CSE 60427: Human-Centered Computing Research

Class Meeting 1: Introduction

Today

- My experience with HCI
- What is human-centered computing/human-computer interaction (HCI)?
- What will you get out of this class?
- Ice breaking
- Course logistics

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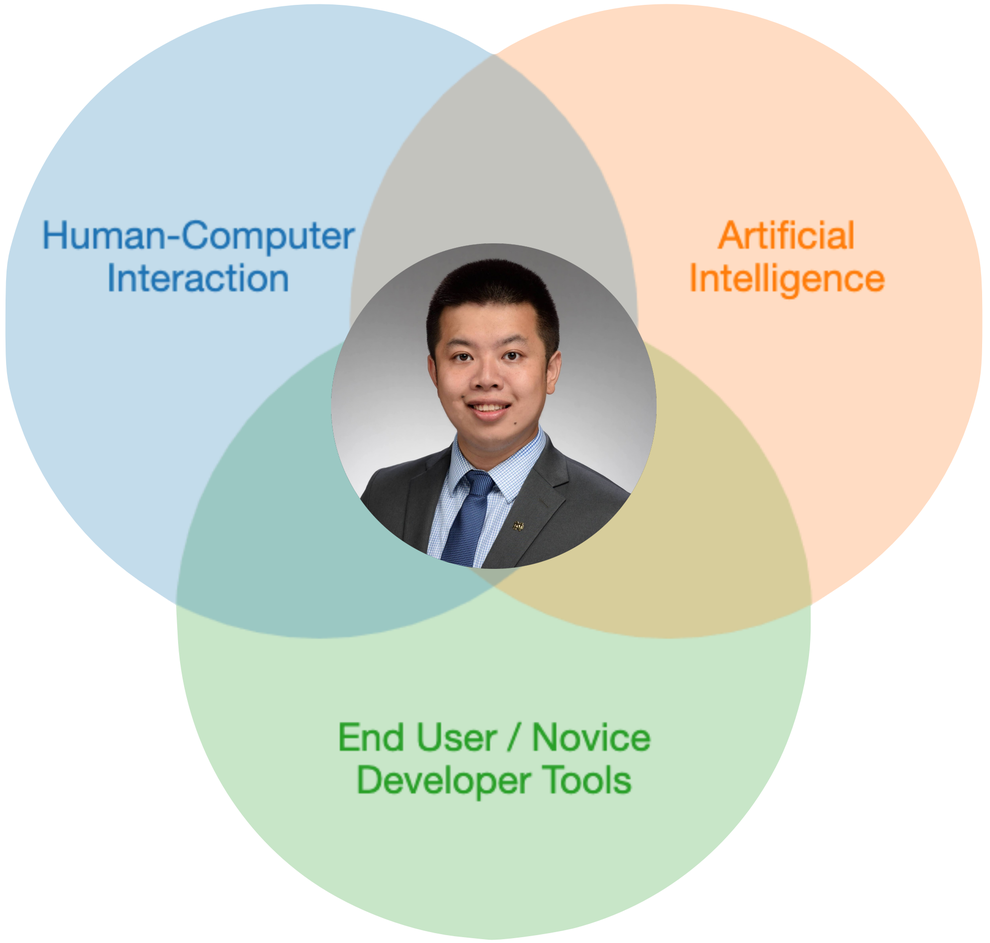
About me: Toby Li (he/him)

- Assistant Professor in Computer Science at the University of Notre Dame
- Ph.D. in Human-Computer Interaction at Carnegie Mellon University
- Research background in Human-Computer Interaction, Applied AI/NLP, and End-User Software Engineering

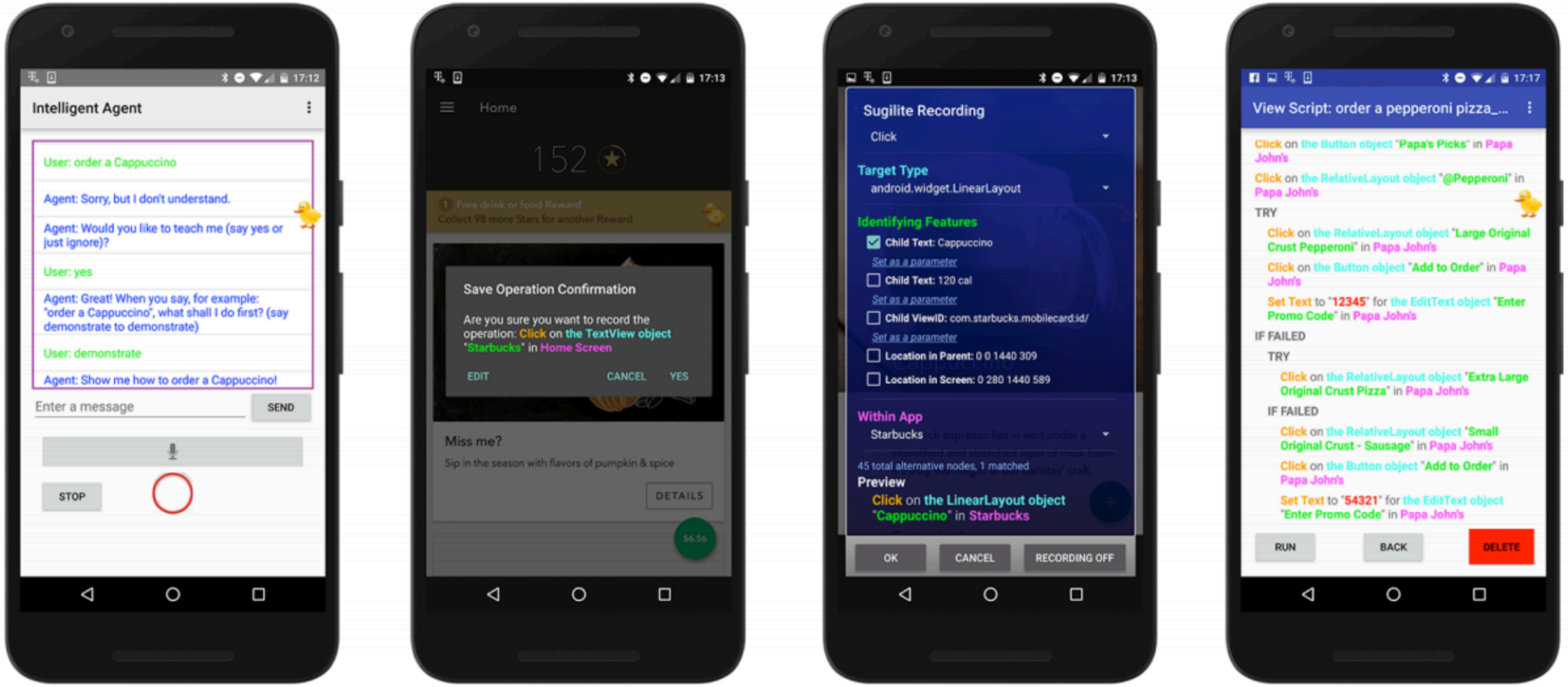


Starting with working on building an API library for supporting semantic analysis and knowledge retrieval using Wikipedia data …

