Research Methods

SWE233: Intelligent User Interfaces

https://dayenam.com/teaching/swe233-fall2025/

Daye Nam

Fall 2025

Learning Goals

After today's class, you should be able to

- Describe and distinguish contextual inquiry, interview, survey and log analysis methods
- Explain the pros and cons of different methods
- Employ different methods in answering research questions

Methods!!!

Usability Methods

Contextual Inquiry
Contextual Analysis (Design)
Paper prototypes
Think-aloud protocols
Heuristic Evaluation
Affinity diagrams (WAAD)
Personas
Wizard of Oz
Task analysis
Cognitive Walkthrough
KLM and GOMS (CogTool)
Video prototyping
Body storming
Expert interviews
Information Architecture Diagrams

A/B studies
Questionnaires
Surveys
Storyboards
Journey maps
Prioritization Matrices
Log analysis
Focus groups
Card sorting
Diary studies
Improvisation
Use cases
Scenarios
Cognitive Dimensions
“Speed Dating”
Journey Maps
…

Steps

1. Defining the research questions

2. Creating a protocol/questionnaire

3. Recruiting participants

4. Carrying out the study

5. Analyzing the data

Activity

As a group of 2–3,
pick 1 product idea (ideally for developers)
utilizing AI/LLM that is very new

Example: A brain computer interface (like Neuralink) that can infer programmers' intent perfectly so that LLM can provide them the perfect software

Contextual Inquiry

Contextual Inquiry

Interpretive field research method

Depends on conversations with users in the context of their work

Used to discover real requirements, plans and designs

User decides the tasks instead of you asking users to do a specific task

Investigate real-world tasks, needs & context

https://youtu.be/JV6br-npgfw?si=AH5GWCJGbqedPWtN

Elements of User's Context: Pay Attention to all of these

User's work space
User's work
User’s workarounds
User's work intentions
User's words (language used)
Tools used
How people work together
Business goals
Organizational and cultural structure

Why Context?

Design a complete work process

- Fits into “fabric” of the entire operations
- Not just “point solutions” to specific problems

Integration!

- Consistency, effectiveness, efficiency, coherent

Design from data

- Not just opinions, negotiation
- Not just a list of features

What to look for?

Key things you are looking for are ***what happens***, specifically

- **Breakdowns** – things that go wrong
- **Efficiencies** – things that go right
  - Be sure not to change these in a redesign
- **Influences** – why are things done the way they are
  - Ask questions when you can’t tell
- **Context** – how the environment affects actions

Activity

With your group, discuss and submit

1) research questions to answer
2) your contextual inquiry participants & how many you'll recruit
3) tasks you want to focus on observing?

Interview

Interview

You invite and ask (well-designed) questions to people

Interview allow rich engagement and follow-up questions

Collect historical data that is not recorded anywhere

Elicit opinions and impressions in richer detail than people would provide through written communication.

Typicall Interview Process

Introduction

Background / History

Opening questions e.g., satisfactions, frustrations

Follow-up questions Specific areas to elaborate on

Other important points ‘Anything to add?’ / ‘Anything we missed?’

Wrap-up Express appreciation


https://youtu.be/eNMTJTnrTQQ?si=cb1Bg3hiKZIjqHKZ

Interview Design

Not a formal schedule of questions to be asked word-for-word in a set order, but list of topics the interviewer should attempt to cover

The guide can evolve after each interview

Focus on concrete examples rather than abstracted generalities

Recruit participants who provides diverse perspectives

Motivate the interviewees by explaining the purpose of the interview

During the interview

Avoid asking multiple questions at once

Avoid leading questions

Avoid assuming that the answer to a question is so obvious

Open with a question that can be answered easily and without potential embarrassment or distress

Ask open-ended questions

Challenges of Contextual Inquiry & Interview

Usually small sample size

The time required

The challenge of finding appropriate interviewees and scheduling a time that works for all parties.

Potential bias introduced by the researchers (word choice, tone of voice, and body language can all affect responses).

The time required for transcription and subsequent analysis.

