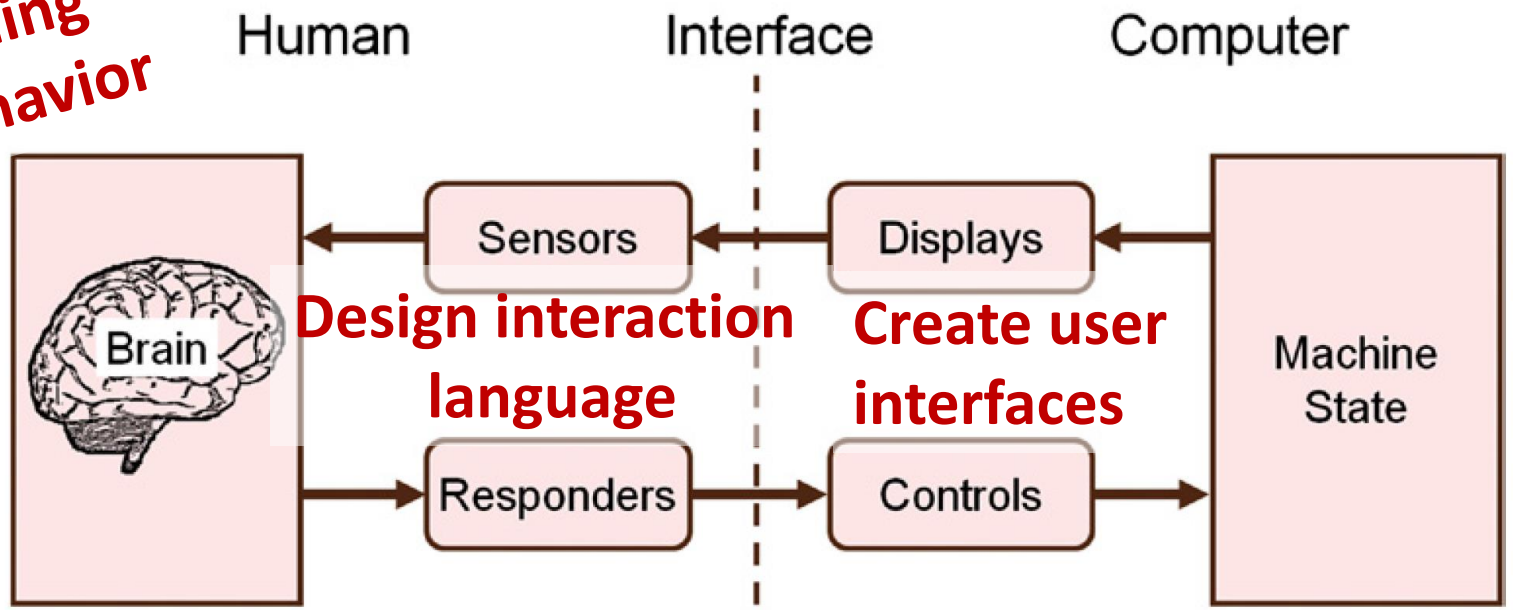


# What is Human-Computer Interaction Research?

# What is Human-Computer Interaction?

*Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.*

**Understanding human behavior**




**Design interaction language**

**Create user interfaces**

**Create new technology**

**Develop evaluation methods**

Kantowitz, B. H., & Sorkin, R. D. (1983). *Human factors: Understanding People-System Relationships*

# Seven Research Contributions in HCI

- Empirical Research Contributions
- Artifact Contributions
- Methodological Contributions
- Theoretical Contributions
- Dataset Contributions
- Survey Contributions
- Opinion Contributions

Jacob O. Wobbrock and Julie A. Kientz. 2016. Research contributions in human-computer interaction. Interactions 23, 3 (April 2016), 38-44.

# Seven Research Contributions in HCI

- **Empirical Research Contributions**
- Artifact Contributions
- Methodological Contributions
- Theoretical Contributions

Jacob O. Wobbrock and Julie A. Kientz. 2016. Research co
Interactions 23, 3 (April 2016), 38-44.



## You Watch, You Give, and You Engage: A Study of Live Streaming Practices in China

**Zhicong Lu, Haijun Xia, Seongkook Heo, and Daniel Wigdor**
University of Toronto, Ontario, Canada
{luzhc | haijunxia | seongkook | daniel}@dgp.toronto.edu

**ABSTRACT**
Despite gaining traction in North America, live streaming has not reached the popularity it has in China, where live-streaming has a tremendous impact on the social behaviors of users. To better understand this socio-technological phenomenon, we conducted a mixed methods study of live streaming practices in China. We present the results of an online survey of 527 live streaming users, focusing on their broadcasting or viewing practices and the experiences they find most engaging. We also interviewed 14 active users to explore their motivations and experiences. Our data revealed the different categories of content that was broadcasted and how varying aspects of this content engaged viewers. We also gained insight into the role reward systems and fan group-chat play in engaging users, while also finding evidence that both viewers and streamers desire deeper channels and mechanisms for interaction in addition to the commenting, gifting, and fan groups that are available today.

**Author Keywords**
Live streaming; social media; user engagement; social network.

**ACM Classification Keywords**
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

**INTRODUCTION**
In recent years, the proliferation of mobile devices equipped with high definition cameras and high-speed internet has led to a surge of individuals making live streams. These *live streams* are supported by software that popularity of Twitch.tv, live streaming in North America has only recently begun to enter into mainstream culture, through the advent of Facebook Live, YouTube Live, and Periscope [7,18,33]. Although a few research projects have focused on understanding the live streaming phenomenon, they have been largely confined to understanding North American usage [7,8,18,26,33]. The present work, however, casts a lens on a country and culture that has almost ubiquitous live streaming usage: China.

The continuous growth of live streaming in China has resulted in more than 200 million viewers watching streamers perform live each night on more than 200 live streaming platforms, creating an estimated 5-billion-dollar industry in 2017 [23]. Chinese live streams differ greatly in content, style, and form compared to those in North America and Europe. Previous studies of US and Canadian live streaming have found that live streaming was almost exclusively for live events [7,33] or sharing among close friends [18]. In contrast, Chinese users utilize live streaming for a wide array of uses, such as *pan-entertainment* (i.e. so-called "showroom performances" of singing, dancing, music instruments, and talk shows hosted and performed by individual streamers), e-commerce, personal knowledge sharing, and personal experience sharing [42]. Although differences in live streaming activities have been identified, there is little understanding as to why these differences exist, what makes live streaming activities so engaging and popular in China, and what we as the designers of live streaming platforms can learn from their use.

# Seven Research Contributions in HCI

- Empirical Research Contributions
- **Artifact Contributions**
- Methodological Contributions
- Theoretical Contributions

Jacob O. Wobbrock and Julie A. Kientz. 2016. Research co
Interactions 23, 3 (April 2016), 38-44.

## Sensing Techniques for Mobile Interaction

*Ken Hinckley, Jeff Pierce, Mike Sinclair, Eric Horvitz*
Microsoft Research, One Microsoft Way, Redmond, WA 98052
{kenh, sinclair, horvitz}@microsoft.com; jpierce@cs.cmu.edu

**ABSTRACT**
We describe sensing techniques motivated by unique aspects of human-computer interaction with handheld devices in mobile settings. Special features of mobile interaction include changing orientation and position, changing venues, the use of computing as auxiliary to ongoing, real-world activities like talking to a colleague, and the general intimacy of use for such devices. We introduce and integrate a set of sensors into a handheld device, and demonstrate several new functionalities engendered by the sensors, such as recording memos when the device is held like a cell phone, switching between portrait and landscape display modes by holding the device in the desired orientation, automatically powering up the device when the user picks it up the device to start using it, and scrolling the display using tilt. We present an informal experiment, initial usability testing results, and user reactions to these techniques.

**Keywords**
Input devices, interaction techniques, sensing, context-awareness, mobile devices, mobile interaction, sensors

**INTRODUCTION**
The rapidly growing market for mobile devices such as personal information managers (PIM's: tablet, pocket, and credit-card sized), cellular telephones, pagers, watches, and wearable computers offers a tremendous opportunity to introduce interface design innovations to the marketplace. Compared to desktop computers, the use of PIM's is more intimate because users often carry or even wear PIM's throughout their daily routine, so they present HCI design opportunities for a more intimate user experience.

People also use mobile devices in many different and changing environments, so designers don't have the luxury of forcing the user to "assume the position"[1] to work with a device, as is the case with desktop computers. For example, the user must accept qualities of the environment such as

detect these important events and properties of the physical world can be viewed as missed opportunities, rather than the basis for leveraging deeper shared understanding between human and computer. Indeed, Buxton has observed that much technological complexity results from forcing the user to explicitly maintain the context of interaction [3].