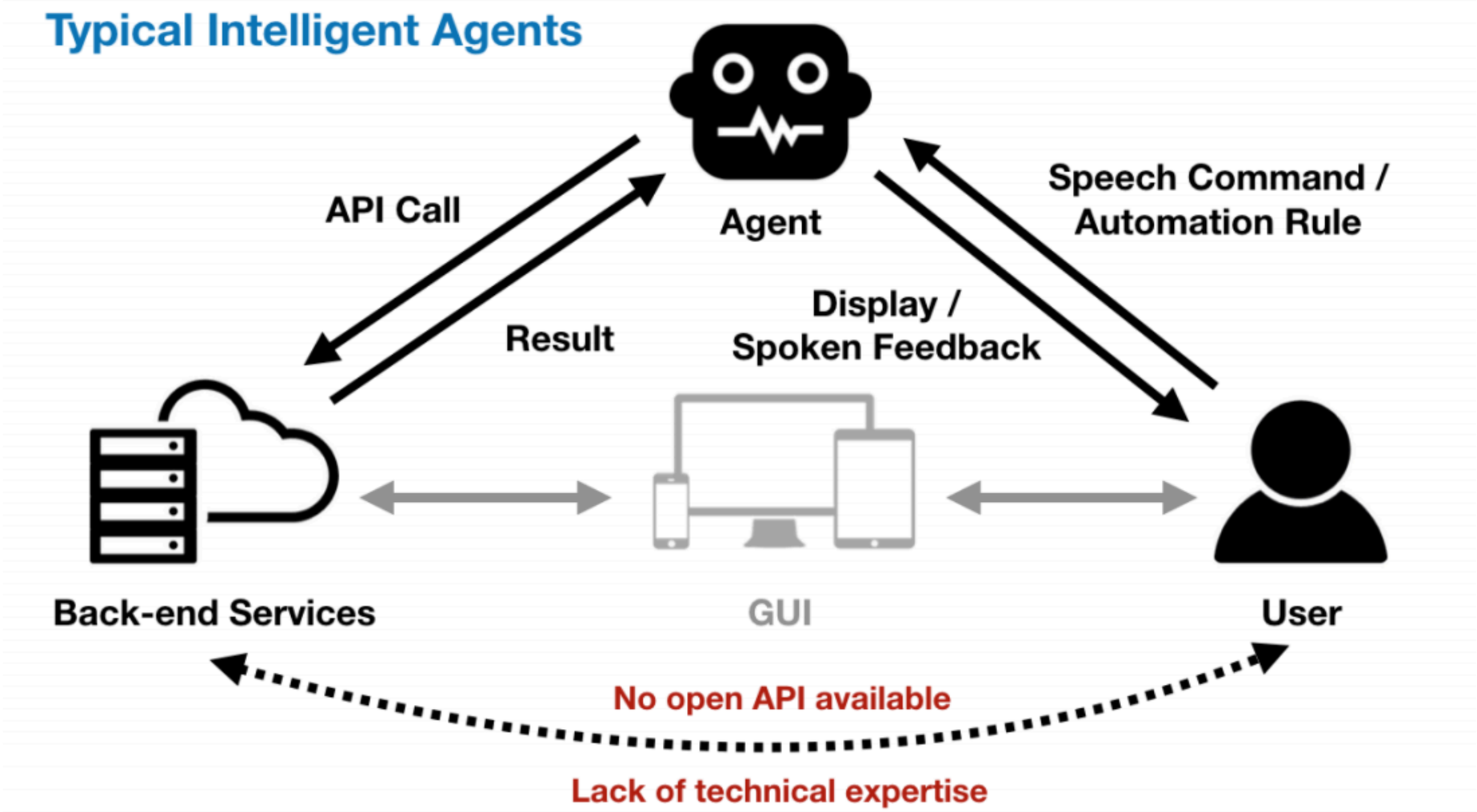
```
LanguageSet langs = new LanguageSet("en,de");
Map<UniversalPage, Point> locations = new HashMap<>();

// Get all geometries and their corresponding concept
// IDs for geographic articles not in the country or
     state layers
Map<Integer, Geometry> geo = sd.getAllGeometries(
        Layers.WIKIDATA, Layers.COUNTRY, Layers.STATE);

// Add points for all concepts that have articles
// in both the German and English Wikipedias
for (Integer conceptId : geo.keySet()) {
    UniversalPage concept = upd.getById(conceptId);
    if (concept.hasAllLanguages(langs)) {
        locations.put(concept,
                (Point)geo.get(conceptId));
    }
}
```

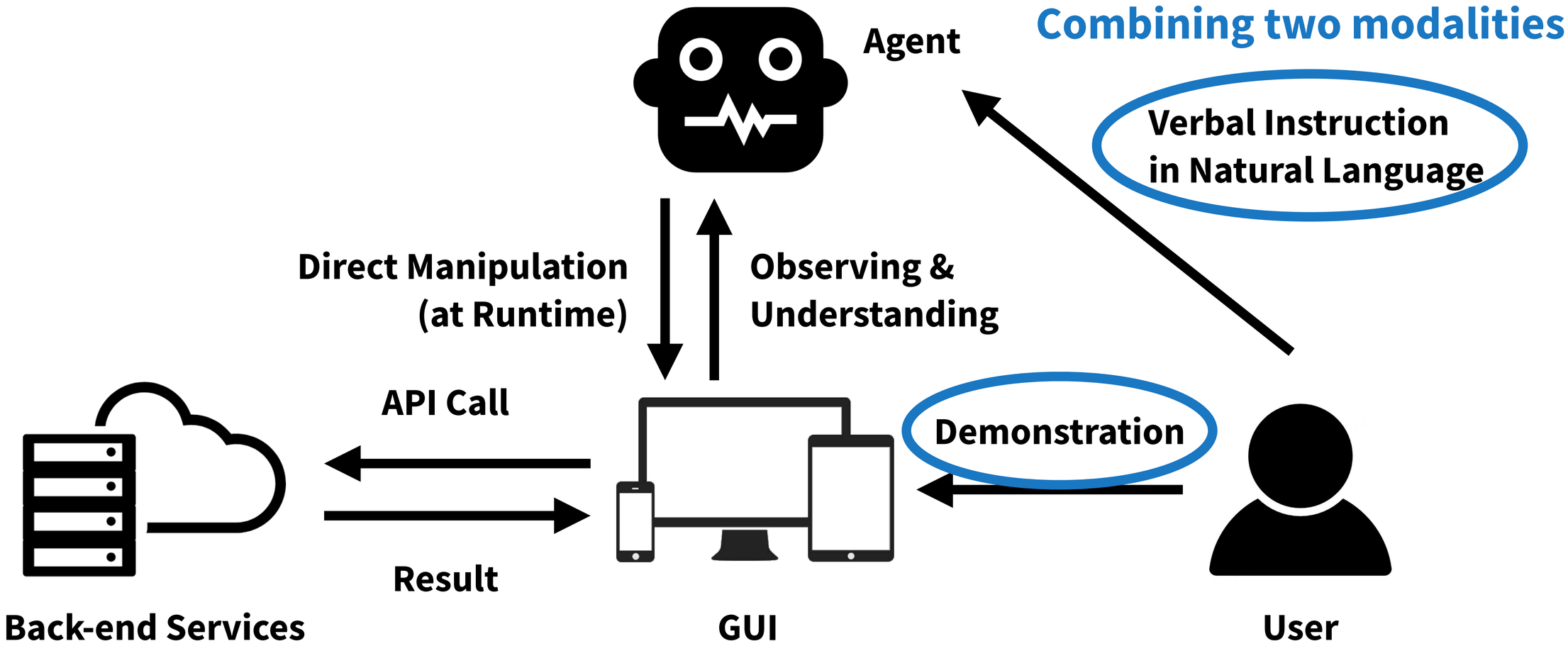
WikiBrain (WikiSym 2014)

Human-Computer Interaction Institute



WikiBrain (CHI 2017 🏅)


Typical Intelligent Agents
API Call
Result
Agent
Speech Command /
Automation Rule
Display /
Spoken Feedback
Back-end Services
GUI
User
No open API available
Lack of technical expertise

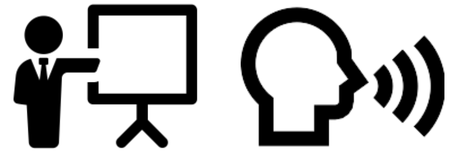

Agent
Combining two modalities
Verbal Instruction
in Natural Language
Direct Manipulation
(at Runtime)
Observing &
Understanding
API Call
Demonstration
Result
Back-end Services
GUI
User

From **making programming easier** to **human-agent collaboration**

Programming Language

From **making programming easier** to **human-agent collaboration**

Programming Language



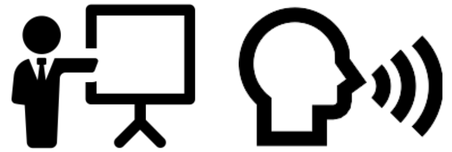
Unconstrained
Visual Demonstration and/or NL Instructions

