Human-Computer Interaction

Project Introduction

Professor Bilge Mutlu

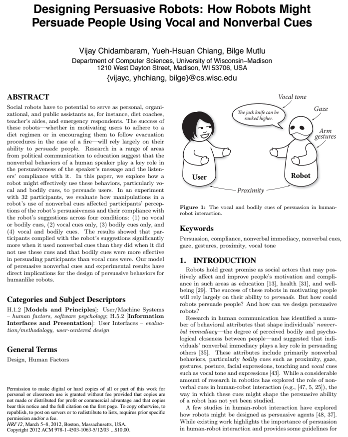
General Outline

We will carry out a semester-long research project where you will practice the research methods we learn to conduct *original research*.

- » Friday class time for team meetings, milestone kickoffs, and feedback sessions
- » Ideally teams of 3, fewer or more should be exceptions
- » 40 + 20% of your total grade, integrates team member evaluations
- » Incrementally write a full-length (~10-pages) paper potentially submittable to an HCI conference

2012

Chidambaram et al.



Designing Persuasive Robots: How Robots Might Persuade People Using Vocal and Nonverbal Cues

Vijay Chidambaram, Yueh-Hsuan Chiang, Bilge Mutlu

200 citations

2012

De Simone et al.

Is cheating a human function? The roles of presence, state hostility, and enjoyment in an unfair video game

J.J. De Simone, Tessa Verbruggen, Li-Hsiang Kuo, Bilge Mutlu

12 citations

2015

Johnson et al.

Handheld or Handsfree? Remote Collaboration via Lightweight Head-Mounted Displays and Handheld Devices

Steven Johnson, Madeleine Gibson, Bilge Mutlu

48 citations

2017

Rakita et al.

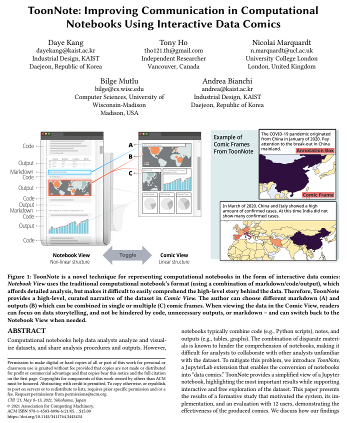
A Motion Retargeting Method for Effective Mimicry-based Teleoperation of Robot Arms

Daniel Rakita, Bilge Mutlu, Michael Gleicher

42 citations

2021

Kang et al.



ToonNote: Improving Communication in Computational Notebooks Using Interactive Data Comics

1 citations

Project Milestones & Deliverables

» Project Topic (Today)