Activity

With your group, discuss and submit

1) research questions to answer
2) your interview participants & how many you'll recruit
3) 3 main interview questions

Log Analysis

Log Analysis

You analyze user logs, instead of observing users

Not every research question can be answered with log analysis

Minimizes response biases

Google Cloud page-view logs analysis

13:00 May 1, 2020

> Cloud SQL Overview

13:03 May 1, 2020

> Cloud SQL Pricing

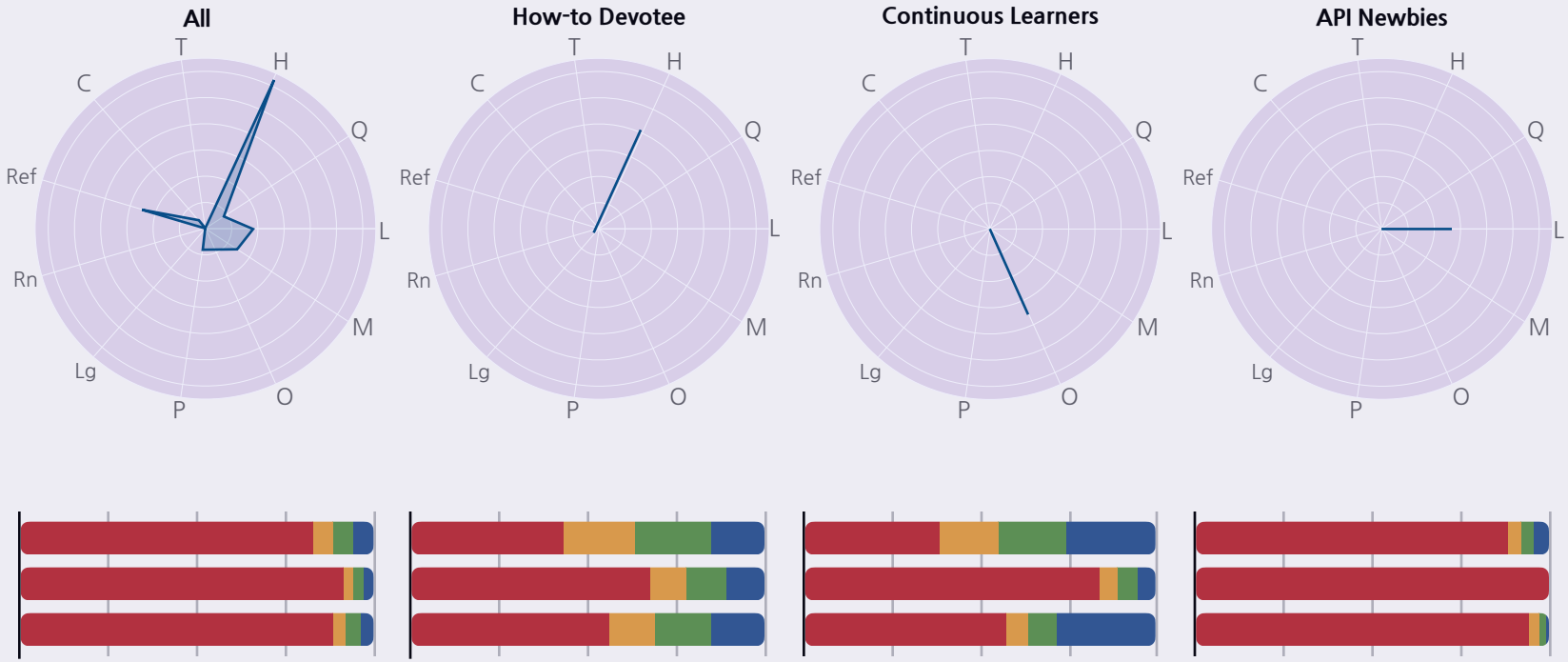
×

of more than **100,000 users**
of 4 Google Cloud products,
of May 2020 (aggregated)
with **privacy-preserving** techniques