From **making programming easier** to **human-agent collaboration**

Naturally Constrained
Visual Demonstration
and/or
NL Instructions

Programming Language

Human-Agent Collaboration in Task Learning



Unconstrained
Visual Demonstration
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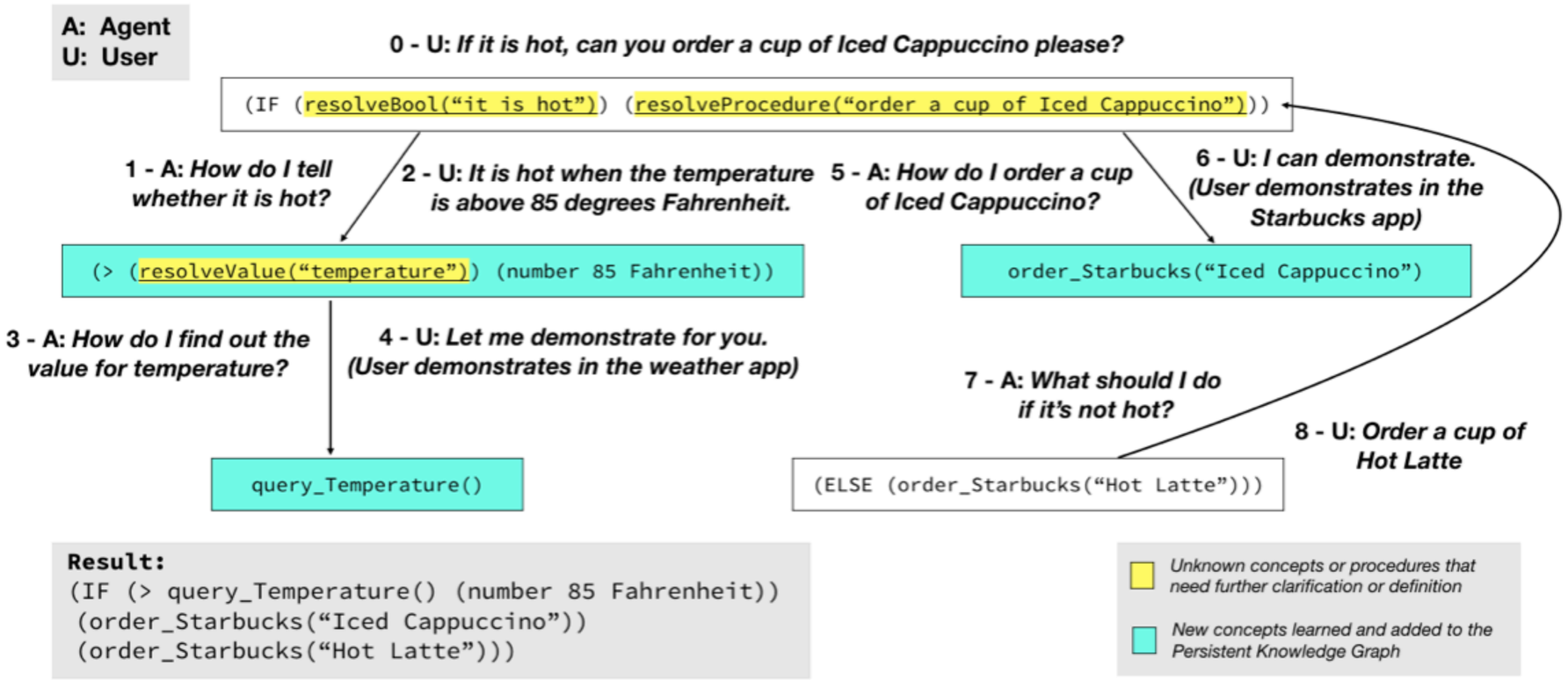
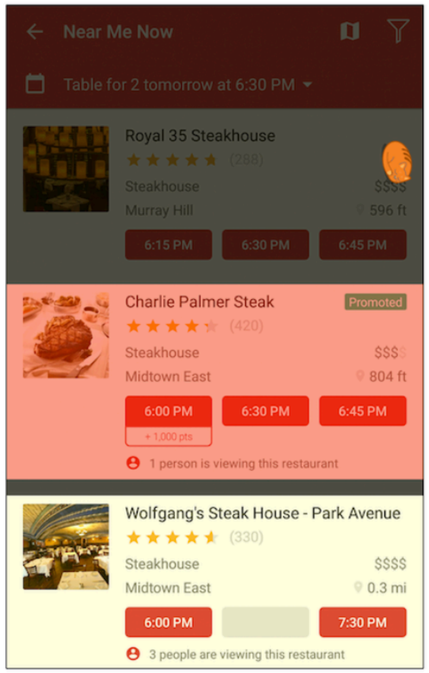
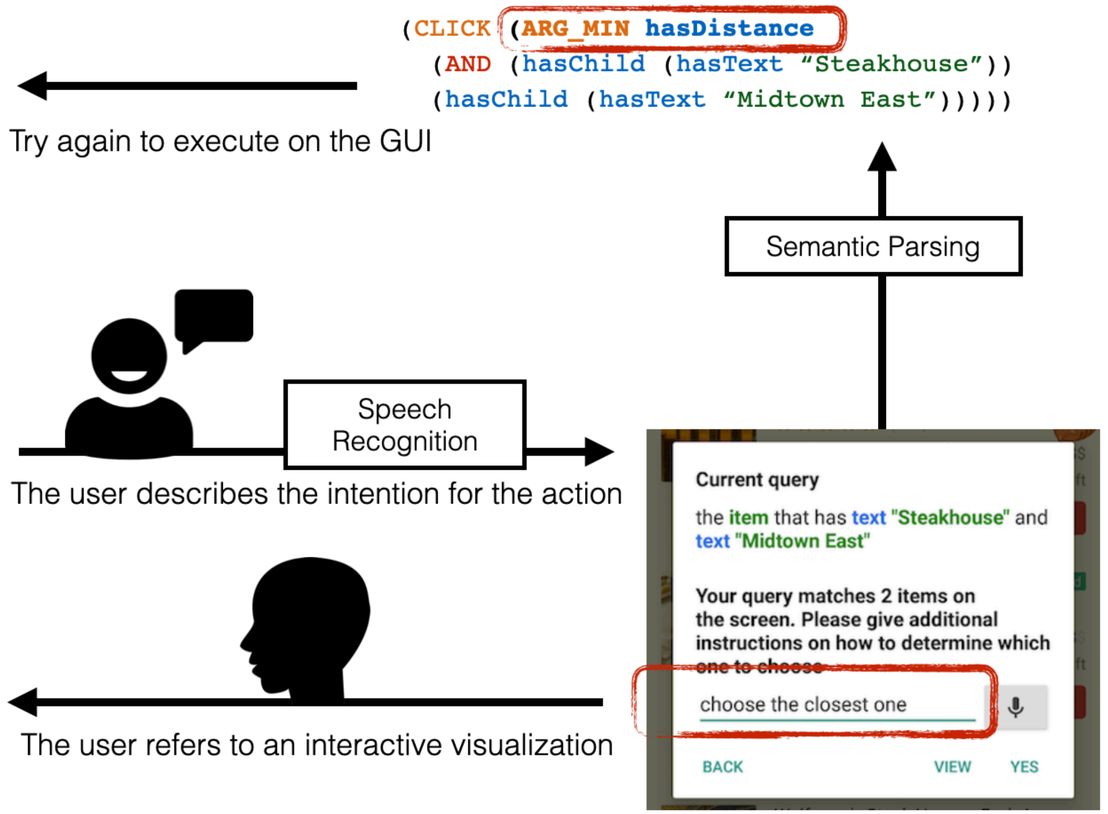
NL Instructions

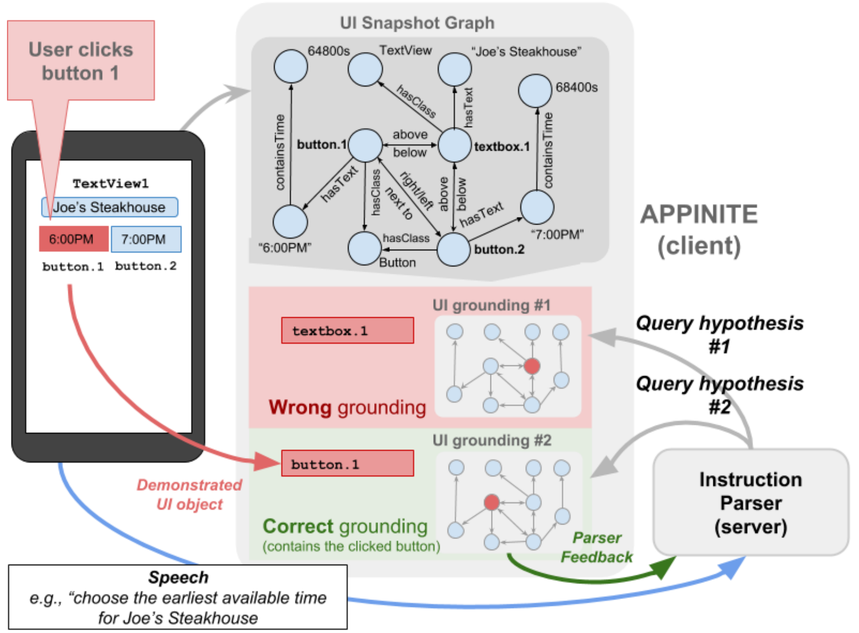


Top-down lazy-evaluation dialog structure in interactive learning (UIST 2019)