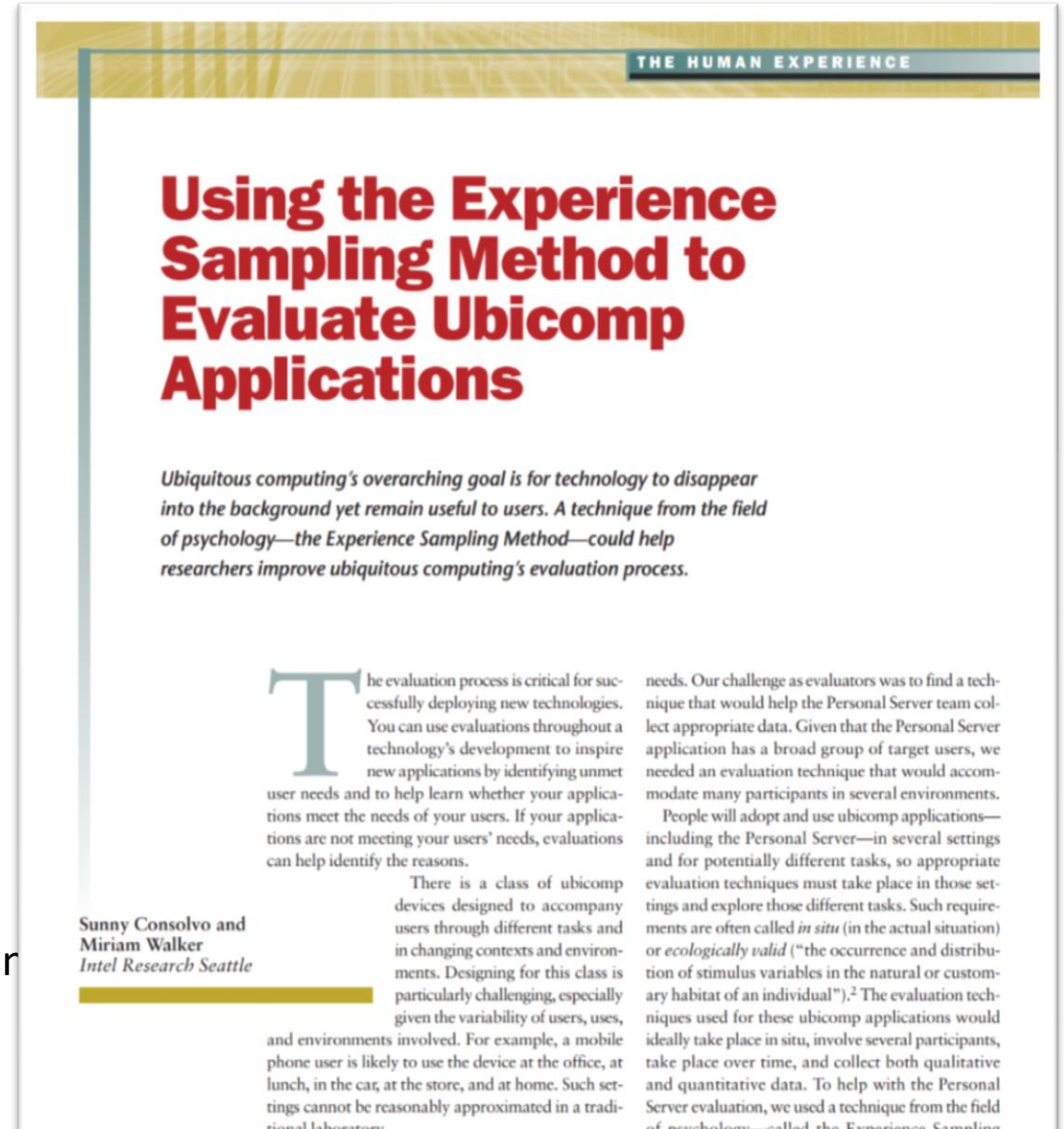

Fig. 1 Our prototype device, a Cassiopeia E105 Palm-sized PC. It is augmented with a proximity range sensor, touch sensitivity, and a two-axis tilt sensor.

Furthermore, the set of natural and effective gestures—the tokens that form the building blocks of the interaction design—may be very different for mobile devices than for desktop computers. Over the course of a day, users may pick up, put down, look at, walk around with, and put away (pocket/case) their mobile device many times; these are naturally occurring "gestures" that can and perhaps should become an integral part of interaction with the device.

# Seven Research Contributions in HCI

- Empirical Research Contributions
- Artifact Contributions
- **Methodological Contributions**
- Theoretical Contributions

Jacob O. Wobbrock and Julie A. Kientz. 2016. Research cor
Interactions 23, 3 (April 2016), 38-44.



THE HUMAN EXPERIENCE

## Using the Experience Sampling Method to Evaluate Ubicomp Applications

*Ubiquitous computing's overarching goal is for technology to disappear into the background yet remain useful to users. A technique from the field of psychology—the Experience Sampling Method—could help researchers improve ubiquitous computing's evaluation process.*

Sunny Consolvo and
Miriam Walker
*Intel Research Seattle*

The evaluation process is critical for successfully deploying new technologies. You can use evaluations throughout a technology's development to inspire new applications by identifying unmet user needs and to help learn whether your applications meet the needs of your users. If your applications are not meeting your users' needs, evaluations can help identify the reasons.

There is a class of ubicomp devices designed to accompany users through different tasks and in changing contexts and environments. Designing for this class is particularly challenging, especially given the variability of users, uses, and environments involved. For example, a mobile phone user is likely to use the device at the office, at lunch, in the car, at the store, and at home. Such settings cannot be reasonably approximated in a tradi-

needs. Our challenge as evaluators was to find a technique that would help the Personal Server team collect appropriate data. Given that the Personal Server application has a broad group of target users, we needed an evaluation technique that would accommodate many participants in several environments.

People will adopt and use ubicomp applications—including the Personal Server—in several settings and for potentially different tasks, so appropriate evaluation techniques must take place in those settings and explore those different tasks. Such requirements are often called *in situ* (in the actual situation) or *ecologically valid* ("the occurrence and distribution of stimulus variables in the natural or customary habitat of an individual").[2] The evaluation techniques used for these ubicomp applications would ideally take place in situ, involve several participants, take place over time, and collect both qualitative and quantitative data. To help with the Personal Server evaluation, we used a technique from the field

# Seven Research Contributions in HCI

- Empirical Research Contributions
- Artifact Contributions
- Methodological Contributions
- **Theoretical Contributions**

Jacob O. Wobbrock and Julie A. Kientz. 2016. Research c
Interactions 23, 3 (April 2016), 38-44.



## THE DESIGN SPACE OF INPUT DEVICES

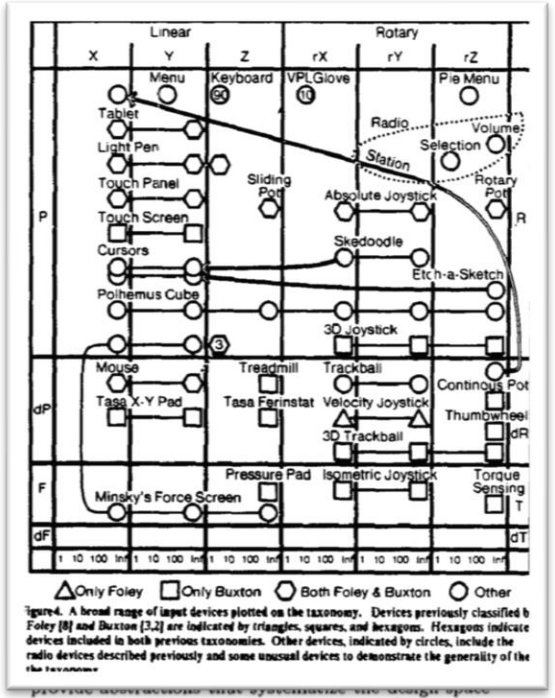
*Stuart K. Card, Jock D. Mackinlay, and George G. Robertson*

Xerox Palo Alto Research Center
3333 Coyote Hill Road
Palo Alto, CA 94304
415-494-4362, card.pa@xerox.com

**ABSTRACT**
A bewildering variety of devices for communication from humans to computers now exists on the market. In order to make sense of this variety, and to aid in the design of new input devices, we propose a framework for describing and analyzing input devices. Following Mackinlay's semantic analysis of the design space for graphical presentations, our goal is to provide tools for the generation and test of input device designs. The descriptive tools we have created allow us to describe the semantics of a device and measure its *expressiveness*. Using these tools, we have built a taxonomy of input devices that goes beyond earlier taxonomies of Buxton & Baecker and Foley, Wallace, & Chan. In this paper, we build on these descriptive tools, and proceed to the use of human performance theories and data for evaluation of the *effectiveness* of points in this design space. We focus on two figures of merit, footprint and bandwidth, to illustrate this evaluation. The result is the systematic integration of methods for both generating and testing the design space of input devices.

**KEYWORDS:** Input devices, semantics, design knowledge systematization.

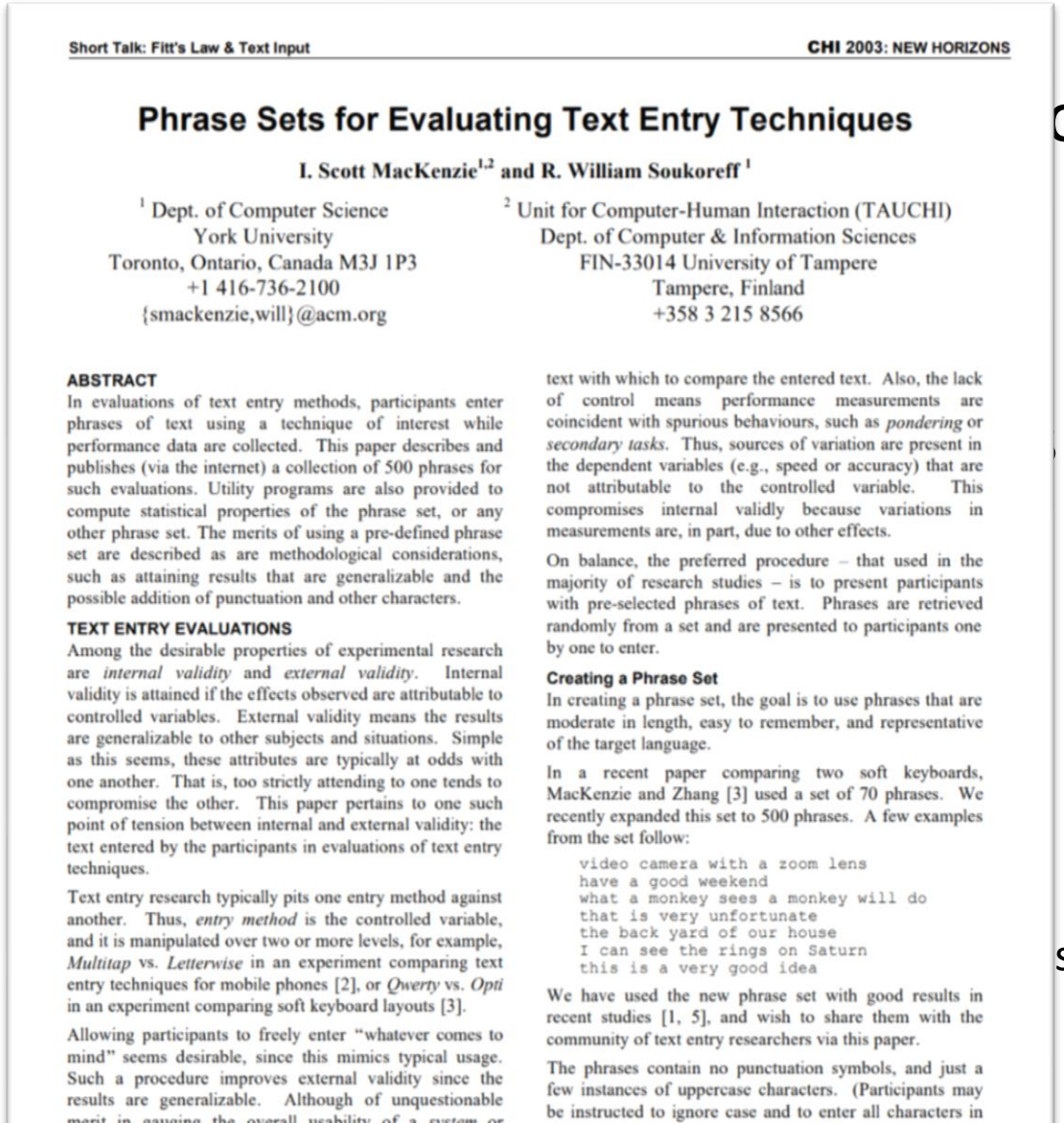
**INTRODUCTION**
Human-machine interface technology has developed to the point where it is appropriate to systematize existing research results and craft into a body of engineering and design knowledge. A case in point is the design of input devices. A bewildering variety of such devices now exist on the market, including typewriter keyboards, mice, headmice, pen and tablets, dialboxes, Polhemus cubes, gloves, and body suits. Given an abundance of designs,