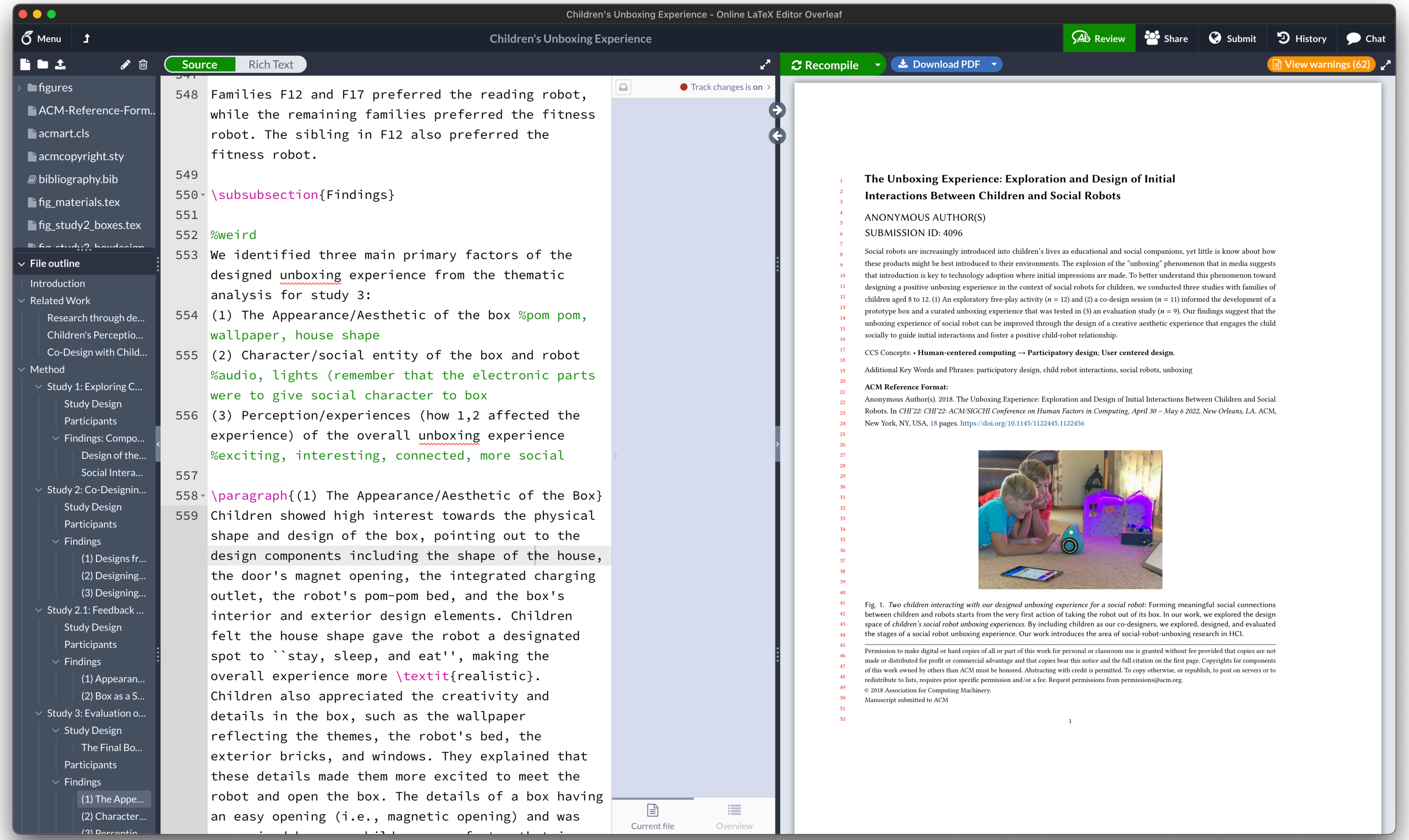
» Literature survey, RQs

» Method

» Data

» Analysis, results

» Final paper



Algorithm

Topic Selection & Team Formation

- Given a set of keywords
  - **Step 1:** Individual Discovery, Interest Development — 10 min
  - **Step 2:** Construct Topics from Keywords — 10 min
  - **Step 3:** Refine Ideas through Search & Discussion — 20 min

Technologies

- LLMs, AI chatbots, VLMs, gen-AI
- AR/VR
- Agents, robots, digital assistants & companions
- Wearable devices, smartwatches, on-body interaction, haptics
- Smart homes, cities
- Assistive technologies
- Autonomous systems
- Remote presence, telepresence robots
- Physiological sensing (e.g., EEG, eye tracking)
- Fabrication, 3D printing

Contexts & Populations

- Older adults & assisted living
- VIPs & the blind
- Learning or developmental disabilities
- Learning & children
- Health, disease management
- Behavior change, wellbeing, mental health
- Workplace, meetings, collaboration
- Whellchair users
- Parents, families, & the home
- Vulnerable populations (chronic illnesses, low income/poverty, homelessness)
- Driving, transportation, navigation

Contribution Types

» Artifact, system, design

» Empirical study of people to inform design

» Empirical study of people using a system

» Survey, scoping/systematic reviews[1]

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[1] Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach

Perspectives

» Accessibility, usability

» Building new capabilities

» Discovering new techniques

» Understanding user perceptions, experience, trust

» Understanding adoption, failures, harm

» Ethical & responsible design

» Understanding new, emerging phenomena

Step 1

Individual Discovery, Interest Development — 10 min

- Spend 10 minutes individually to digest keywords
- Search for these keywords to see what kinds of papers they point to
  - CHI 2023 Program, CHI 2022 Program

Step 2

Construct Topics from Keywords — 10 min

- Combine technologies, contexts, perspectives, contributions types that are of interest to you
- Take cards and go to a booth, or go to a booth that sounds interesting to you
- Spend 10 minutes chatting with others at the booth