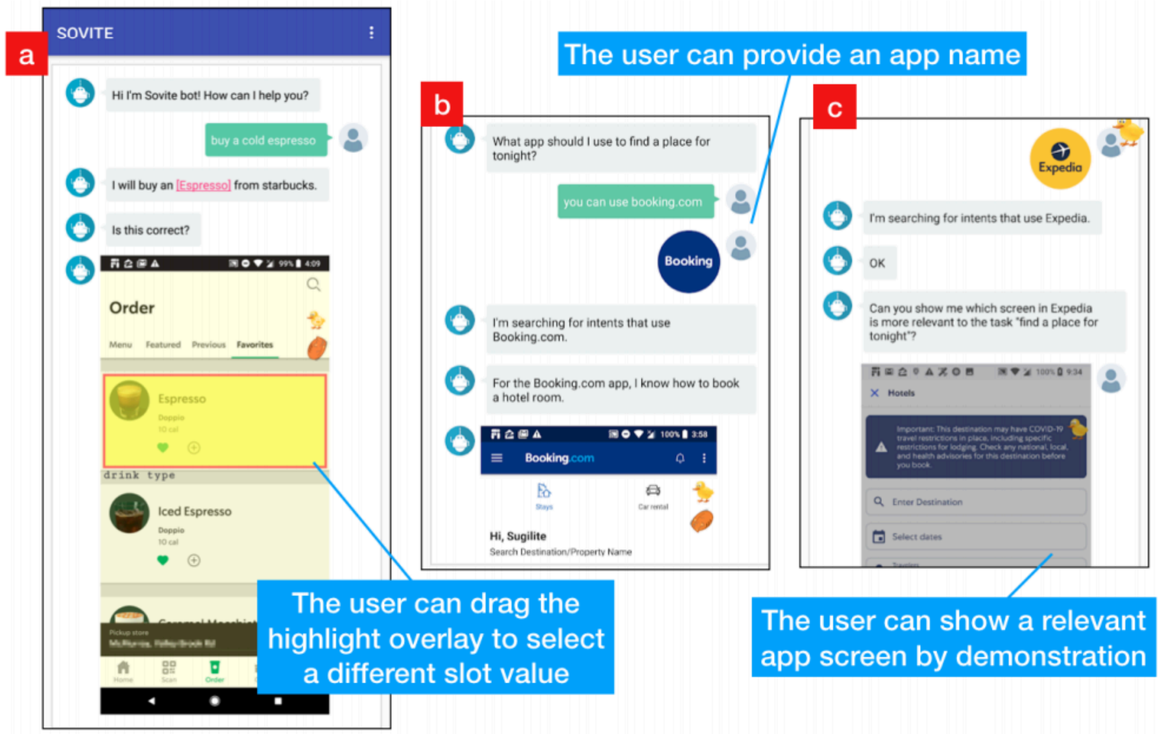


Interactive Visualization Overlay

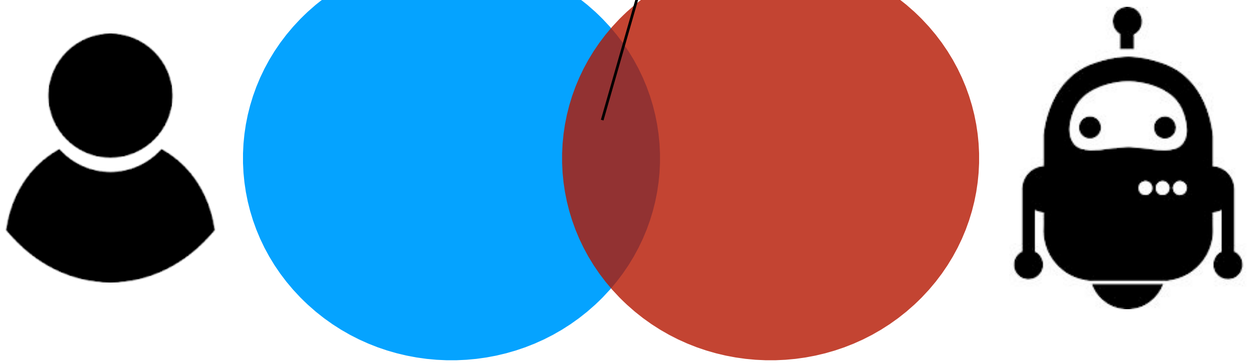




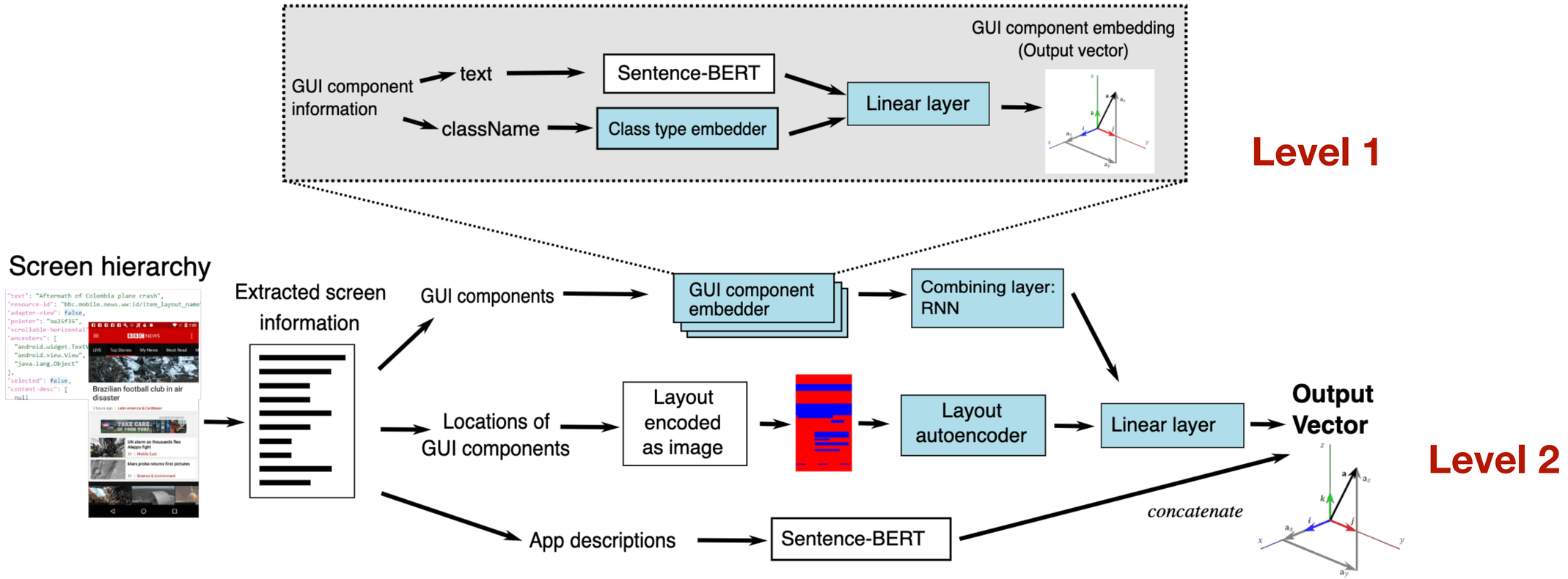
Iterative disambiguation with interactive visualization overlay (VL/HCC 2018) and GUI instruction grounding (ACL 2020)



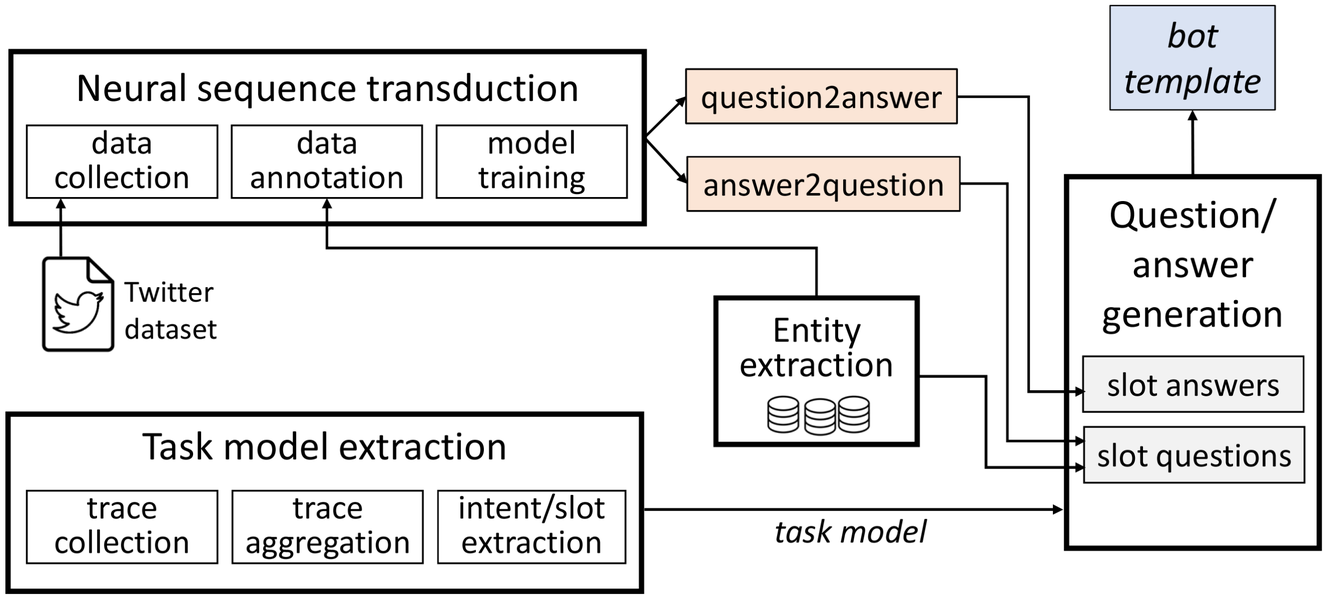
Common ground:
mutual knowledge
mutual belief
mutual assumption