igure4. A broad range of input devices plotted on the taxonomy. Devices previously classified b Foley [8] and Buxton [3,2] are indicated by triangles, squares, and hexagons. Hexagons indicate devices included in both previous taxonomies. Other devices, indicated by circles, include the radio devices described previously and some unusual devices to demonstrate the generality of the the taxonomy

of input devices. Foley, Wallace, and Chan [10] focused on computer graphics subtasks. They classified input devices under the graphics subtasks they were capable

# Seven Research Contributions in HCI





## Phrase Sets for Evaluating Text Entry Techniques

I. Scott MacKenzie[1,2] and R. William Soukoreff [1]

[1] Dept. of Computer Science
York University
Toronto, Ontario, Canada M3J 1P3
+1 416-736-2100
{smackenzie,will}@acm.org

[2] Unit for Computer-Human Interaction (TAUCHI)
Dept. of Computer & Information Sciences
FIN-33014 University of Tampere
Tampere, Finland
+358 3 215 8566

**ABSTRACT**
In evaluations of text entry methods, participants enter phrases of text using a technique of interest while performance data are collected. This paper describes and publishes (via the internet) a collection of 500 phrases for such evaluations. Utility programs are also provided to compute statistical properties of the phrase set, or any other phrase set. The merits of using a pre-defined phrase set are described as are methodological considerations, such as attaining results that are generalizable and the possible addition of punctuation and other characters.

**TEXT ENTRY EVALUATIONS**
Among the desirable properties of experimental research are *internal validity* and *external validity*. Internal validity is attained if the effects observed are attributable to controlled variables. External validity means the results are generalizable to other subjects and situations. Simple as this seems, these attributes are typically at odds with one another. That is, too strictly attending to one tends to compromise the other. This paper pertains to one such point of tension between internal and external validity: the text entered by the participants in evaluations of text entry techniques.

Text entry research typically pits one entry method against another. Thus, *entry method* is the controlled variable, and it is manipulated over two or more levels, for example, *Multitap* vs. *Letterwise* in an experiment comparing text entry techniques for mobile phones [2], or *Qwerty* vs. *Opti* in an experiment comparing soft keyboard layouts [3].

Allowing participants to freely enter "whatever comes to mind" seems desirable, since this mimics typical usage. Such a procedure improves external validity since the results are generalizable. Although of unquestionable

text with which to compare the entered text. Also, the lack of control means performance measurements are coincident with spurious behaviours, such as *pondering* or *secondary tasks*. Thus, sources of variation are present in the dependent variables (e.g., speed or accuracy) that are not attributable to the controlled variable. This compromises internal validly because variations in measurements are, in part, due to other effects.

On balance, the preferred procedure – that used in the majority of research studies – is to present participants with pre-selected phrases of text. Phrases are retrieved randomly from a set and are presented to participants one by one to enter.

**Creating a Phrase Set**
In creating a phrase set, the goal is to use phrases that are moderate in length, easy to remember, and representative of the target language.

In a recent paper comparing two soft keyboards, MacKenzie and Zhang [3] used a set of 70 phrases. We recently expanded this set to 500 phrases. A few examples from the set follow:

```
video camera with a zoom lens
have a good weekend
what a monkey sees a monkey will do
that is very unfortunate
the back yard of our house
I can see the rings on Saturn
this is a very good idea
```

We have used the new phrase set with good results in recent studies [1, 5], and wish to share them with the community of text entry researchers via this paper.

The phrases contain no punctuation symbols, and just a few instances of uppercase characters. (Participants may be instructed to ignore case and to enter all characters in

ons

search contributions in human-computer interaction.

- **Dataset Contributions**
- Survey Contributions
- Opinion Contributions

# Seven Research Contributions in HCI

## Finding Common Ground: A Survey of Capacitive Sensing in Human-Computer Interaction

**Tobias Grosse-Puppendahl[1], Christian Holz[1], Gabe Cohn[1], Raphael Wimmer[2], Oskar Bechtold[3], Steve Hodges[1], Matthew S. Reynolds[4], Joshua R. Smith[4]**
[1]Microsoft Research, Cambridge, UK / Redmond, WA, USA; {tgp, cholz, gabe, shodges}@microsoft.com
[2]University of Regensburg, Regensburg, Germany; raphael.wimmer@ur.de
[3]Technische Universität Darmstadt, Darmstadt, Germany; oskar.bechtold@stud.tu-darmstadt.de
[4]University of Washington, Seattle, WA, USA; jrs@cs.washington.edu, matt.reynolds@ee.washington.edu

**ABSTRACT**
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.

**Author Keywords**
survey; capacitive sensing; electric field sensing

**ACM Classification Keywords**
H.5.2. Information Interfaces and Presentation: User Interfaces - Graphical user interfaces; Input devices & strategies

**INTRODUCTION**
Capacitive sensing has become so ubiquitous that it is hard to imagine the world without it. We are surrounded by capacitive sensors—from the touchscreens and touchpads on our phones, tablets, and laptops, to the capacitive "buttons" frequently used on consumer electronics devices and com-

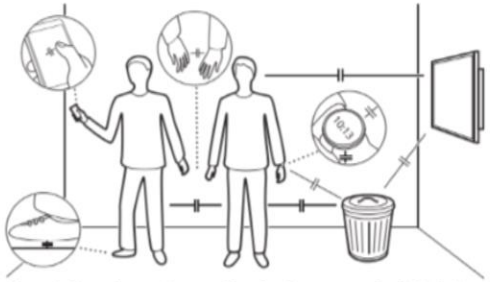


**Figure 1. Capacitance (+) naturally exists between people, their devices, and conductive objects in the environment. By measuring it, capacitive sensors can infer the position and proximity of users and other objects, supporting a range of different applications. However, this inherent capacitive coupling between objects also increases ambiguity of sensor readings and adds noise.**

products, the use of capacitive sensing is common in human-computer interaction research, with examples ranging from grasp detection to the estimation of human positioning.

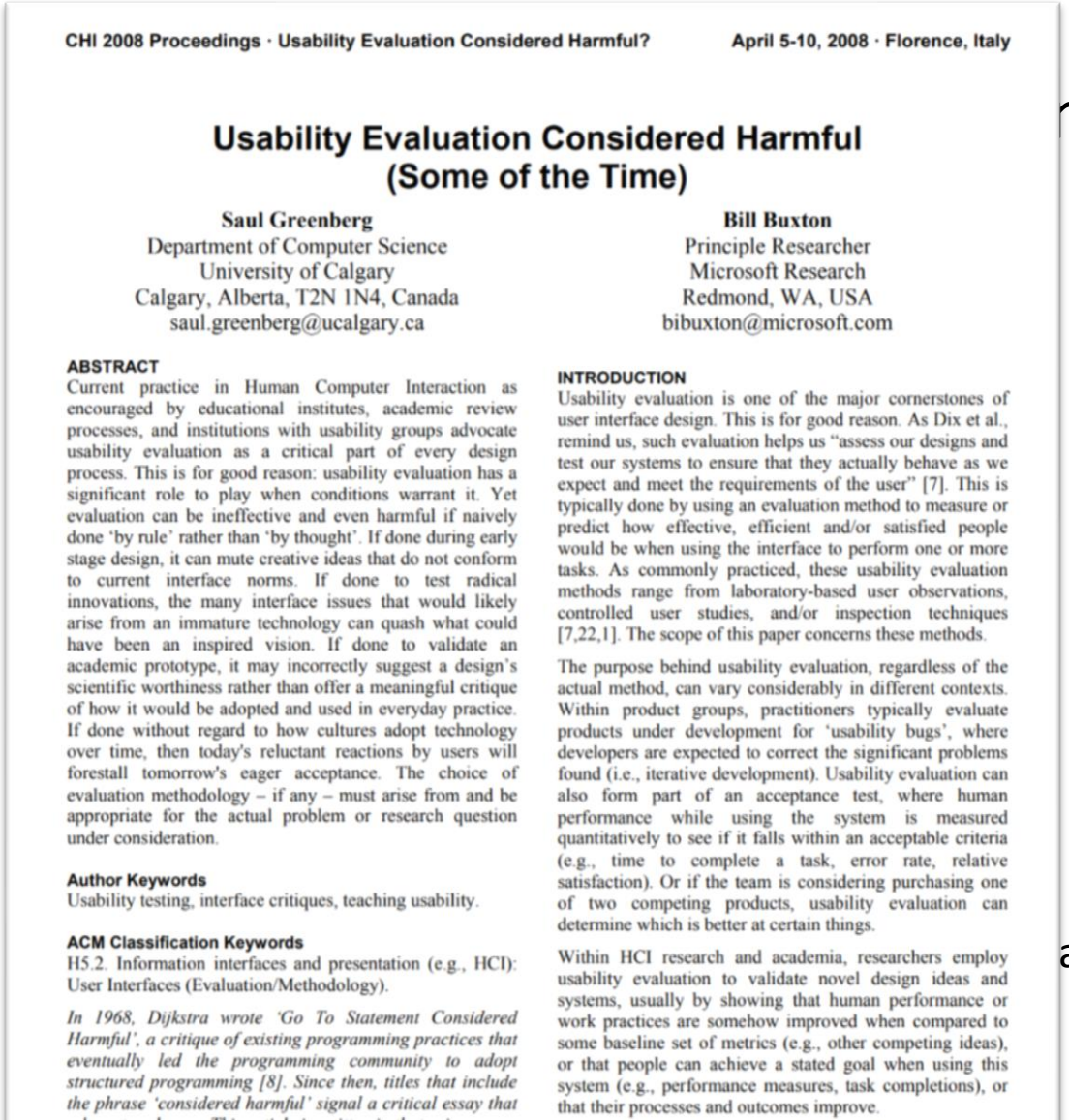
As shown in Figure 1, a plethora of natural capacitances exist between the people, devices and objects in the environment. It is important to realize that the capacitances shown in the figure are not capacitor components purchased from an electronics supplier. Instead, they represent the natural *capacitive coupling* between various objects. By measuring these ever-changing values it is possible to infer relative position, motion and more—supporting a multitude of interaction techniques and applications. The small size, low cost, and low power aspects of capacitive sensing make it an appealing technology for both products and research prototypes. Furthermore, its ability to support curved, flexible, and stretchable surfaces has enabled interaction designers to work with non-rigid ob-