Examples

- » **Context/population:** The blind, navigation
- » **Technology:** Robots
- » **Contribution Type:** Artifact
- » **Perspective:** Building new capabilities

PathFinder: Designing a Map-less Navigation System for Blind People in Unfamiliar Buildings

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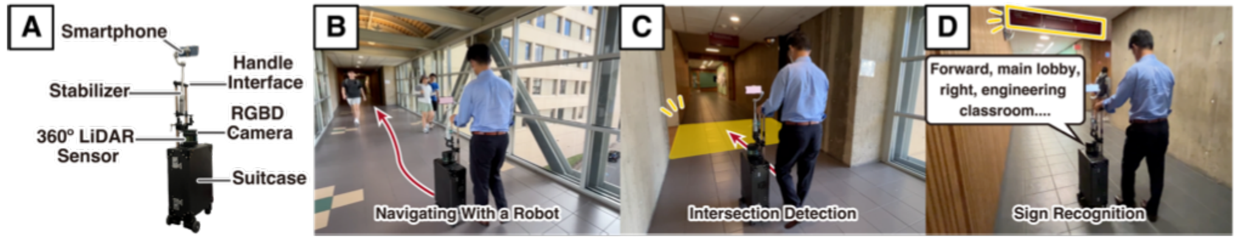


Figure 1: We present PathFinder, a map-less navigation system that can navigate blind people in unfamiliar buildings by detecting intersections and recognizing signs.

ABSTRACT

Indoor navigation systems with prebuilt maps have shown great potential in navigating blind people even in unfamiliar buildings. However, blind people cannot always benefit from them in every building, as prebuilt maps are expensive to build. This paper explores a map-less navigation system for blind people to reach destinations in unfamiliar buildings, which is implemented on a robot. We first conducted a participatory design with five blind people, which revealed that intersections and signs are the most relevant information in unfamiliar buildings. Then, we prototyped PathFinder, a navigation system that allows blind people to determine their way by detecting and conveying information about intersections and signs. Through a participatory study, we improved the interface of PathFinder, such as the feedback for conveying the detection results. Finally, a study with seven blind participants validated that PathFinder could assist users in navigating unfamiliar buildings with increased confidence compared to their regular aid.

ACM ISBN 978-1-4503-9421-5/23/04...$15.00
https://doi.org/10.1145/3544548.3580687

CCS CONCEPTS

• **Human-centered computing → Accessibility systems and tools;** • **Social and professional topics → People with disabilities.**

KEYWORDS

visual impairment, orientation and mobility, intersection detection, sign recognition