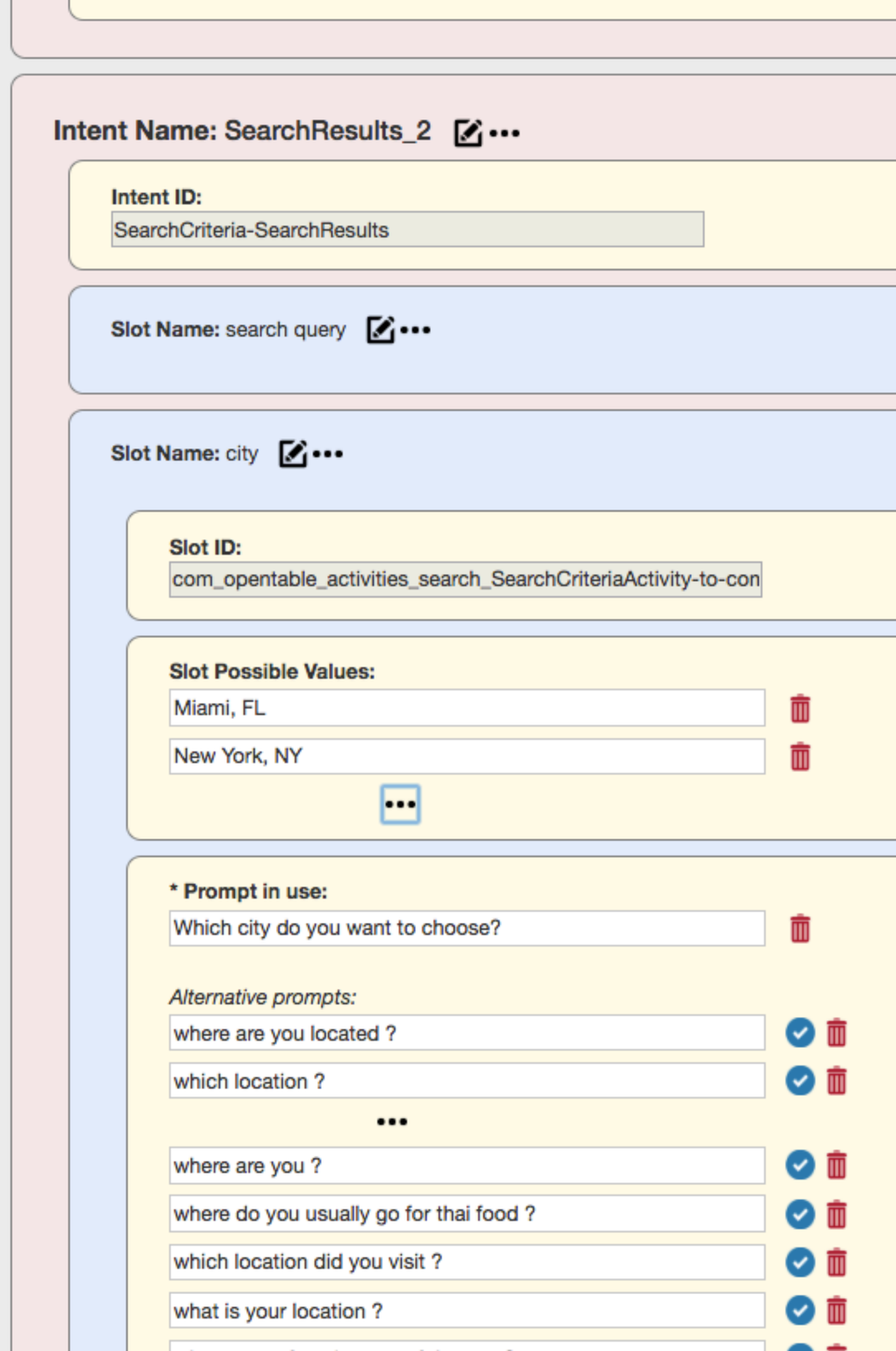
Multi-modal repair of conversational breakdowns (UIST 2020 🏆)

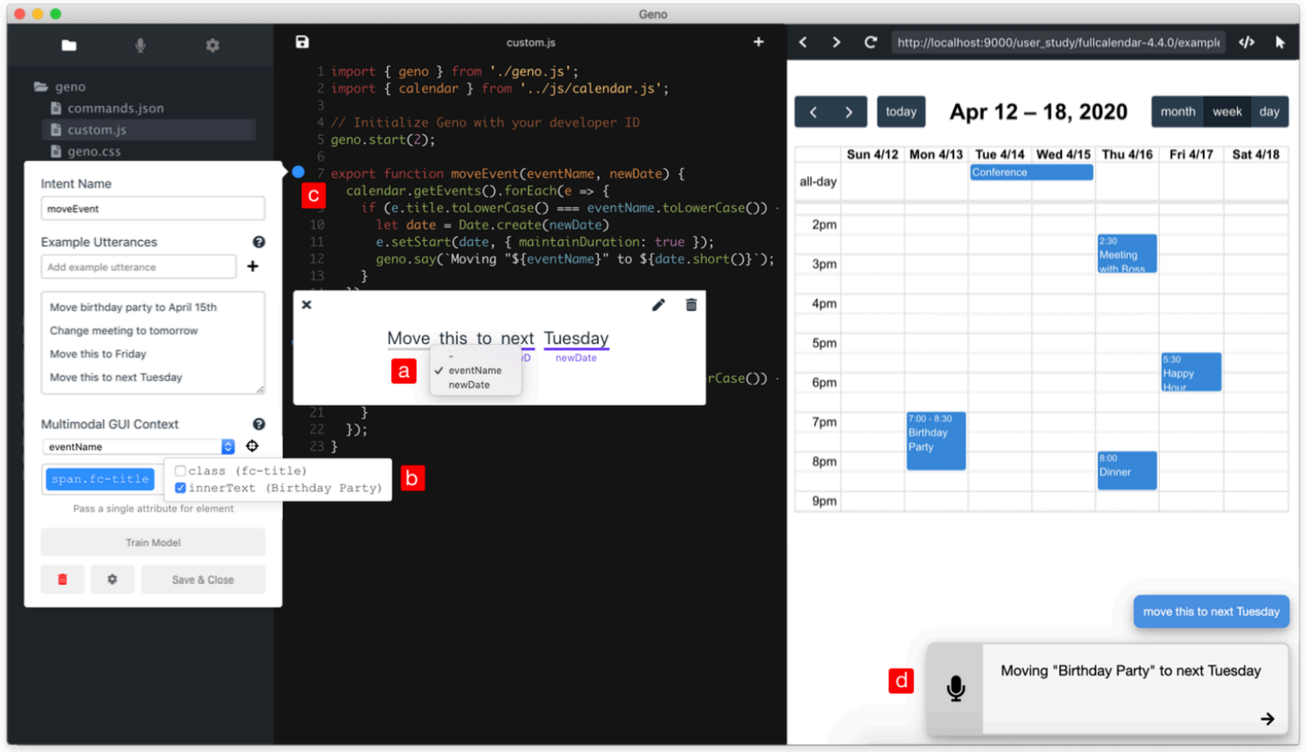


Screen2Vec: contextual semantic representation of GUI screens
(CHI 2021 🏅)



KITE: Bootstraping chatbots from user traces (MobiSys 2018)





GENO: authoring multi-modal interaction on existing web apps (UIST 2020)

HCI + X

Software engineering
Machine learning
Natural language processing
Robotics
Graphics
Sensors
Security and Privacy
Learning science
…