ns

- Dataset Contributions
- **Survey Contributions**
- Opinion Contributions

arch contributions in human-computer interaction.

# Seven Research Contributions in HCI





## Usability Evaluation Considered Harmful (Some of the Time)

**Saul Greenberg**
Department of Computer Science
University of Calgary
Calgary, Alberta, T2N 1N4, Canada
saul.greenberg@ucalgary.ca

**Bill Buxton**
Principle Researcher
Microsoft Research
Redmond, WA, USA
bibuxton@microsoft.com

**ABSTRACT**
Current practice in Human Computer Interaction as encouraged by educational institutes, academic review processes, and institutions with usability groups advocate usability evaluation as a critical part of every design process. This is for good reason: usability evaluation has a significant role to play when conditions warrant it. Yet evaluation can be ineffective and even harmful if naively done 'by rule' rather than 'by thought'. If done during early stage design, it can mute creative ideas that do not conform to current interface norms. If done to test radical innovations, the many interface issues that would likely arise from an immature technology can quash what could have been an inspired vision. If done to validate an academic prototype, it may incorrectly suggest a design's scientific worthiness rather than offer a meaningful critique of how it would be adopted and used in everyday practice. If done without regard to how cultures adopt technology over time, then today's reluctant reactions by users will forestall tomorrow's eager acceptance. The choice of evaluation methodology – if any – must arise from and be appropriate for the actual problem or research question under consideration.

**Author Keywords**
Usability testing, interface critiques, teaching usability.

**ACM Classification Keywords**
H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces (Evaluation/Methodology).

*In 1968, Dijkstra wrote 'Go To Statement Considered Harmful', a critique of existing programming practices that eventually led the programming community to adopt structured programming [8]. Since then, titles that include the phrase 'considered harmful' signal a critical essay that*

**INTRODUCTION**
Usability evaluation is one of the major cornerstones of user interface design. This is for good reason. As Dix et al., remind us, such evaluation helps us "assess our designs and test our systems to ensure that they actually behave as we expect and meet the requirements of the user" [7]. This is typically done by using an evaluation method to measure or predict how effective, efficient and/or satisfied people would be when using the interface to perform one or more tasks. As commonly practiced, these usability evaluation methods range from laboratory-based user observations, controlled user studies, and/or inspection techniques [7,22,1]. The scope of this paper concerns these methods.

The purpose behind usability evaluation, regardless of the actual method, can vary considerably in different contexts. Within product groups, practitioners typically evaluate products under development for 'usability bugs', where developers are expected to correct the significant problems found (i.e., iterative development). Usability evaluation can also form part of an acceptance test, where human performance while using the system is measured quantitatively to see if it falls within an acceptable criteria (e.g., time to complete a task, error rate, relative satisfaction). Or if the team is considering purchasing one of two competing products, usability evaluation can determine which is better at certain things.

Within HCI research and academia, researchers employ usability evaluation to validate novel design ideas and systems, usually by showing that human performance or work practices are somehow improved when compared to some baseline set of metrics (e.g., other competing ideas), or that people can achieve a stated goal when using this system (e.g., performance measures, task completions), or that their processes and outcomes improve.

ns

- Dataset Contributions
- Survey Contributions
- **Opinion Contributions**

arch contributions in human-computer interaction.

# Seven Research Contributions in HCI

- Empirical Research Contributions
- **Artifact Contributions**
- Methodological Contributions
- Theoretical Contributions
- Dataset Contributions
- Survey Contributions
- Opinion Contributions

Jacob O. Wobbrock and Julie A. Kientz. 2016. Research contributions in human-computer interaction. Interactions 23, 3 (April 2016), 38-44.

# How to Conduct HCI Research?

# Research Methods

- Observational Method
- Experimental Method
- Correlational Method

# Research Methods

- Observational Method
  - Observe humans interacting with computers in a natural setting
  - Using interviews, field investigations, case studies, focus groups, etc.
  - Tends to be qualitative
  - High relevance, but sacrifices precision
- Experimental Method
- Correlational Method

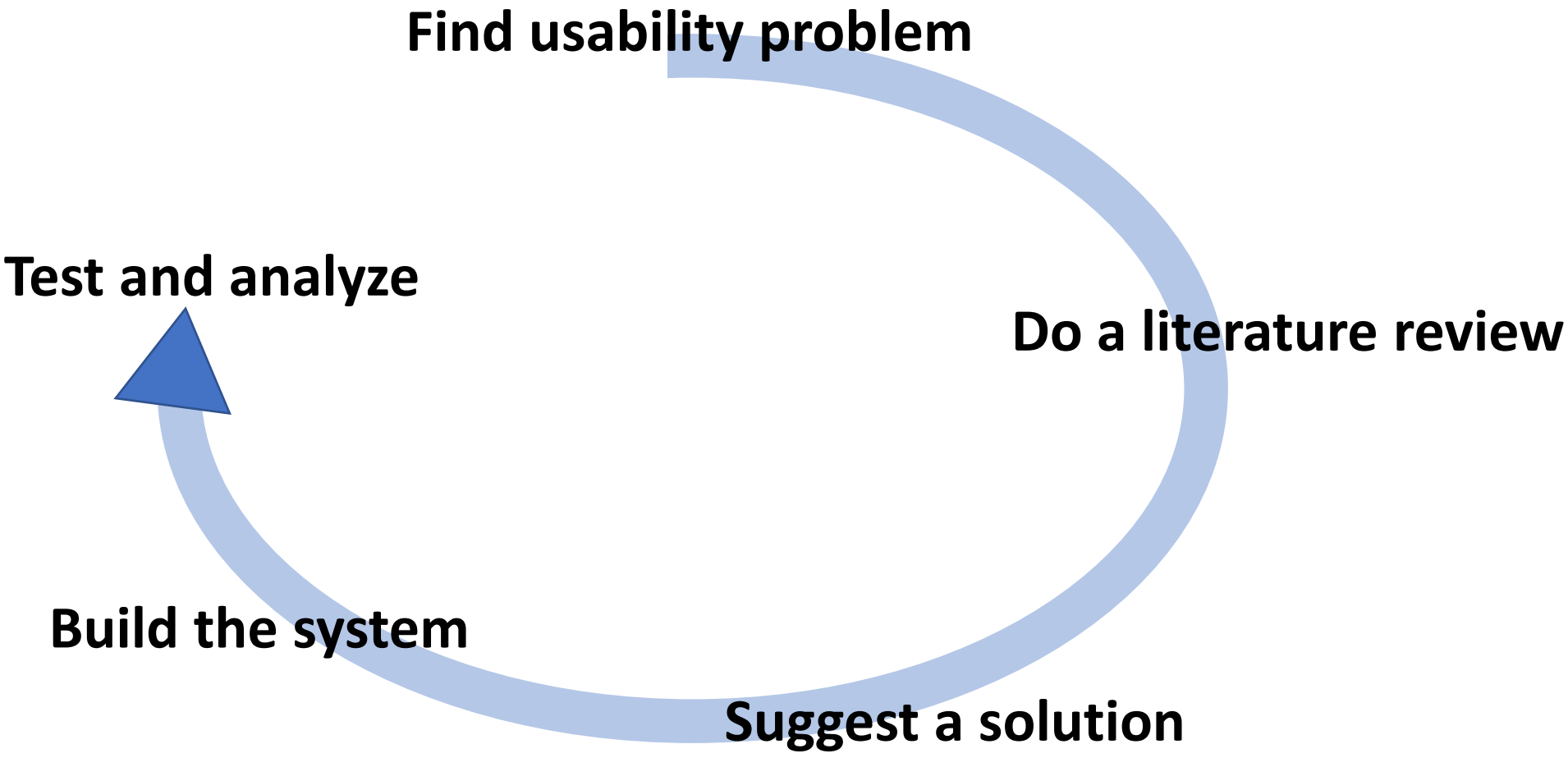
# Research Methods

- Observational Method
- Experimental Method
  - Acquire knowledge through controlled lab experiments.
  - Tests if changes to a manipulated variable result in changes to a response variable.
  - High precision, low relevance.
- Correlational Method