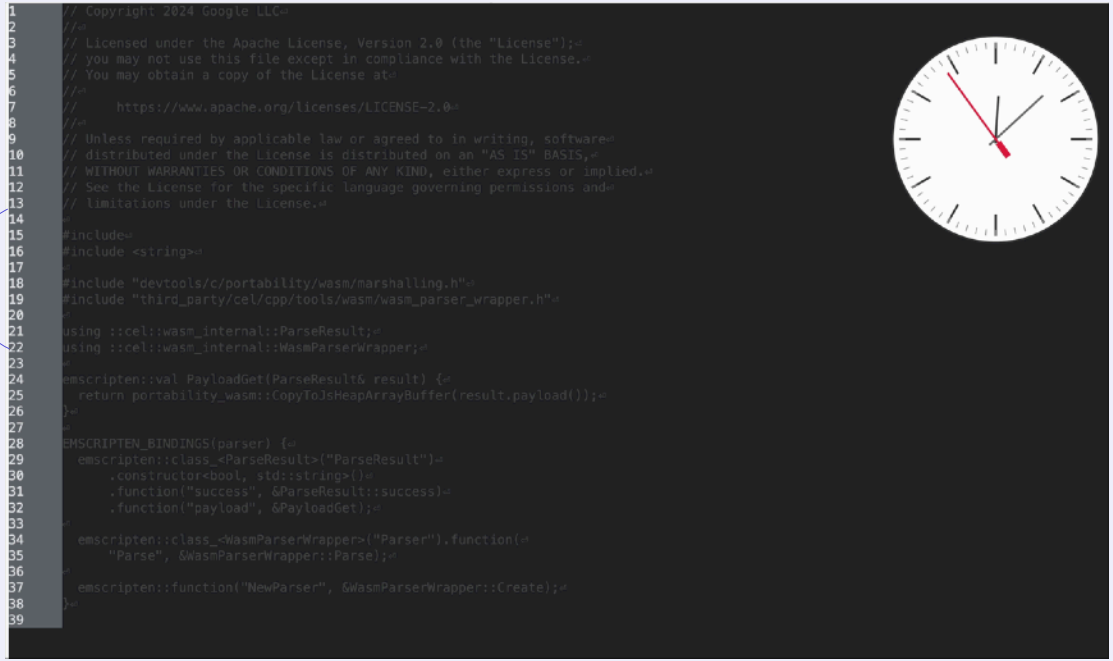
Documentation Page-view Logs

		Dwell Time (m)			
User	**Product**	Reference	How-to	…	Pricing
0	P1	1	0	…	0
1	P1	35	0	…	0
⋮	⋮	⋮	⋮	⋮	⋮

RQ1:
What are the different documentation type usage patterns?