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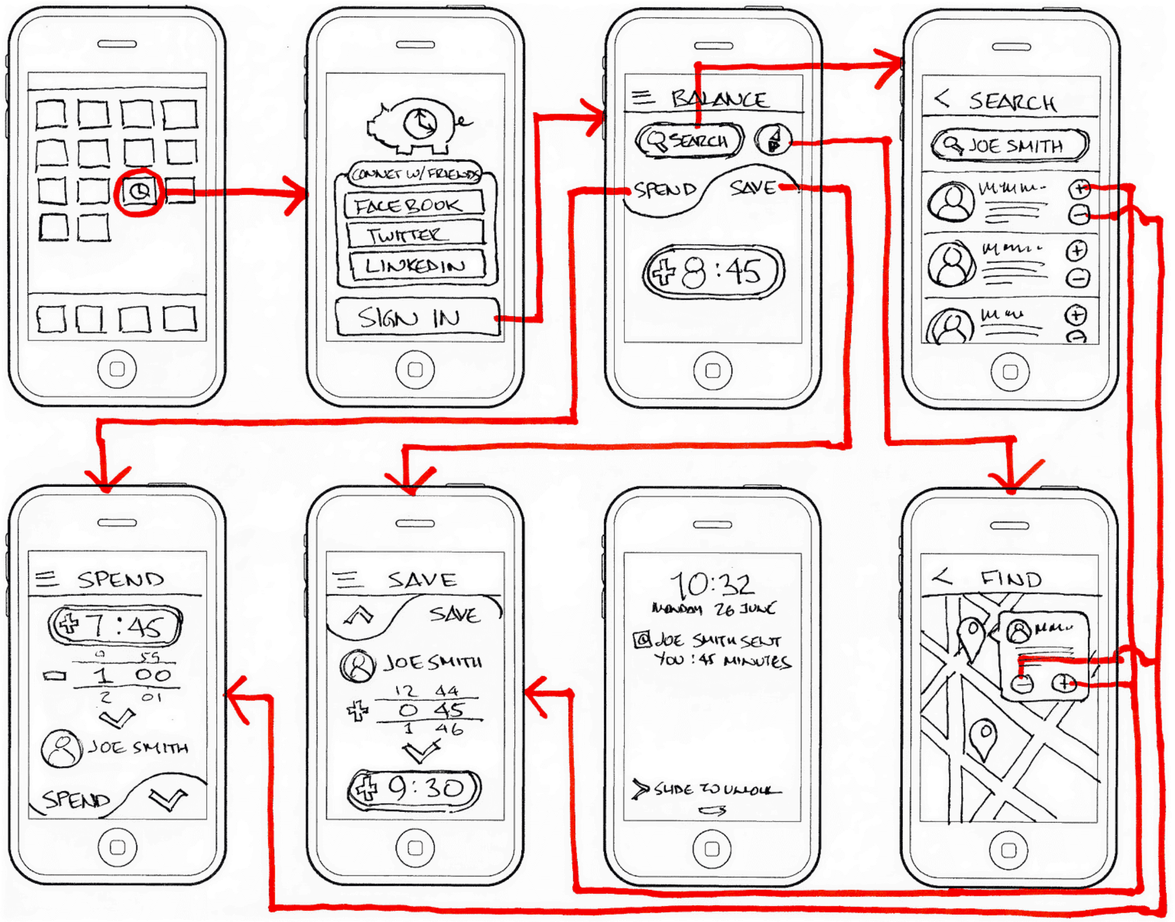
"The two hardest problems in computer science are: (i) people, (ii), convincing computer scientists that the hardest problem in computer science is people, and, (iii) off-by-one errors."

@jeffbigham

HCI Practice vs. HCI Research

- UX Research
  - UX (user experience) research is the systematic study of target users and their requirements
- UX Design
  - User experience (UX) design is the process design teams use to create products that provide meaningful and relevant experiences to users.



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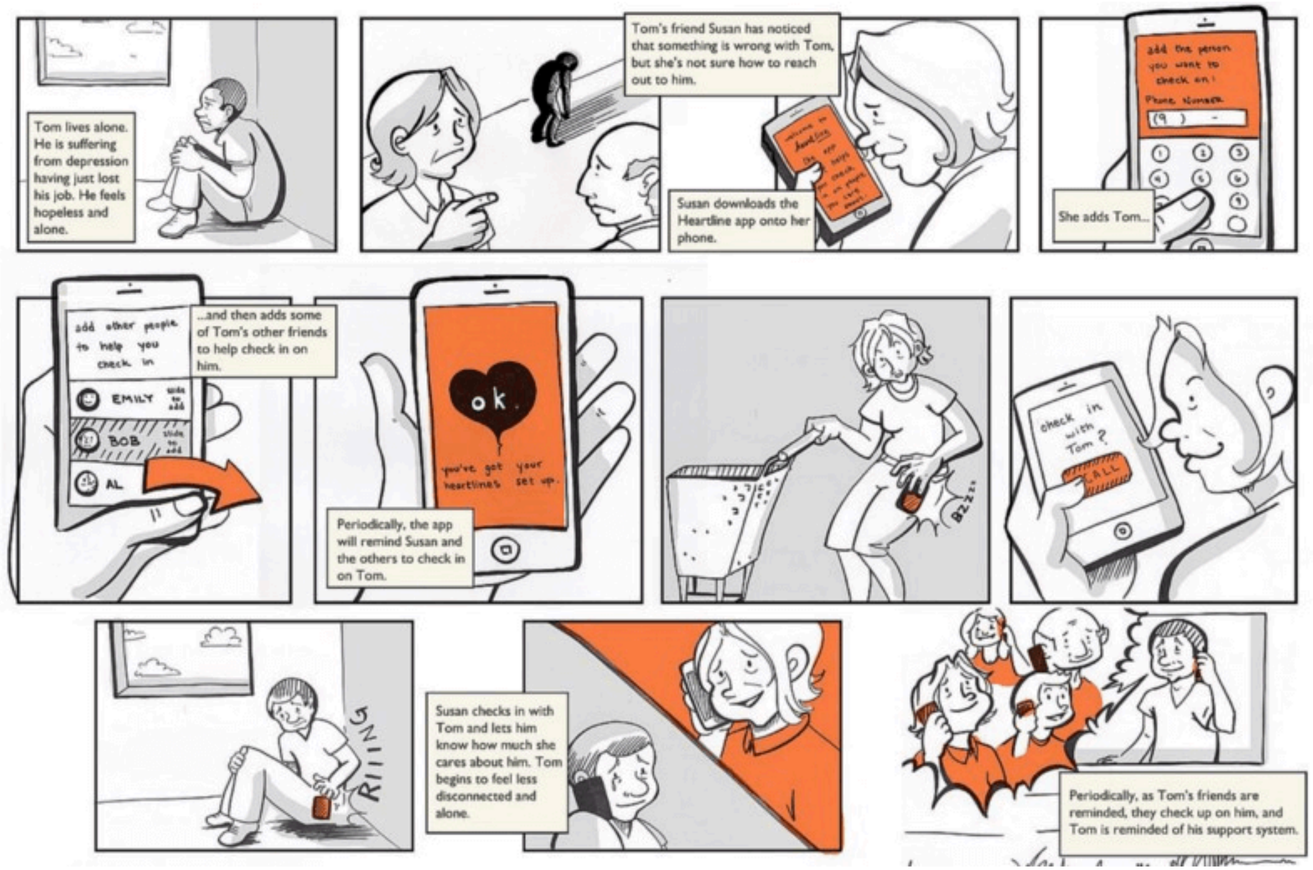