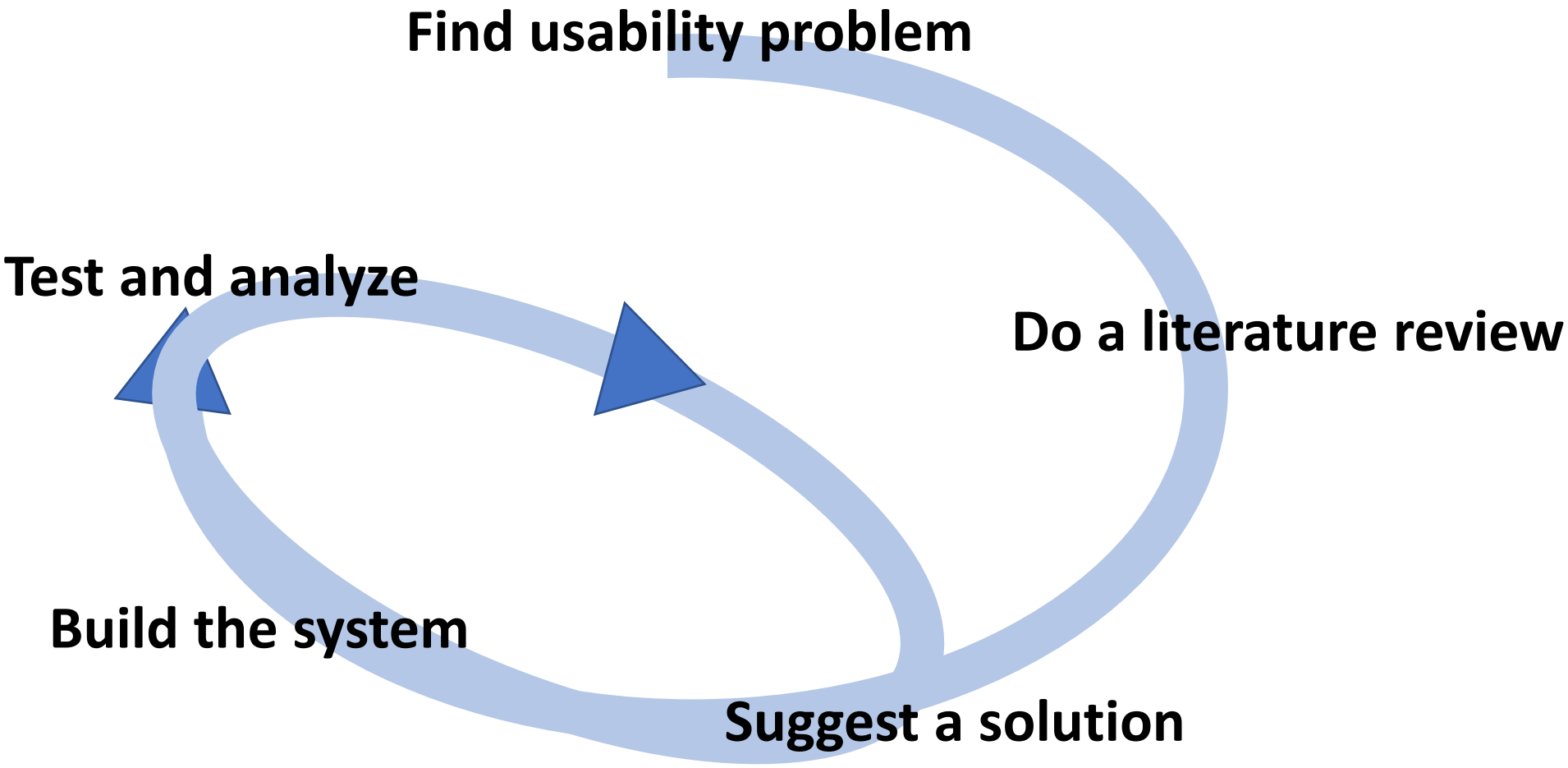
# Research Methods

- Observational Method
- Experimental Method
- Correlational Method
  - Look for relationships between variables.
  - Uses data collected through variety of methods, e.g., interviews, surveys, questionnaires, etc.
  - Provides a balance between relevance and precision

# Conducting HCI Research



# Conducting HCI Research



# Step-by-step guide with an example

## Crowdsourcing Step-by-Step Information Extraction to Enhance Existing How-to Videos

**Juho Kim**[1] **Phu Nguyen**[1] **Sarah Weir**[1] **Philip J. Guo**[1,2] **Robert C. Miller**[1] **Krzysztof Z. Gajos**[3]

[1]MIT CSAIL
Cambridge, MA USA
{juhokim, phun, sweir, rcm}@mit.edu

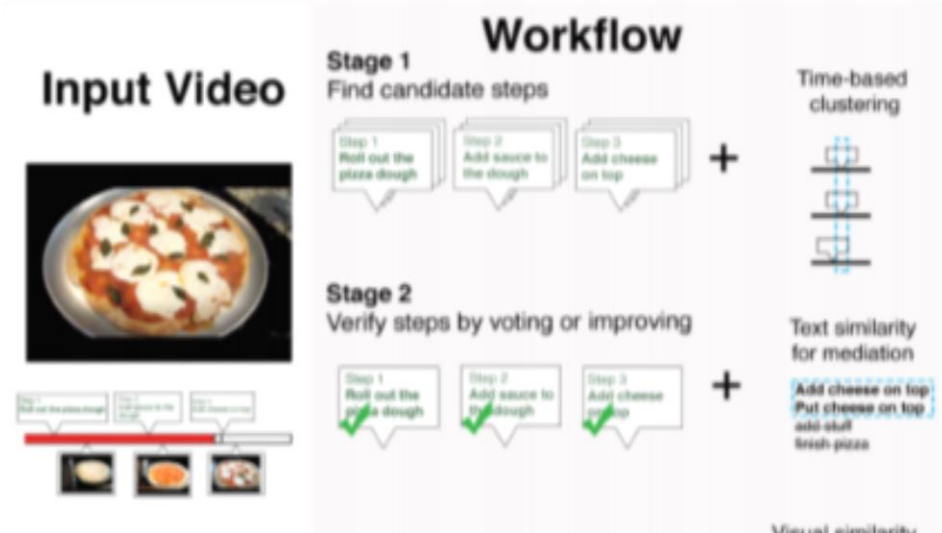
[2]University of Rochester
Rochester, NY USA
pg@cs.rochester.edu

[3]Harvard SEAS
Cambridge, MA USA
kgajos@eecs.harvard.edu

**ABSTRACT**

Millions of learners today use how-to videos to master new skills in a variety of domains. But browsing such videos is often tedious and inefficient because video player interfaces are not optimized for the unique step-by-step structure of such videos. This research aims to improve the learning experience of existing how-to videos with *step-by-step annotations*.

We first performed a formative study to verify that annotations are actually useful to learners. We created ToolScape, an interactive video player that displays step descriptions and intermediate result thumbnails in the video timeline. Learners in our study performed better and gained more self-efficacy



# Finding usability problem

- Find usability problems
- Can be found by observing people or reviewing literature
- Needs to be specific
  - Who is the target user
  - What is the task
- Make a problem statement
  - E.g. it is difficult for learners watching online how-to-videos to browse the video

# Do a literature review

- Don’t reinvent the wheel
  Know what other researchers have done and build your work upon it.

- Survey papers can be helpful if there’s one.

- Use keyword search or browse proceedings.

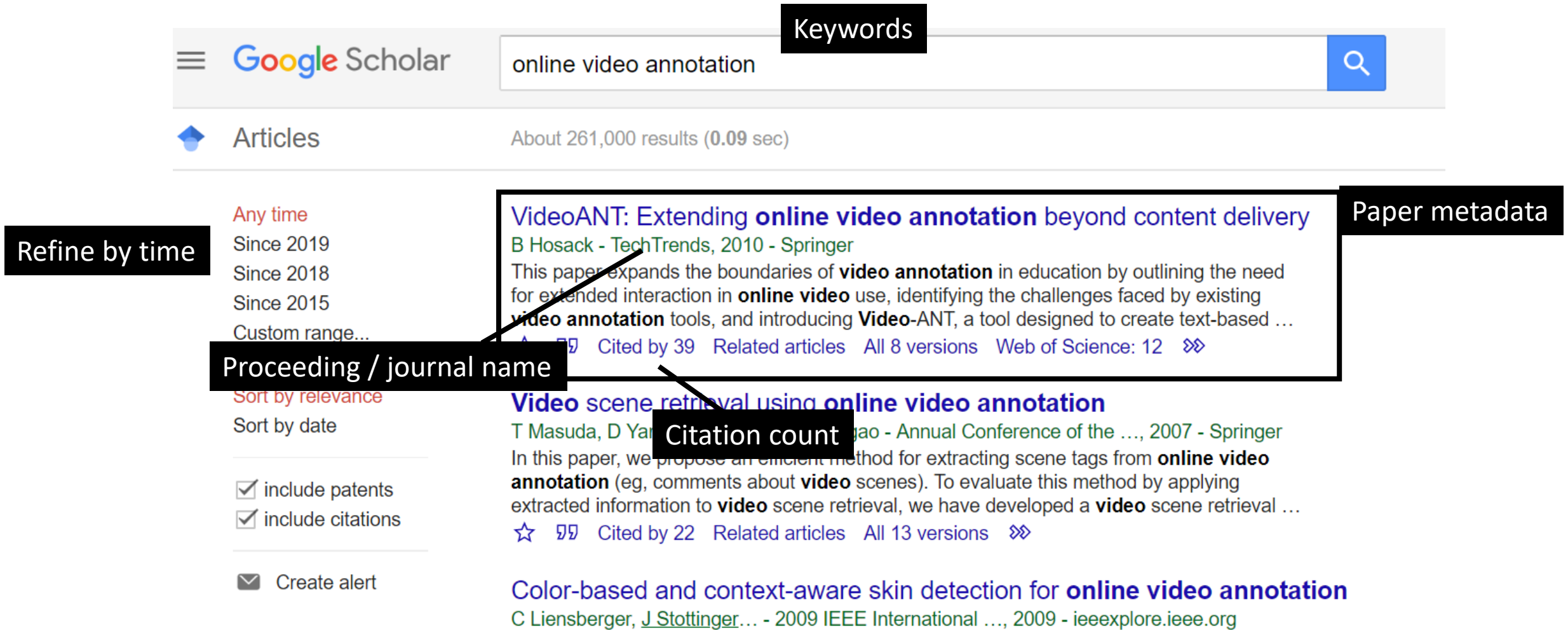
- Google Scholar is your friend.
  http://scholar.google.com

**"If I have seen further it is by standing on the shoulders of Giants."**

**-Isaac Newton in 1675**

# Do a literature review

- Finding papers using Google Scholar:



# Do a literature review

- Finding papers from a relevant paper

## RELATED WORK

We review previous research in leveraging interaction history to improve user interfaces and video navigation.