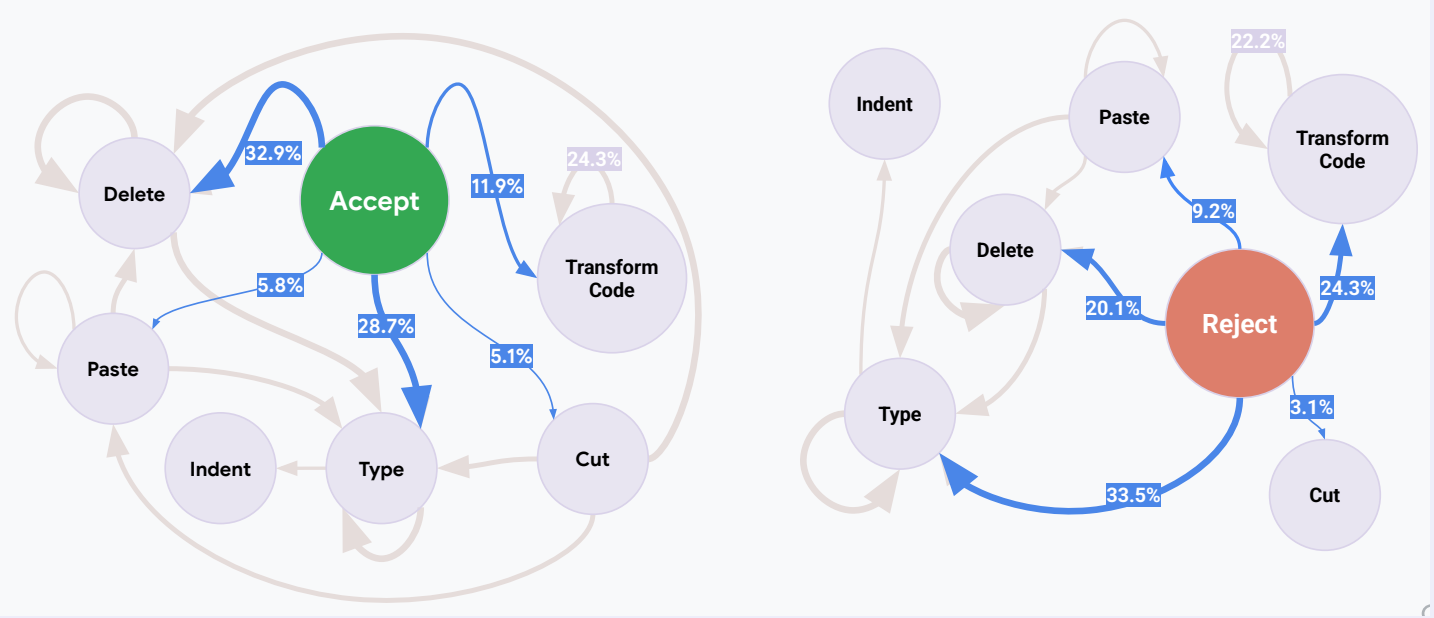
Challenges in effectively communicating needs to intelligent tools



Edit by Transform Code

“Fix code” x 3

Challenges in effectively communicating needs to intelligent tools



Challenges in Logs Analysis

It is extremely hard to get access to log data unless you own the product

There is a lot of noise in the data

You can infer the user needs and challenges, but additional studies are necessary to fully confirm them

Activity

With your group, discuss and submit

1) research questions to answer
2) logs data to analyze
3) analysis plan

Key distinctions

Contextual Inquiry / Logs Analysis

Ongoing experience & concrete data

What users **do**

User intent & rationale **inferred**

Spontaneous, as it happens

What users actually **need**

Interviews, Surveys, Focus Groups

Summary data & abstractions

What customers **say**

User intent & rationale **described**

Limited by reliability of human memory

What customers **think** they want

Administrivia

Problem Identification (due: Oct 8)

Submit a short abstract (300 words) that covers the following:

Problem Definition

Target Users

Intelligent Solutions

Please talk to me if you need help!

ABSTRACT

Code-generating large language models map natural language to code. However, only a small portion of the infinite space of naturalistic utterances is effective at guiding code generation. For non-expert end-user programmers, learning this is the challenge of *abstraction matching*. We examine this challenge in the specific context of data analysis in spreadsheets, in a system that maps the user's natural language query to Python code using the Codex generator, executes the code, and shows the result. We propose *grounded* abstraction matching, which bridges the abstraction gap by translating the code back into a systematic and predictable naturalistic utterance. In a between-subjects, think-aloud study (n=24), we compare grounded abstraction matching to an ungrounded alternative based on previously established query framing principles. We find that the grounded approach improves end-users' understanding of the scope and capabilities of the code-generating model, and the kind of language needed to use it effectively.

Paper Bidding

https://docs.google.com/document/d/1ru-WUuR2A3grR47dOwzWxiuQOaGl46orh9hF-j6OzIc/edit?usp=sharing

Paper Presentation

Summarize main research questions, proposed methods, and key contributions
    Focus on the used methodologies; if not covered in the previous classes, please delve deeper into the details

Slide upload deadline is 1 am on the day you're presenting the paper
    e.g., if you're presenting a paper on Oct 8, you should finalize your slides by October 8, 1 am

Upload your slides to the #presentation-slides channel on Slack

Prepare 3 discussion questions

References

- CMU’s 05-863 (Fall 2018) Lecture 2
- CMU’s 17-803 (Fall 2022) Sep 13 Lecture
- Creswell, John W., and J. David Creswell. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2017.