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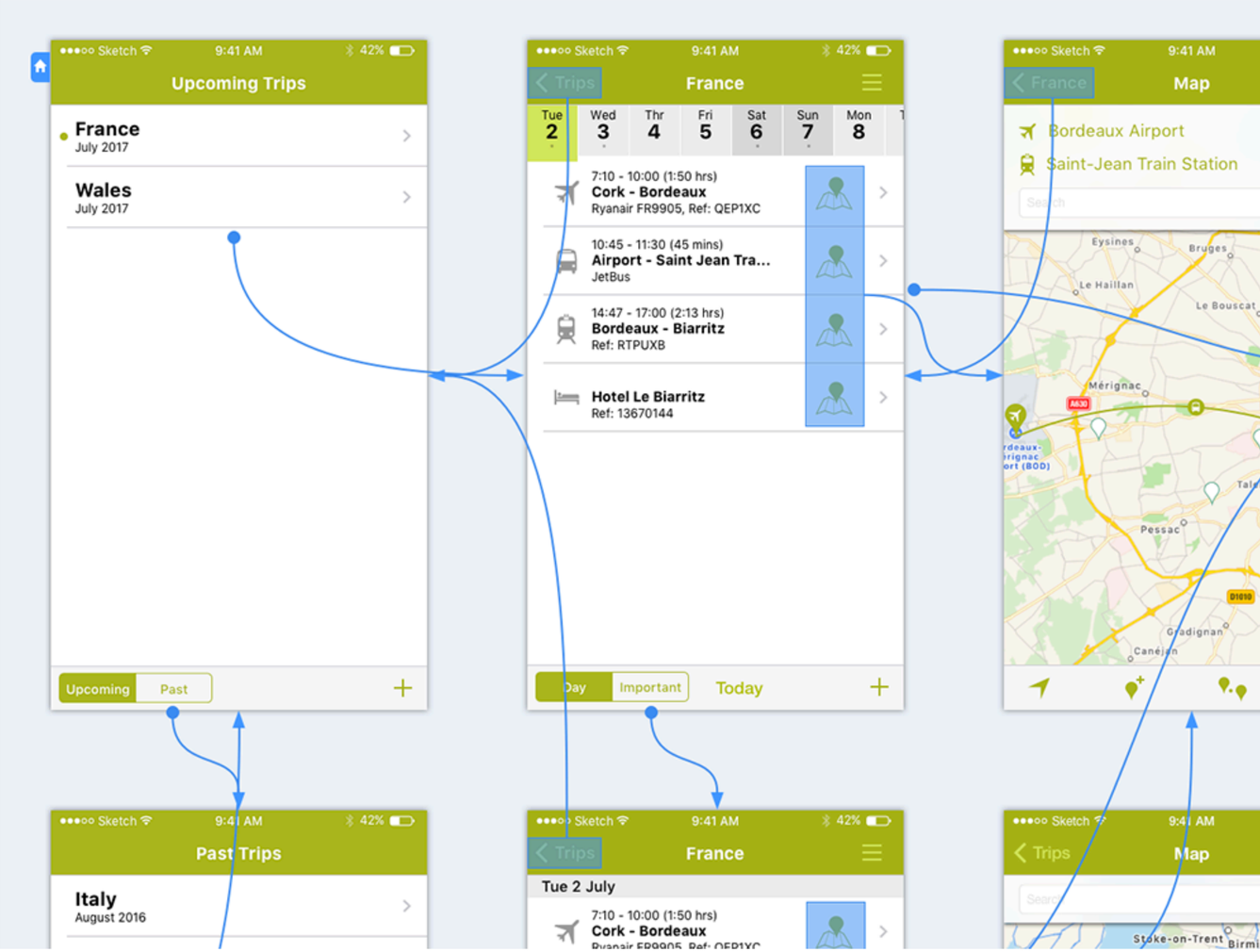

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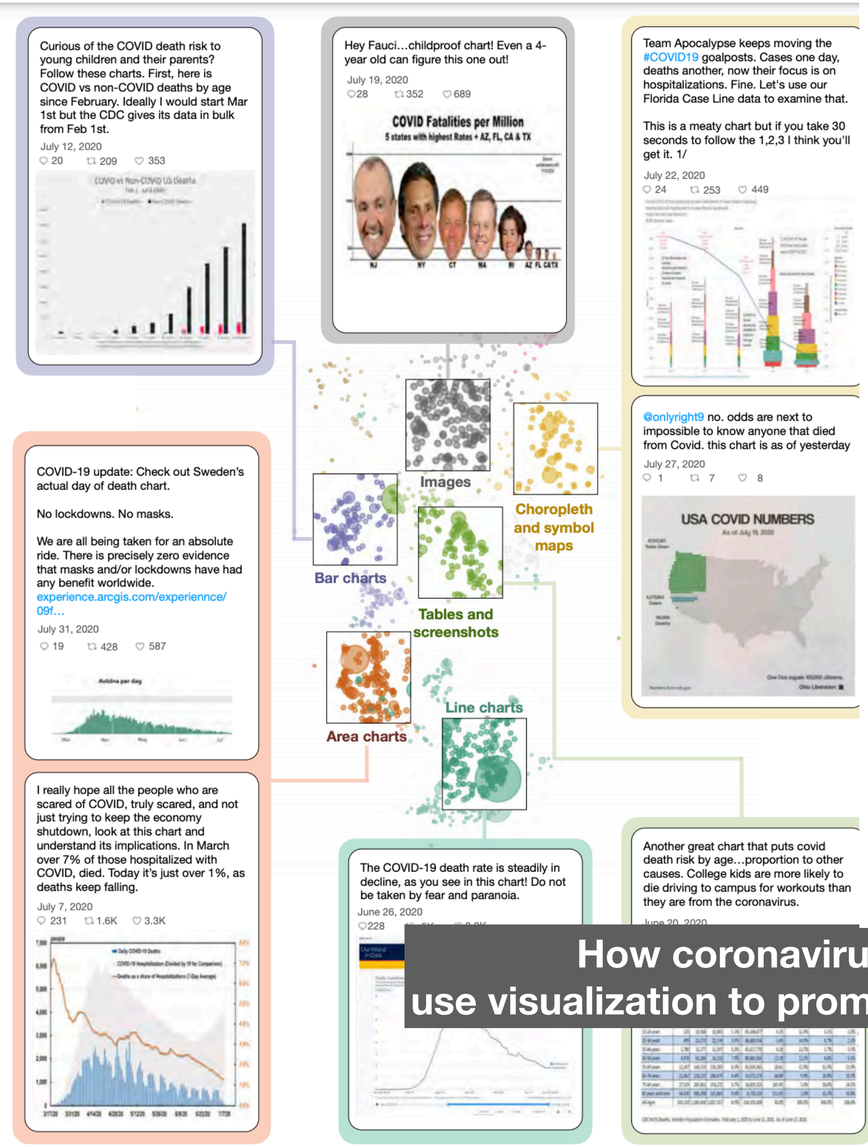
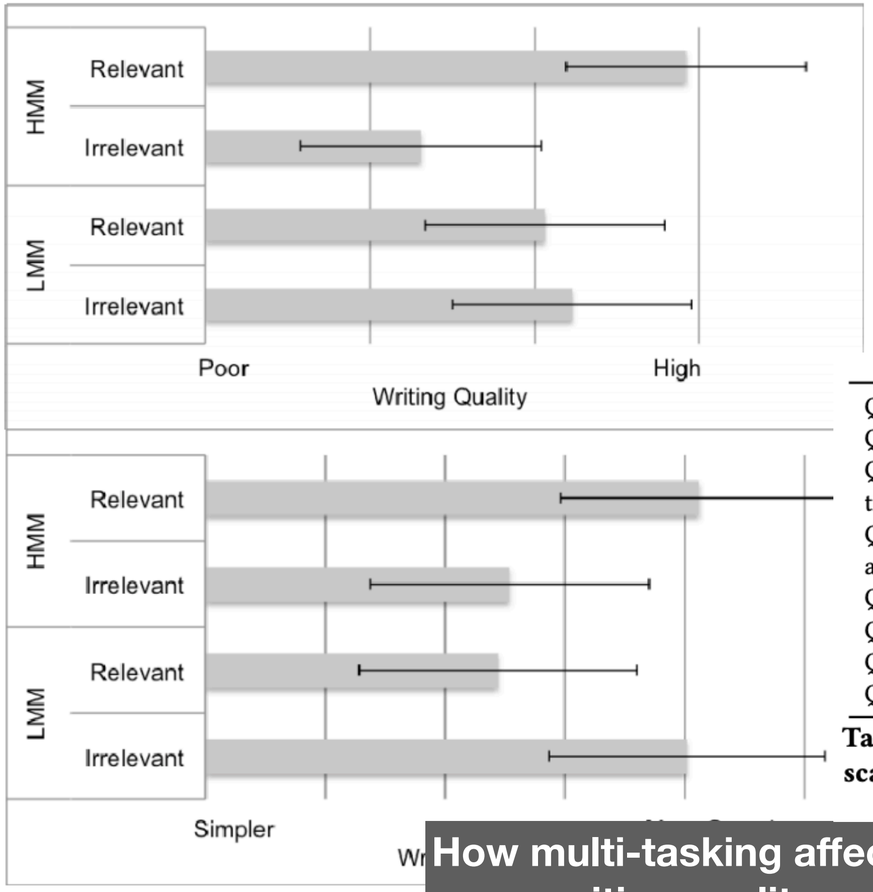
List of the Subcommittees

Sixteen subcommittees are listed and described below. Each has a title, short des indication of who will Chair and serve on the subcommittee and if a subcommitte multiple tracks. Subcommittees have been constructed with an eye to maintainin clusters of topics.