### Leveraging Interaction History

There is a rich thread of research in using interaction history data to analyze usage patterns and improve users' task performance. Interaction history data is automatically collected by applications during normal usage. Examples include Web browsers logging Web page visit history, search engines capturing query history, and video players storing video interaction clickstreams such as play and pause events. Read Wear [14] presented a visionary idea in this space to visualize users' read and edit history data in the scrollbar. Chronicle [12] captured and provided playback for rich, contextual user interaction history inside a graphical application. Dirty Desktops [16] applied magnetic forces to each interaction trace, which improved target selection for commonly used widgets. Patina [26] separated individual and collective history and added overlays on top of the GUI, to help people find commonly used menu items and discover new ways of completing desktop-related tasks. Causality [30] introduced an

## REFERENCES


1. Al-Hajri, A., Miller, G., Fong, M., and Fels, S. S. Visualization of personal history for video navigation. In *CHI '14* (2014).
2. Alexander, J., Cockburn, A., Fitchett, S., Gutwin, C., and Greenberg, S. Revisiting read wear: Analysis, design, and evaluation of a footprints scrollbar. In *CHI '09* (2009), 1665–1674.
3. Arman, F., Depommier, R., Hsu, A., and Chiu, M.-Y. Content-based browsing of video sequences. In *MULTIMEDIA '94* (1994), 97–103.
4. Baudisch, P., Cutrell, E., Hinckley, K., and Eversole, A. Snap-and-go: Helping users align objects without the modality of traditional snapping. In *CHI '05* (2005), 301–310.
5. Blanch, R., Guiard, Y., and Beaudouin-Lafon, M. Semantic pointing: Improving target acquisition with control-display ratio adaptation. In *CHI '04* (2004), 519–526.
6. Bostock, M., Ogievetsky, V., and Heer, J. $D^3$ data-driven documents. *Visualization and Computer Graphics, IEEE Transactions on 17*, 12 (2011), 2301–2309.
7. Carlier, A., Charvillat, V., Ooi, W. T., Grigoras, R., and Morin, G. Crowdsourced automatic zoom and scroll for video retargeting. In *Multimedia '10* (2010), 201–210.
8. Chi, P.-Y. P., Liu, J., Linder, J., Dontcheva, M., Li, W., and Hartmann, B. Democut: generating concise instructional videos for physical demonstrations. In *UIST '13*, ACM (2013).
9. Chorianopoulos, K. Collective intelligence within web video. *Human-centric Computing and Information Sciences 3*, 1 (2013), 10.

# Do a literature review

- Top venues in HCI
  - CHI: Largest conference. All topics are covered
  - UIST: User interface software and technology
  - CSCW: Computer-supported collaborative work
  - Assets: Accessiblity

# Suggest a solution

- Create a hypothesis
- Brainstorming and discussion can be very helpful
- Find other research projects that solves problems with similar characteristics

# Suggest a solution

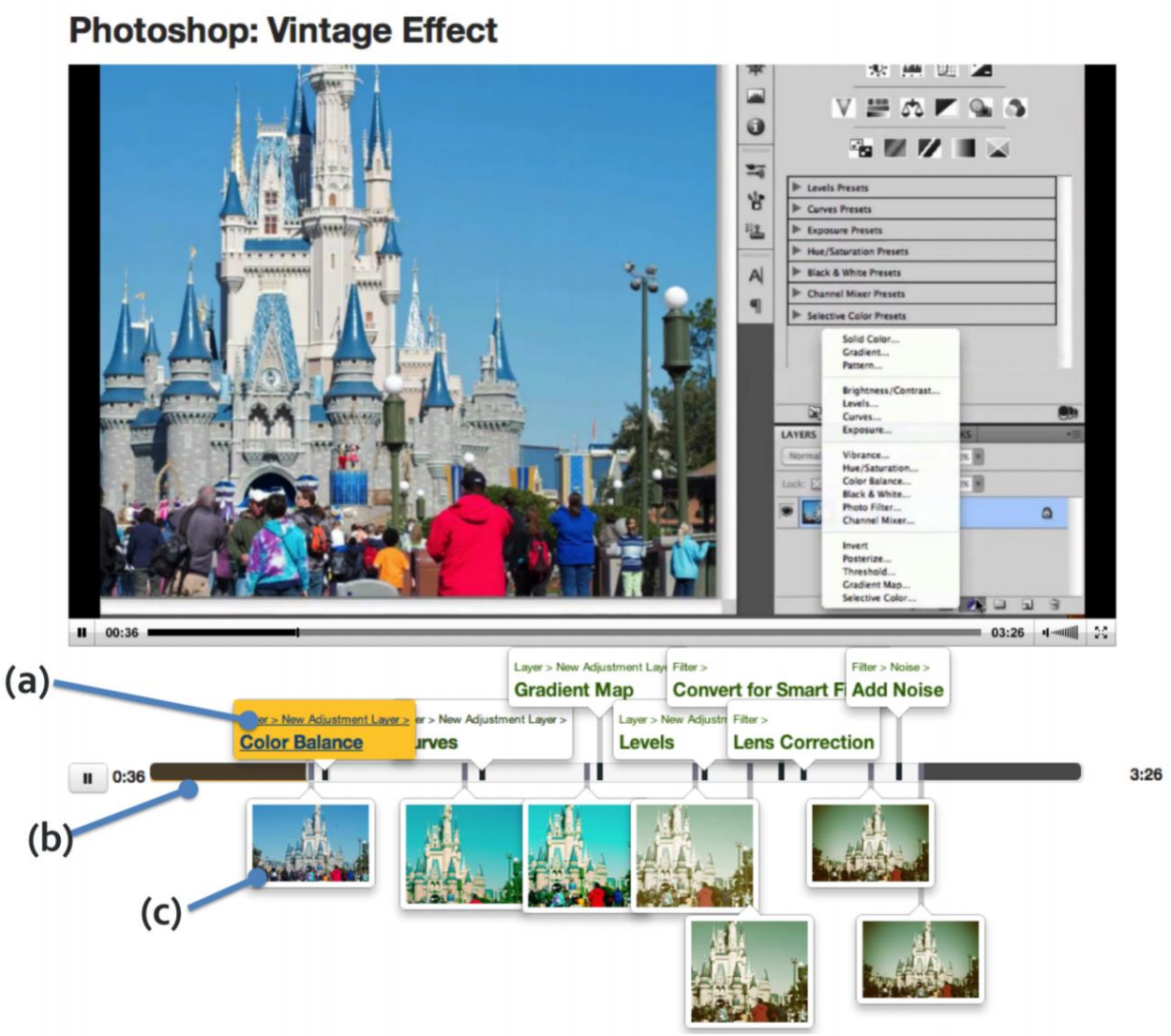



**Figure 4. ToolScape augments a web-based video player with an interactive timeline. Annotations are shown above the timeline (a), screenshots of intermediate states are shown below the timeline (c), and the gray regions at both ends (b) show "dead times" with no meaningful progress (e.g., waiting for Photoshop to launch).**

# Suggest a solution

**Task 1: Retro Effect**

Retro effect makes a photo look dated or analog,
with color effects such as color washes, light leaks, and blurs.

**What to do**

Your task is to apply Retro Effect to the image below.
You can use the video tutorial browsing interface during your work.
You have **20 minutes** to complete the task.

Make sure your Photoshop is open with the right image.

If you are ready to proceed, please click NEXT.

NEXT

**Task 2: Photo to Sketch Effect**

Convert a photo to look like a pencil-drawn sketch.

**What to do**

Your task is to apply Photo to Sketch Effect to the image be
You can use the video tutorial browsing interface during you
You have **20 minutes** to complete the task.

Make sure your Photoshop is open with the right image.

If you are ready to proceed, please click NEXT.

NEXT

**Formative Study Design**

To assess the effects of step annotations, we ran a formative study on novice Photoshop learners watching how-to videos on image manipulation tasks. We compared the experiences of learners using ToolScape and a baseline video player without the interactive timeline. We hypothesized that interacting with step annotations provided by ToolScape improves both task performance and learner satisfaction. Specifically:

**H1** Learners complete design tasks with a higher self-efficacy gain when watching how-to videos with ToolScape.

**H2** Learners' self-rating of the quality of their work is higher when watching with ToolScape.

**H3** Learners' designs when watching with ToolScape are rated higher by external judges.

**H4** Learners show higher satisfaction with ToolScape.

**H5** Learners perceive design tasks to be easier when watching with ToolScape.

# Build the system

- Focus on the core feature that you want to test.
  Product vs. Research prototype
- Don’t make the complete version at first.
- Iteration is the key.

