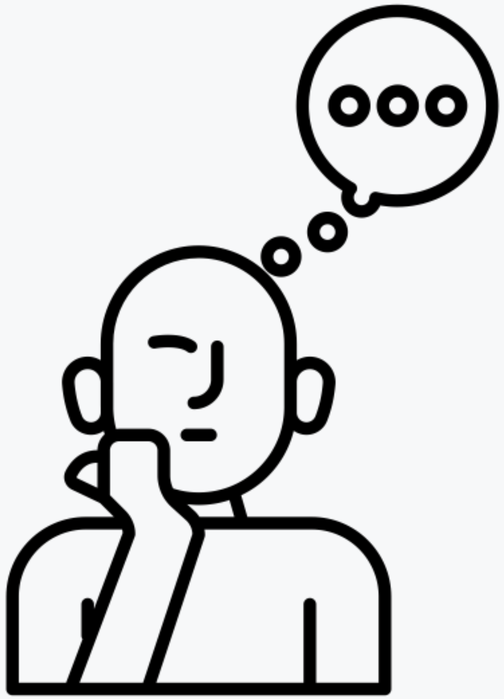
Fundamentals of People-Oriented Computing

Lecture 1: Research contributions

Chat Wacharamanotham

Fall Semester 2025

FPOC course overview



Chatchavan Wacharamanotham

Tenured lecturer at University of Zurich

PhD in Human–Computer interaction from RWTH Aachen University, Germany

Previously:

- Assistant professor at University of Zurich
- Lecturer at Swansea University, UK

Research: Improving how computer can help people do better and transparent science https://chatw.ch

Starter: How do you read research papers?

(10 minutes)

1. Say hi to the person next to you.
2. In pairs, discuss how you generally read research papers

The following questions may give some inspiration on what to talk about

- Do you read from the first page to the last page?
- How does the purpose of reading influence your strategy?
- What other materials from the research paper did you consider?

Lecture landing page

Keep the page linked below open during the lecture.

- Links to materials that we will use in the lecture
- Lecture slides (which will also be available on OLAT)

https://chatw.ch/fpoc25

Intended learning outcomes

By the end of this course, students will be able to

- ❏ Specify goals for reading research papers and monitor their reading process
- ❏ Classify domains and contribution types of research papers
- ❏ Based on these classifications, decide on the relevance and merit of papers in light of their reading goals

https://chatw.ch/fpoc25

How to read research papers

1. Determine **why** you want to read the paper
   - To learn about the topic
   - To use the method
   - To use the results
   - To satisfy your curiosity in general
   - To change your mind

2. Get an overview of the paper through **the seven levels of abstraction**

    Title

    First figure

    Abstract

    Introduction

    Conclusion

    Charts

    Body text

(The “seven levels of abstraction” concepts is from Patrick Baudisch, personal communication in 2012)

IMRD structure

Introduction, **M**ethods, **R**esults, and **D**iscussion

All research articles (and yours) are typically structured in this order

- **Introduction** – Why was the study undertaken? What was the research question, the tested hypothesis, or the purpose of the research?
- **Related Work** – What are the findings of previous work before the study was undertaken?
- **Methods** – When, where, and how was the study done? What materials were used, or who was included in the study groups (patients, etc.)?
- **Results** – What answer was found to the research question? What did the study find? Was the tested hypothesis true?
- **Discussion** – What might the answer imply, and why does it matter? How does it fit in with what other researchers have found? What are the perspectives for future research?

 Based on slides by Valentin Schwind

Hourglass structure

ABSTRACT

INTRODUCTION

- Motivation & Problem Statement
- Theoretical Background
- Research Question
- Hypothesis

RELATED WORK

METHOD

- Study Design
- Independent Variables
- Dependent Variables
- Apparatus
- Tasks
- Procedure
- Participants

RESULTS

- Descriptive statistics
- Inferential statistics (No interpretation!)