- User Experience and Usability
- Specific Applications Areas
- Learning, Education, and Families
- Interaction Beyond the Individual
- Games and Play
- Privacy and Security
- Visualization
- Health
- Accessibility and Aging
- Design
- Building Devices: Hardware, Materials, and Fabrication
- Interacting with Devices: Interaction Techniques & Modalities
- Blending Interaction: Engineering Interactive Systems & Tools
- Understanding People: Theory, Concepts, and Methods
- Critical and Sustainable Computing
- Computational Interaction



How coronavirus skeptics use visualization to promote misinformation



How multi-tasking affects writing quality

How data scientists work with AutoML

Q1. I am confident in the AutoDS. I feel that it works well.
Q2. The outputs of the AutoDS are very predictable.
Q3. The AutoDS is very reliable. I can count on it to be correct all the time.
Q4. I feel safe that when I rely on the [AutoDS] I will get the right answers.
Q5. AutoDS is efficient in that it works very quickly.
Q6. I am wary of the AutoDS.
Q7. AutoDS can perform the task better than a novice human user.
Q8. I like using the system for decision making.

Table 3: XAI survey from [27]. With the removal of Q2, this scale has acceptable reliability (Cronbach's $\alpha = 0.75$).

Object-Oriented Drawing

Haijun Xia[1], Bruno Araujo[1], Tovi Grossman[2], Daniel Wigdor[1]

[1]University of Toronto
[2]Autodesk Research

UNIVERSITY OF TORONTO

AUTODESK. RESEARCH

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HCI Research

- Readings for the next class
  - Research Contributions in Human-Computer Interaction.
  - Concepts, Values, and Methods for Technical Human-Computer Interaction Research.
- Will spend 4 weeks on different types of HCI research contributions and overview of technical HCI topics

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Learning Goals: essential HCI skills for a *technical* HCI researcher

1. Skills at identifying and refining HCI research questions
2. Skills at identifying opportunities and applying human-centered research techniques in adjacent fields in CS (e.g., AI, SE, PL, Systems, Robotics)
3. Understanding of the strengths, weaknesses, and limitations of different types of HCI research methods, and how to design the appropriate approach for different research questions
4. Understanding of the ethics issues in HCI research
5. Familiarity with several latest research trends and topics in technical HCI

Final deliverable: a research proposal

A research proposal on **a topic of choice** that includes:

1. Research questions, expected research contributions, and the intellectual merits
2. A comprehensive and interdisciplinary literature survey on the topic
3. A detailed description of the proposed research methods (need-finding, prototyping, evaluation), including the analysis methods for the expected results
4. Discussion on the broader impact of the proposed work

This course is your oyster

- Want me to cover a specific topic?
- Tweak the specifications of an assignment to better align with your research plan?
- Unsure if a topic fits into the scope of the final project?

Talk to me! The #1 goal of this class is to benefit your research

Schedule

- **Week 1-4:** HCI research contributions and overview of technical HCI
- **Week 5-6:** Overview of design and social research in HCI
- **Week 7:** HCI research ethics, IRB, and HCI hot research topic 1
- **Week 8-9:** Qualitative and quantitate research methods; HCI hot research topic 2
- **Week 10-12:** HCI design, prototyping, and evaluation methods
- **Week 13:** HCI broader impacts and HCI hot research topic 3
- **Week 14-15:** Final presentations

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Introduce yourself…

- Your name
- The year and the program you are in
- Where you came from
- Your research interest
- One fun fact about you

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Course website

https://sites.google.com/view/nd-cse-60427/home

Discussion leader

- Read all the readings for the session (including the optional ones)
- (highly encouraged) Meet with the instructor 1-2 weeks before the class to go over the discussion plan
- By 6 pm on Wednesday the week before class, create a thread for each reading and post discussion questions
- Present a 15-20 minutes overview of the readings on their background, implications, and impacts, and lead the class discussion
- Sign up by the end of today — for discussion sessions starting next week

Other students

- Read the required readings for the session (encouraged to check out the optional ones)
- By 6 pm on the day before class, participate in the discussion threads of at least 2 readings. These “discussion items” can be an insight you found in the paper, something you found particularly interesting or noteworthy, a question you would like to discuss in class, a point you disagree with, or a constructive comment on someone else’s posting. These will typically be 5 to 10 lines; up to a paragraph or two long, and should provide evidence that you have read and understand the paper.
- Participate in the class discussion

A typical class

- **3:30 - 3:55:** The instructor gives an overview of the class topic
- **3:55 - 4:15:** The discussion leader presents the overview on the readings
- **4:15 - 4:45:** Class discussion and/or activities

Todo:

1. Read the course website
2. Sign up for discussion leaders (due at 11:59pm today)
3. Vote on guest lecture topics (due 08/29 at 11:59pm)
4. Read the readings for the next class (no discussion thread for them)

Jacob O. Wobbrock, University of Washington
Julie A. Kientz, University of Washington

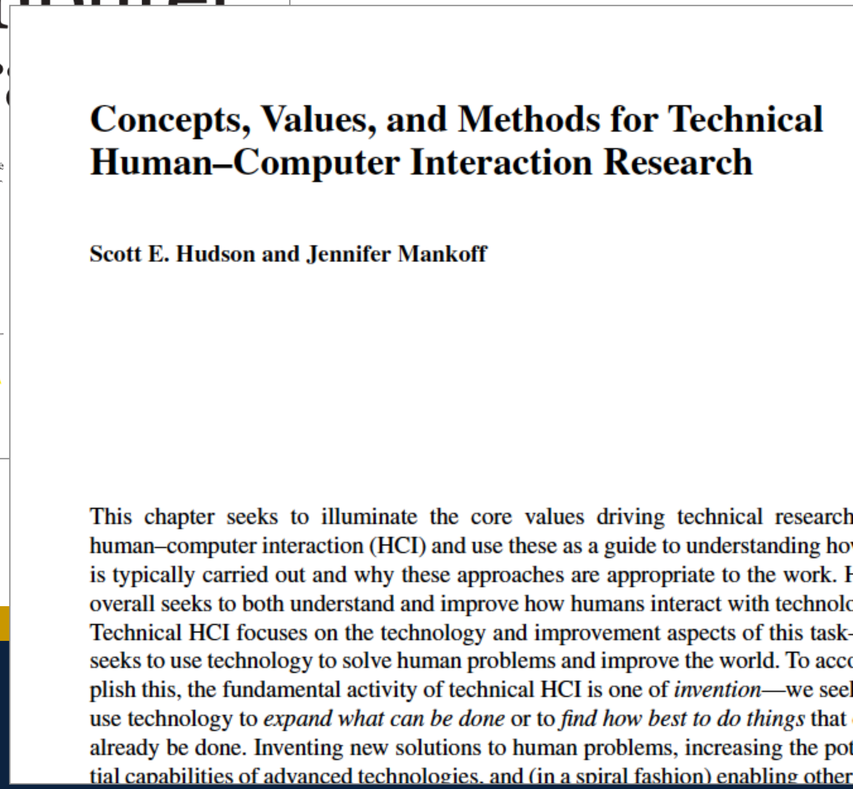
Research Contributions in Human-Comput Inter

Insights

- Knowledge generated by HCI research can be categorized into certain contribution types.
- Each contribution type has key characteristics that imply how it is judged.
- The contribution types used for submissions to the CHI conference have evolved over time to distill types of knowledge from other concerns.

All scholarly fields strive to contribute new knowledge. In the field of human-computer interaction (HCI), this new knowledge increasingly comes in rich forms like videos and demos, but the archival research paper remains the most widely used and accepted capture and delivery mechanism for research knowledge. The knowledge contribution made by a research paper—or more precisely, made by the work a research paper describes—is any research paper's central feature. For example, a theoretical physics paper may contribute a new mathematical model for the behavior of light near black holes. A civil

IMAGE BY KARINTHEIN MEKARAON



Concepts, Values, and Methods for Technical Human–Computer Interaction Research

Scott E. Hudson and Jennifer Mankoff

This chapter seeks to illuminate the core values driving technical research human–computer interaction (HCI) and use these as a guide to understanding ho is typically carried out and why these approaches are appropriate to the work. H overall seeks to both understand and improve how humans interact with technolo Technical HCI focuses on the technology and improvement aspects of this task- seeks to use technology to solve human problems and improve the world. To acc plish this, the fundamental activity of technical HCI is one of *invention*—we seel use technology to *expand what can be done* or to *find how best to do things* that already be done. Inventing new solutions to human problems, increasing the pot tial capabilities of advanced technologies, and (in a spiral fashion) enabling other