# Build the system

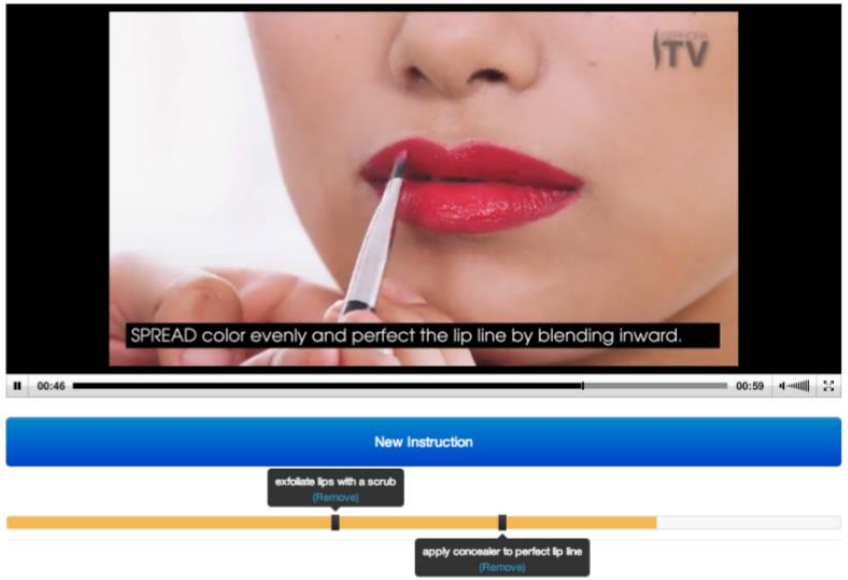



**Figure 6. In the Find stage, the crowd worker adds new steps to the timeline by clicking on the "New Instruction" button.**

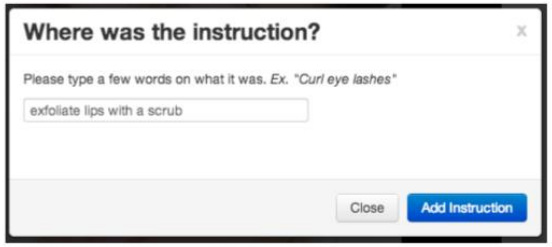



**Figure 7. Upon clicking on the "New Instruction" button, a popup window asks the worker to describe what the step is about in free-form text.**

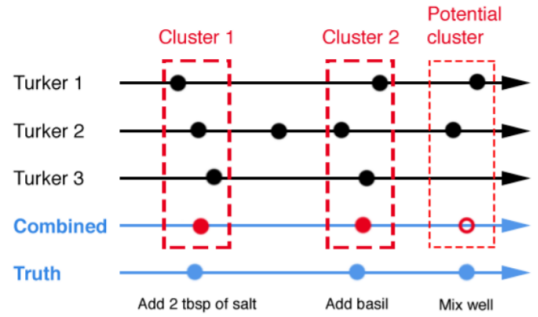



**Figure 8. Our clustering algorithm groups adjacent time points into a candidate step. It further adds a potential cluster as a candidate, which might turn out to be a proper step once checked in the Verify stage. This inclusive strategy mitigates the effect of clustering errors.**

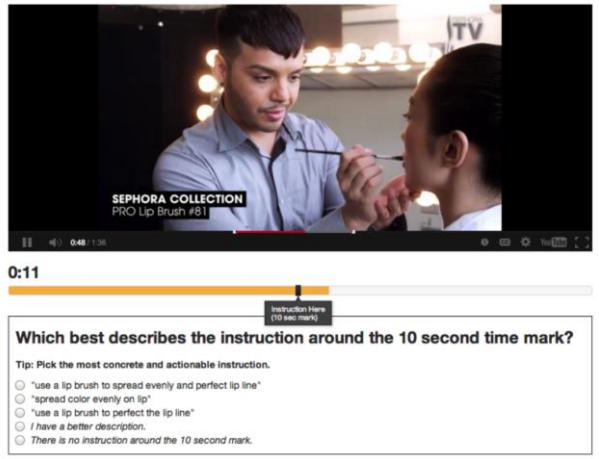



**Figure 9. The Verify stage asks the worker to choose the best description of a candidate step. The options come from workers in the Find stage. Additional default options allow the worker to either suggest a better description or mark the step as invalid.**

# Test the system

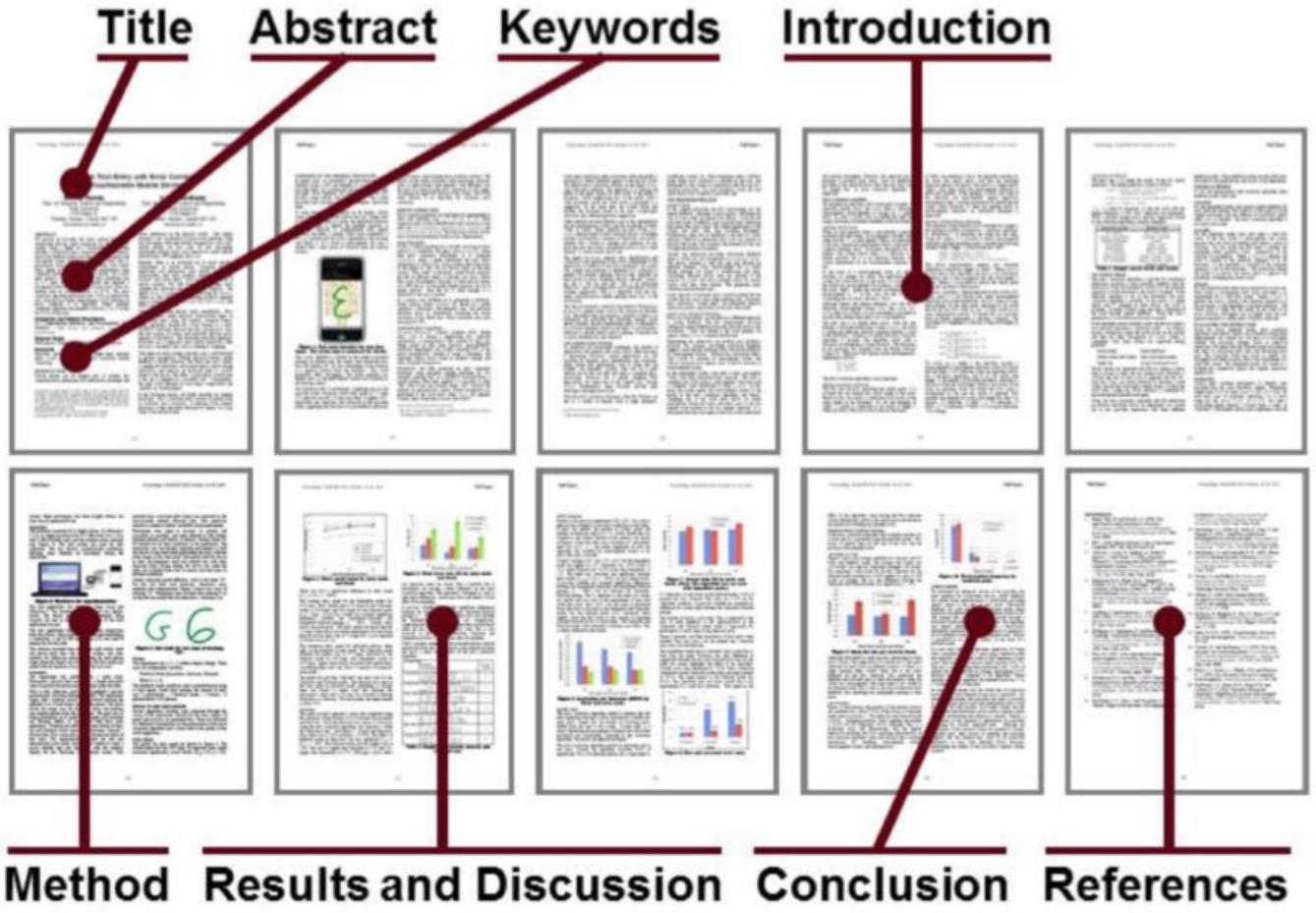
- Have a specific measure
  - How does it work? Is it any good?
  - Does the system extract similar number of steps from the video when used by untrained crowd workers to that extracted by experts?
  - Is typing with a new smartphone keyboard faster than QWERTY keyboard?

# Analyze and discuss

- Analyze the results
  - Test if the differences are statistically significant and how different.
  - Brake down the results in a smaller pieces to better understand the results.
    - E.g., time to complete typing = time to press keys + time to fix characters + (time to change modes)
- Discuss the results in your language

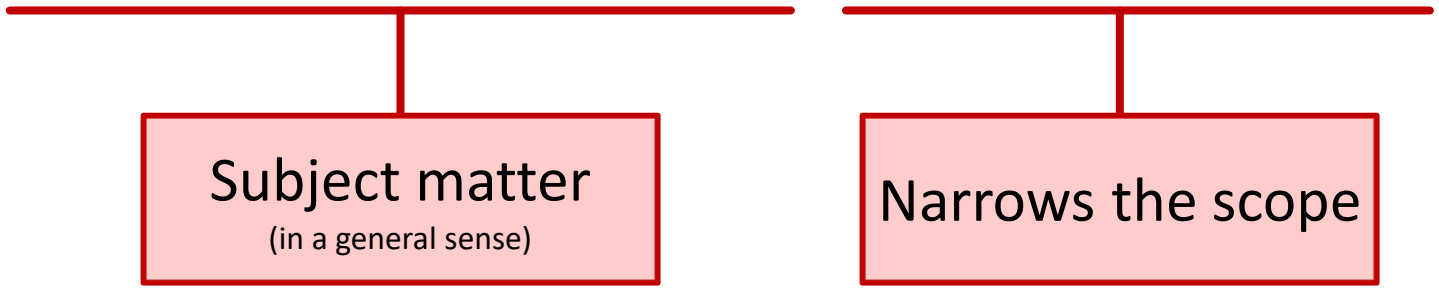
# Reading and Writing Research Papers

# Anatomy of a research paper



# Title

- Every word tells!
- The title must…
  - Identify the subject matter of the paper
  - Narrow the scope of the work
  - A title should be neither too broad nor too narrow
- Example: Eyes-free Text Entry with Error Correction on Touchscreen Mobile Devices



# Abstract

- Typically a word limit (e.g., 150 words)
- A single paragraph, no citations
- The abstract's mission is to tell the reader…
  - What you did
  - What you found
- Give the most salient finding(s)
- Common fault:
  - Treating the abstract as an introduction to the subject matter (don't!)