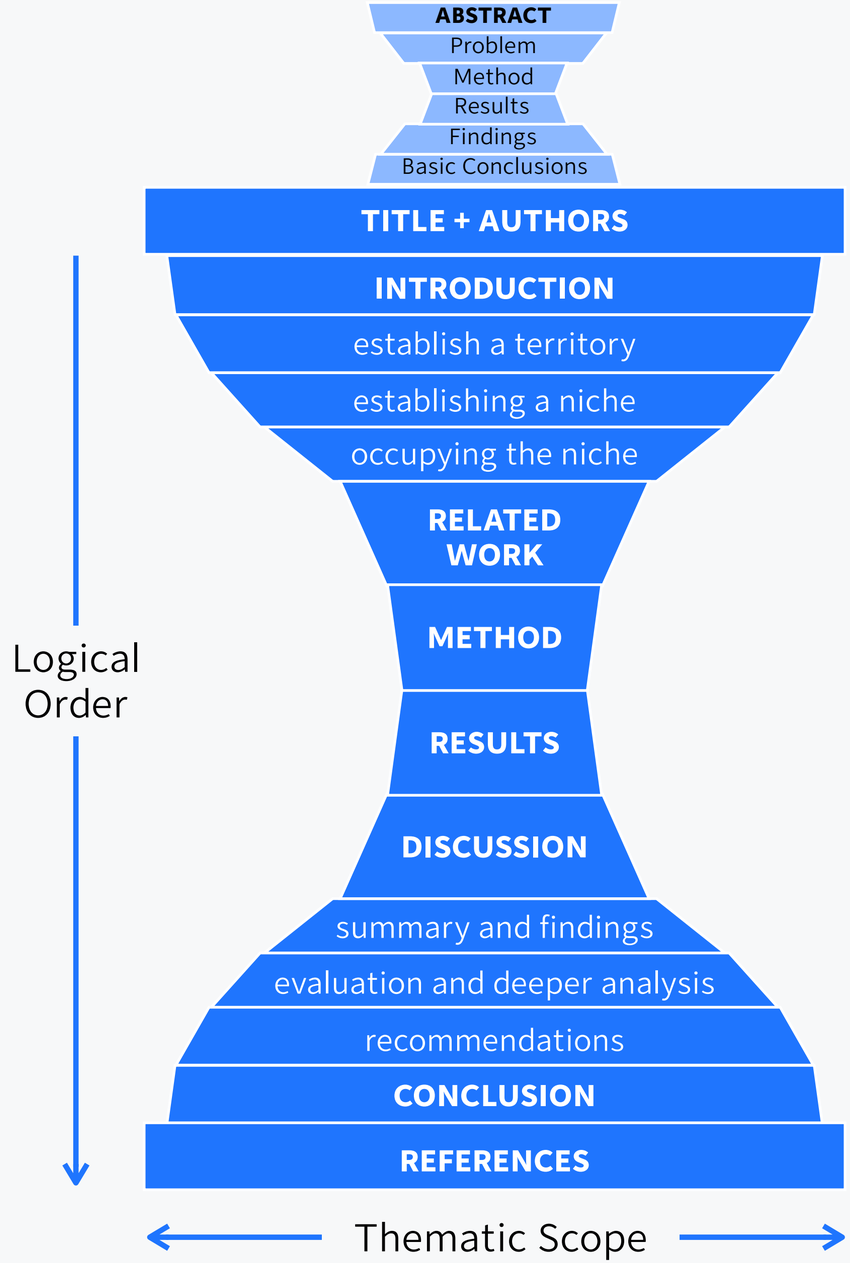
DISCUSSION

- Brief summary of findings
- Discussion/Interpretation of findings
- Relation to previous/ related work
- Limitations of the study

CONCLUSION

(CONTRIBUTION)

(ACKNOWLEDGEMENTS)