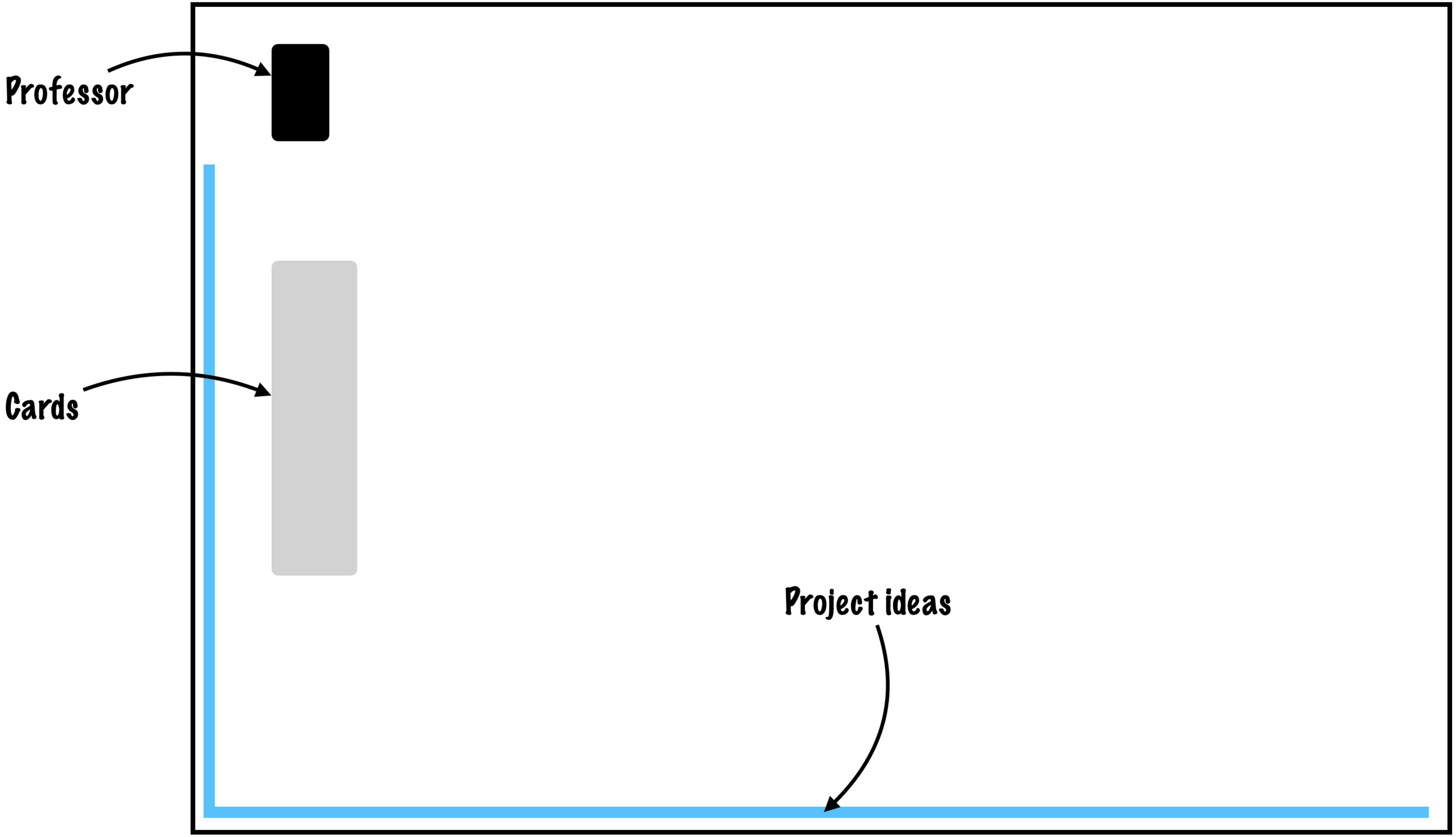
ACM Reference Format:
Masaki Kuribayashi, Tatsuya Ishihara, Daisuke Sato, Jayakorn Vongkulbhisal, Karnik Ram, Seita Kayukawa, Hironobu Takagi, Shigeo Morishima, and Chieko Asakawa. 2023. PathFinder: Designing a Map-less Navigation System for Blind People in Unfamiliar Buildings. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23), April 23–28, 2023, Hamburg, Germany.* ACM, New York, NY, USA, 16 pages. https://doi.org/10.1145/3544548.3580687

Tips

- Understand the limitations of this process
- Most combinations will be non-sensical, but some will be interesting
- Find topics that are of clear value to study, beneficial to society, to science, etc.
    - Problems worth studying must be: *not studied/understudied, significant/ impactful, pervasive/frequent, persistent*
- Choose perspectives that you are inclined to take
- Important to find teammates you click with

Q&A

- Q: Can I bring my own research into this?
    - A: Yes. The technology, context/population, and/or perspective can come from your research. ideally, you will convince two of your classmates to work with you.


Professor
Cards
Project ideas

Step 3

Refine Ideas through Search & Discussion — 20 min

- As a team, spend 10 minutes looking through papers you can find on your constructed topic
- Spend another 10 minutes to discuss ideas toward refining your topic
- Capture your team and topic in this spreadsheet

Q&A

- Q: Will we have access to technology, platforms, funds/resources?
  - A: Yes, within reasonable limits. You can borrow equipment from my lab. For participant samples, most teams will use classmates, friends, roommates. In general, we will try to be resourceful (e.g., reserve a room at the union/library to run studies).
- Q: Can we change any part of our topic?
  - A: Yes, you are committing to a starting place. You will shift and adapt different facets of your project topic along the way.

Next Steps

- Congratulations! You have a project topic and a team 🎉
- Next project milesone is **literature review, research question**
  - Due in two weeks
  - Become familiar with ~30 papers on the topic you chose
  - Build conceptual maps, identify gaps and opportunities
  - Develop and refine a research question
  - Write and submit a "related work" section