# Introduction

- Opening section of the research paper
- Gives the context for the research
- Opening comments characterise the state of the art
- A UI problem or challenge is noted and the reader is alerted to the impending solution (which is developed and evaluated in the rest of the paper)
- Specific contributions are highlighted

# Expected Content

- Contribution of the work
  - What is novel and interesting about the research?
- Literature review
  - Discuss related work (how it is similar and how it differs)
  - Include citations (with full information in reference section at end)
- Technical details of the proposed solution
- Sections and sub-sections
  - No rules (organize in any manner that seems reasonable)
  - It’s your story to tell!
- Aids
  - Use formulae, photos, drawings, screen snaps, sketches, or any appropriate visual aide to help the reader

# Conclusion, References

- Conclusion
  - Summarize what you did
  - Restate contribution and/or significant findings
  - Identify topics for further work (but avoid developing new ideas in the Conclusion section)
- Acknowledgment
  - Optional (thank people who helped, funding agencies)
- References
  - Full bibliographic information for papers cited
  - Format as required (details matter!)

# Research Must Be Reproducible

- A high standard or reproducibility is essential
- The research write-up must be sufficiently detailed to allow a skilled researcher to replicate the research if he/she desired
- The easiest way to ensure reproducibility is to follow a standardized methodology

# Video Break

# RichReview
## Blending Ink Speech and Gesture to Support Collaborative Document Review

**Dongwook Yoon**
**Francois Guimbretiere**

Cornell University
Information Science Department

**Nicholas Chen**
**Abigail Sellen**

Microsoft Research

Yoon, Dongwook, et al. "RichReview: blending ink, speech, and gesture to support collaborative document review." *UIST 2014.*

# Course Information

- Course website
  - http://seongkookheo.com/cs6501-fall2019/
  - Syllabus & Course materials
- Discussion & Announcement
  - Slack (topicshci.slack.com) – You need virginia.edu email to join
- Office hours
  - Wednesday 2-3pm, Thursday 10-11am
  - Rice 524

# In this course, you will

Learn the basic concepts of HCI

Learn evaluation methods in HCI

Learn recent research trends in HCI

Learn to conduct HCI research project

# In this course, you will

Present

Read

Analyze

Design, Build, Test

Discuss

# In this course, you will

Topic Presentations – 20%

Reading Responses – 10%

Assignments – 20%

Design Project – 40%

Participation – 10%

# Topic Presentation

- You will present the topic and the papers, and lead discussions on the topic.
- Thoroughly read the papers and discuss within the team.
- Every member of the team should present.
- 30 min presentation, 20 min discussion.

# Reading Response

- One-page report that you write about the reading material or one of the papers to be discussed in the class.
- One response per week
- Should include
  - A summary of the paper in your words
  - Your reaction to the paper, such as your thoughts and critiques about it.
  - Three paragraphs should be enough.

# Assignments

- There will be two assignments for you to try the methods learned at class.
- You will be collecting data and analyze them and submit reports.
- Should be done individually.

# Design Project

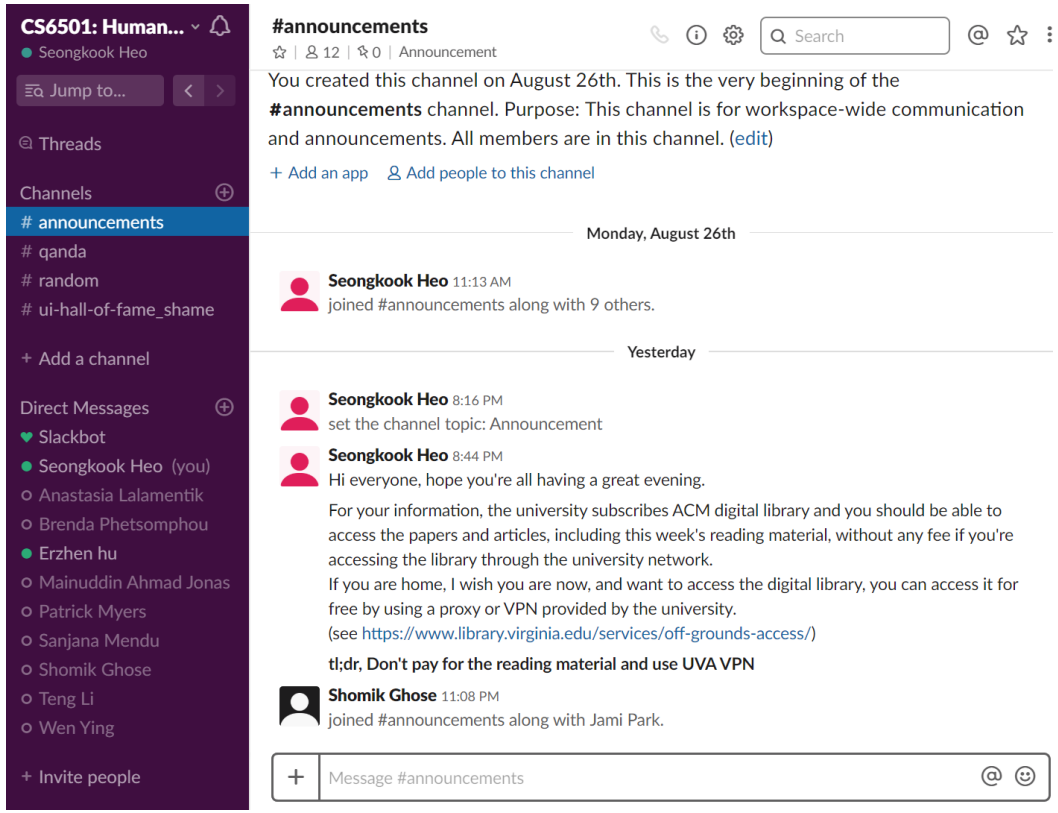
- You will design and build an interactive system.
- You will evaluate the system through user study.
- Connecting your ongoing research is encouraged.
- There will be three presentations, proposal, progress, and final.
- You may use any programming language or computing platform.
- Team of 3-4

# Participation

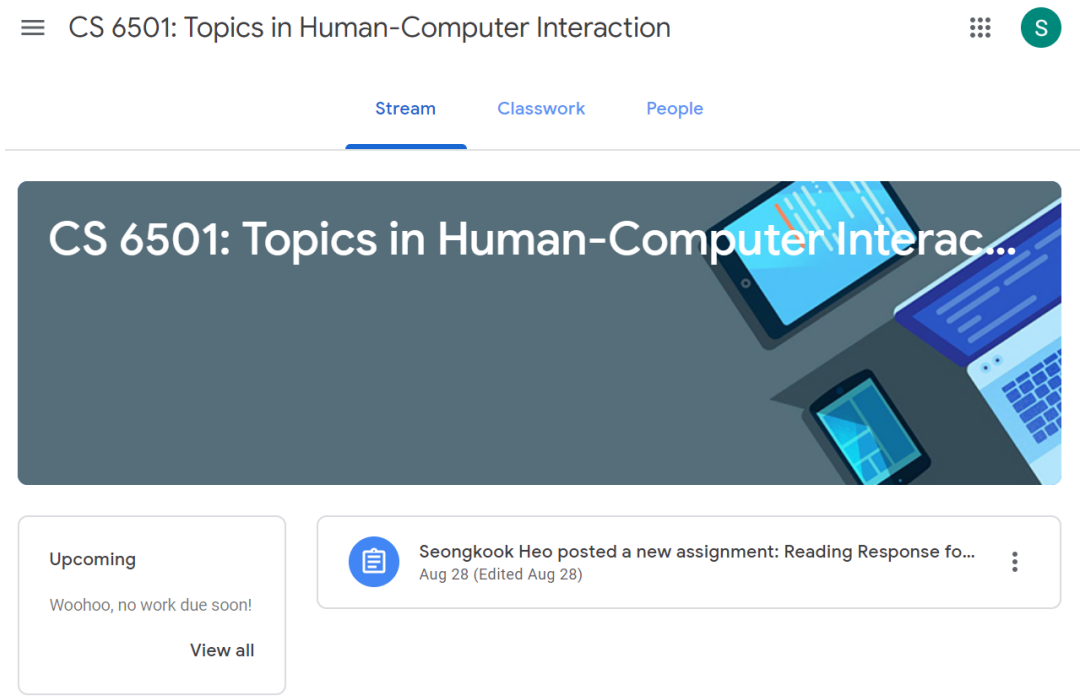
- Your participation matters!
- Comment, ask questions, and give feedback.
- Do not multitask during the class unless absolutely necessary.

# Slack and Google Classroom

http://topicshci.slack.com
Use your virginia.edu email




http://classroom.google.com
Class code: hemfvt9



# Late Policy

- Reading responses
  - By 11:59pm (ET), the day before the class
  - No late submissions
  - Two lowest-graded reading responses will be removed
- Assignments and design project
  - By 11:59pm (ET)
  - You may submit reports until 3 days after the deadline, with 10%, 20%, 40% penalty

# TODO items for you

- Sign up for course Slack
  - http://topicshci.slack.com
  - Announcements, Q&A, Discussions
- Check course website
  - http://seongkookheo.com/cs6501-fall2019/
- Do a reading material of the week: As we may think
- If interested, you may check CHI conference proceedings at https://dl.acm.org/citation.cfm?id=3290605
- Sign up for the Google classroom – for assignment submissions
  - http://classroom.google.com
  - Class code: hemfvt9

# Acknowledgements


- Some of the materials are based on materials by
  - Tovi Grossman, Univ. of Toronto
  - Juho Kim, KAIST
  - Scott MacKenzie, Human-Computer Interaction: An Empirical Research Perspective

Thank you!