 Based on slides by Valentin Schwind

Abstract

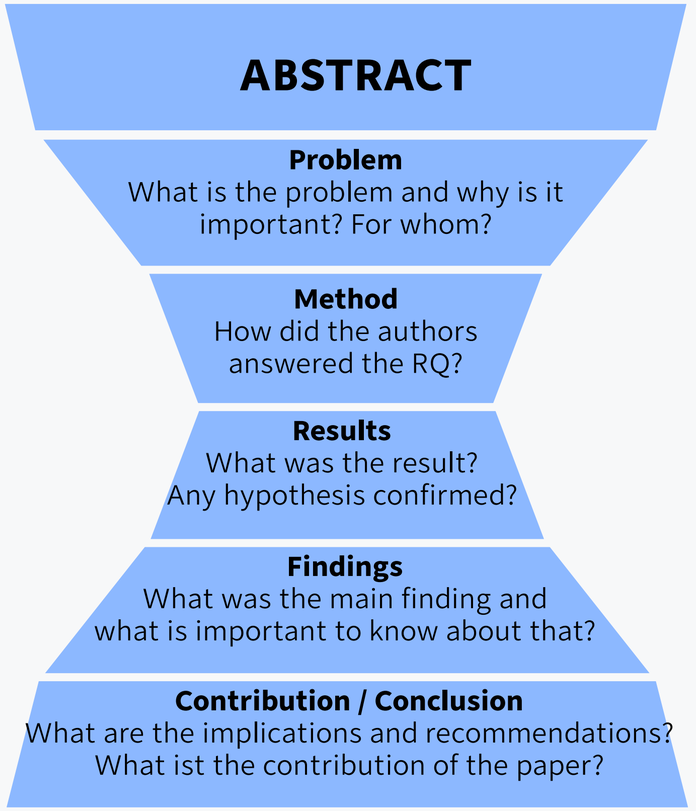
Typically, 150 - 250 words

Briefly introduces the reader to

- motivation, problem, and relevance
- aims of the study
- methods that were used
- results and findings
- conclusion & contribution

The abstract **always answers** these four questions:

- Why did you do this?
- What did you do?
- What did you find?
- What do your findings mean?



 Based on slides by Valentin Schwind

3. **Selectively read** parts of the paper

   To **learn** about the topic → Introduction, Related work, References

   To **use the method** → Method

   To **use the results** → Conclusion, Discussion, Results

   To satisfy **general curiosity** → Abstract, Conclusion

   To **change your mind** → Read as the whole paper sequentially

4. **Revisit your “why”**

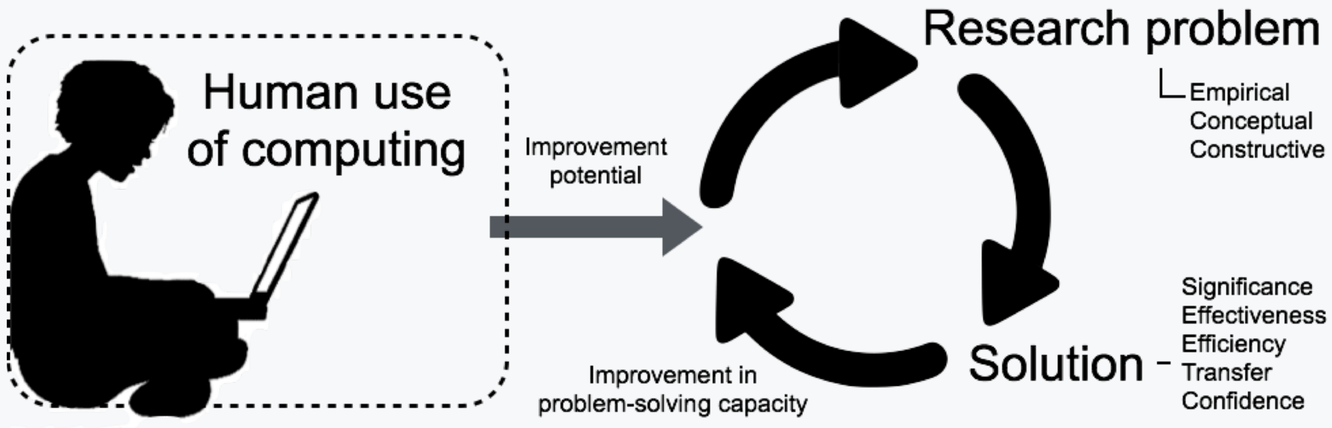
   Have your question(s) been answered?

   If not, can this paper answer your question(s)?

   Would it be useful to continue reading this paper?

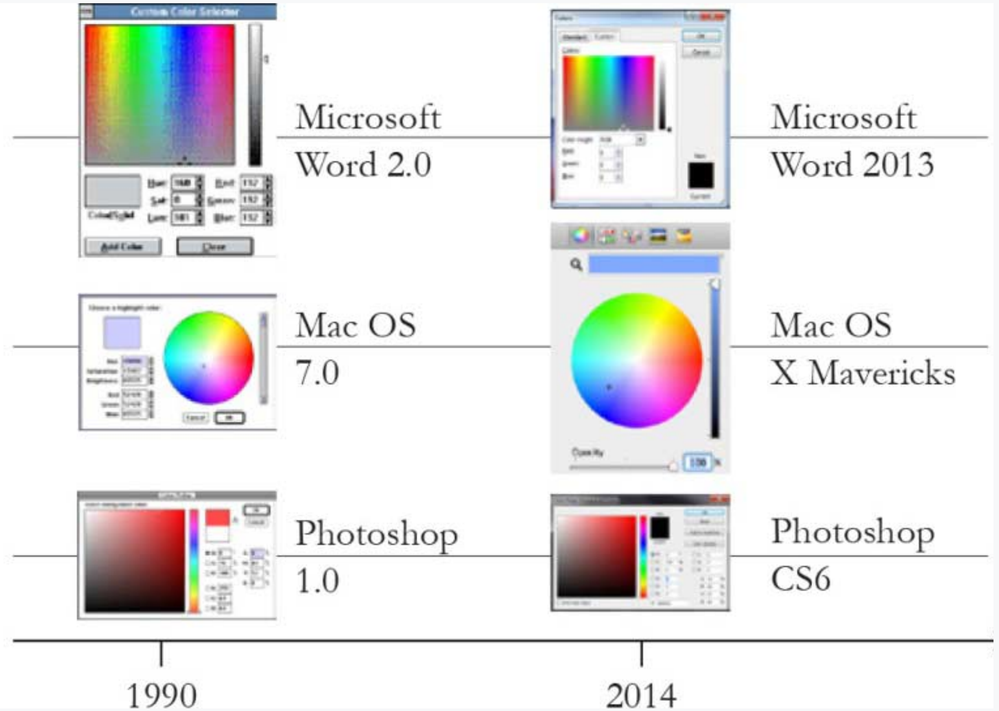
Research contributions

= “Knowledge contributions”: What does this paper add to what we (humanity) know?



Oulasvirta, A., & Hornbæk, K. (2016, May). HCI research as problem-solving. In Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (pp. 4956-4967).

Example: color portraits



Sample	start from an initial color; tweak properties to obtain a final color.
Palette	manipulate relationships among groups of colors.
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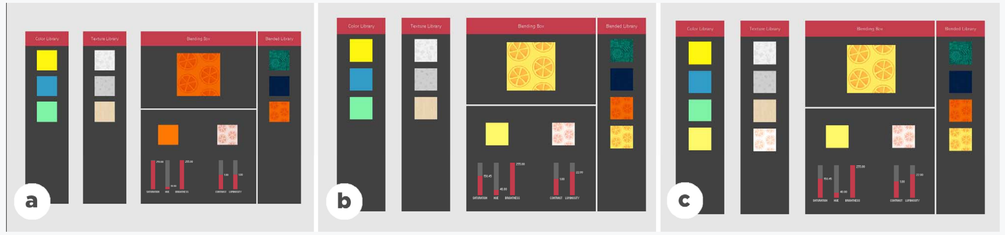


 Jalal et al. (2015) Color Portraits: From Color Picking to Interacting with Color

McGrath’s Three domains where each research paper is about

- **Substantive domain:** The content worthy of study (usually users + application)
- **Conceptual domain:** The ideas that give meaning to the results
- **Methodological domain:** The techniques for conducting the research

How to use these domains:

- Reading: Identify them and evaluate the strength of research contribution in each domain
- Writing: Communicating them upfront and clear early on in your paper

Types of research contribution

Empirical: Knowledge about users or system usage

Artifact: Design and engineering of interactive systems

Methodological: New or better ways do to research

Dataset: Benchmarks, inputs for future research

Survey: Giving structure to the body of knowledge

Theoretical: Principles, models, lens to better understand research

Opinion: Changing readers' mind

Cover in the reading assignment (examable)

A research paper may make multiple contributions

This section is based on Wobbrock & Kientz (2016). Research Contributions in Human–Computer Interaction

Empirical contributions

Knowledge based on data gathered through observations

- In the lab, field (real-world), or simulations

Research methods include:

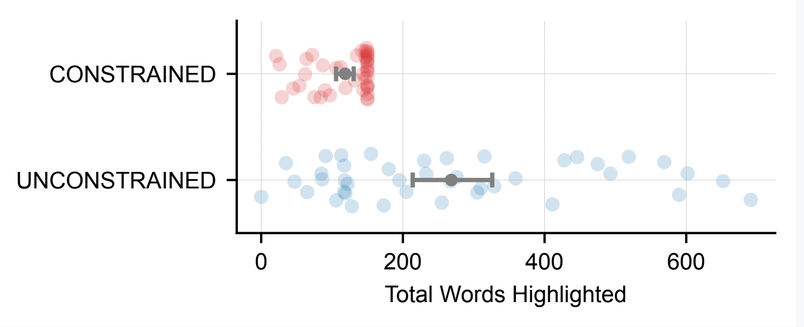
- Qualitative, quantitative, or mixed
- Experiment, observations, interview, survey questionnaire, ethnography, experience sampling, diary, crowdsourcing

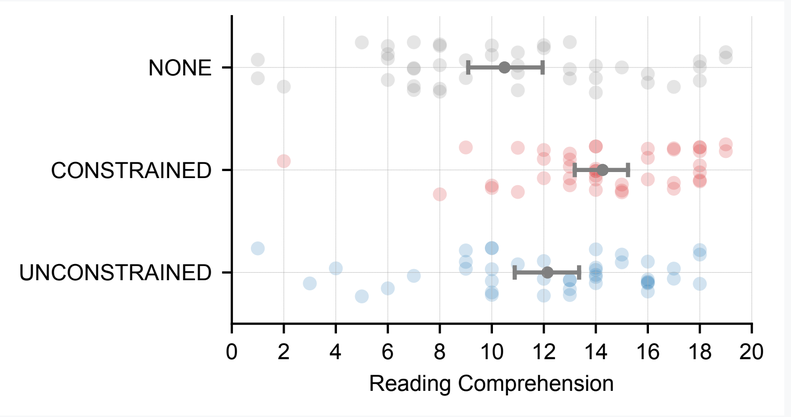
Evaluation:

- Importance of the findings (to the target users, to technologies, to future research)
- Soundness of the method

EXAMPLE: CONSTRAINED HIGHLIGHTING

	UNCONSTRAINED	CONSTRAINED
(a)	*wearing a homemade t-shirt with the word "Yes"*	*wearing a homemade t-shirt with the word "Yes"*
(b)	*Mateo was quiet, and a constant planner, researcher and designer.*	*Mateo was quiet, and a constant planner, researcher and designer.*





Joshi & Vogel (2024) Constrained Highlighting in a Document Reader can Improve Reading Comprehension

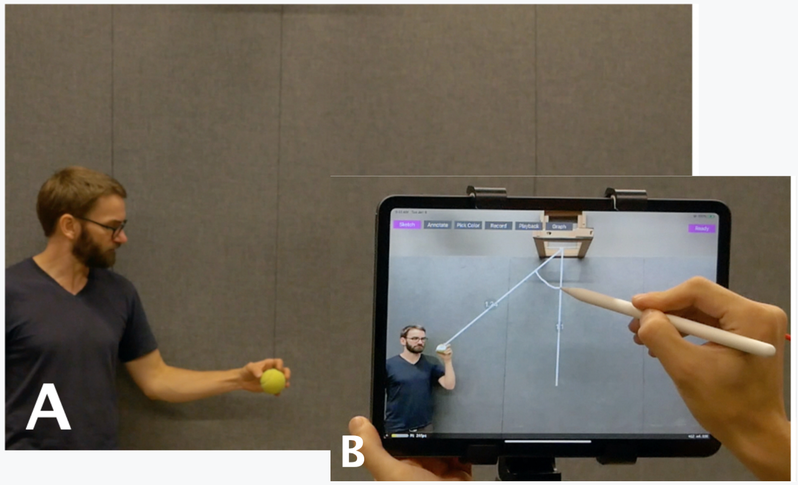
Artifact contributions

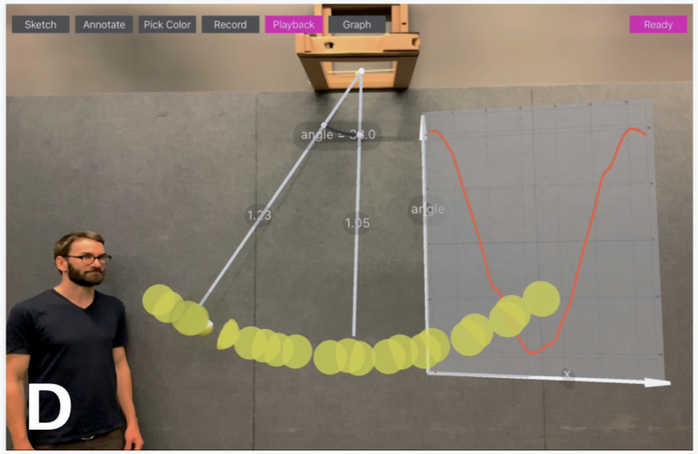
Design and engineering of interactive systems that reveal new possibilities

Evaluation:

- Systems, architectures, tools, and toolkit: What do they make possible? How do they do so?
- Interaction techniques: Quantitative evaluation of human performance benefits
- Design sketches: How insightful, compelling, and innovative? How designs negotiates trade-offs and hold competing priorities in balance?

EXAMPLE: DYNAMIC SKETCHING WITH AR





Suzuki et al. (2020) RealitySketch: Embedding Responsive Graphics and Visualizations in AR through Dynamic Sketching

Methodological contributions

New ways of acquiring knowledge, e.g., improv
discover, measure, analyze, or create things

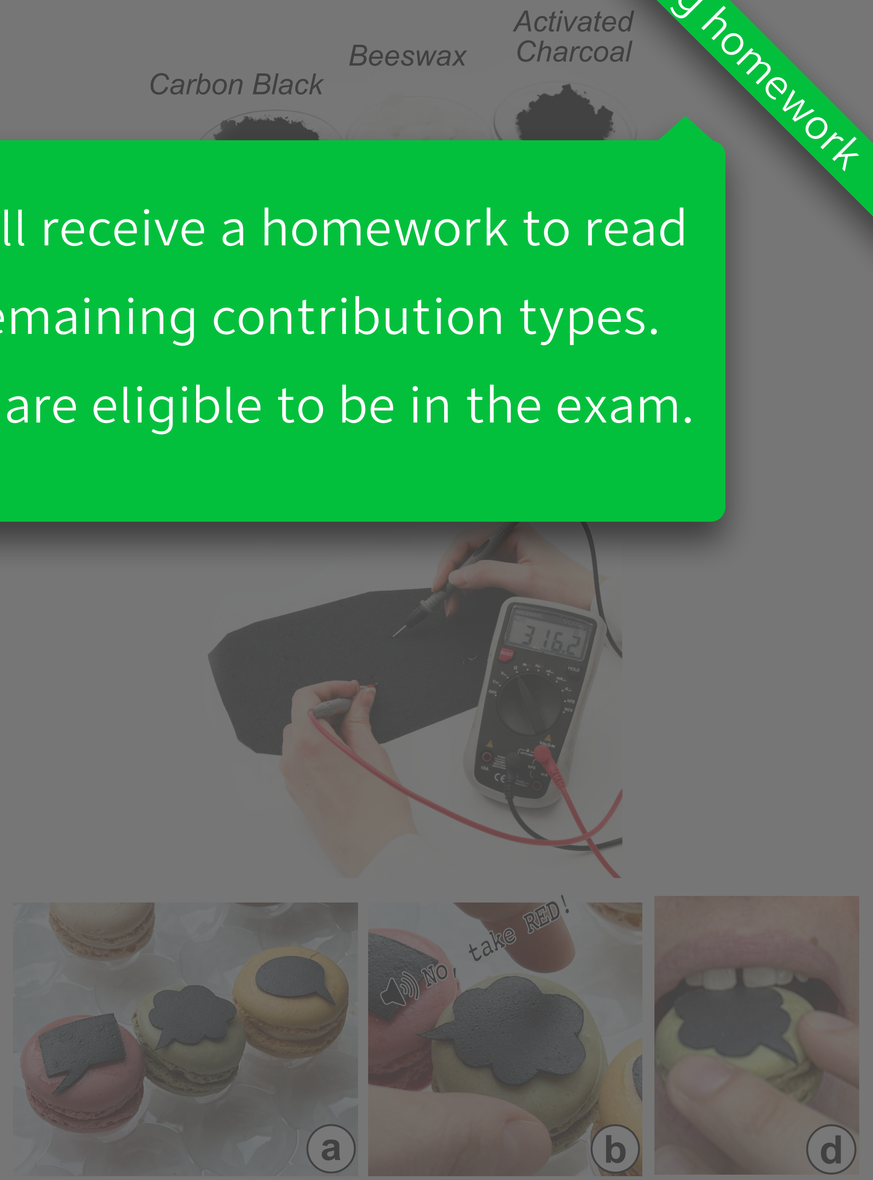
Evaluation:

- **Utility:** What does the proposed method en
  accomplish this by any other means?
- **Validity:** To which extent does the method perform as claimed? What are limitations?
- **Reproducibility:** How easy can others apply the methods?
- **Reliability:** Given the same input, does it always produce outputs with the same key characteristics?

reading homework

Tomorrow you will receive a homework to read about the five remaining contribution types.
The content here are eligible to be in the exam.

EXAMPLE: BIOPLASTICS AS PROTOT G MATERIALS



Koelle et al. (2022) Prototyping Soft Devices with Interactive Bioplastics

Methodological contributions

New ways of acquiring knowledge, e.g., improving how we discover, measure, analyze, or create things

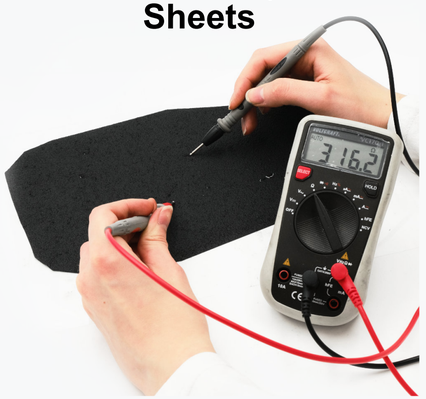
Evaluation:

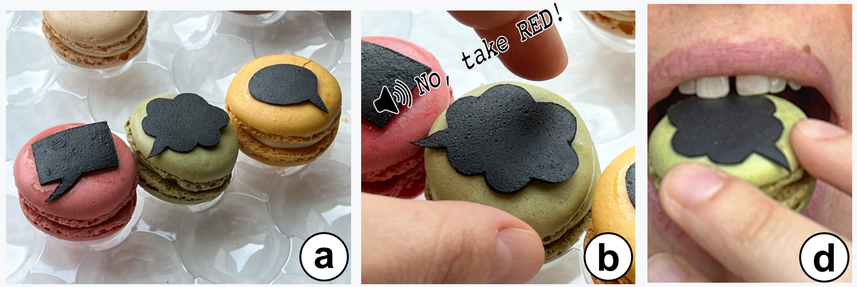
- **Utility:** What does the proposed method enable? Can we accomplish this by any other means?
- **Validity:** To which extent does the method perform as claimed? What are limitations?
- **Reproducibility:** How easy can others apply the methods?
- **Reliability:** Given the same input, does it always produce outputs with the same key characteristics?

reading homework

EXAMPLE: BIOPLASTICS AS PROTOTYPING MATERIALS

Conductive Bioplastic **Sheets**





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Theoretical contributions

Concepts, principles, or frameworks that can describe or predict phenomena. “vehicles for thought”

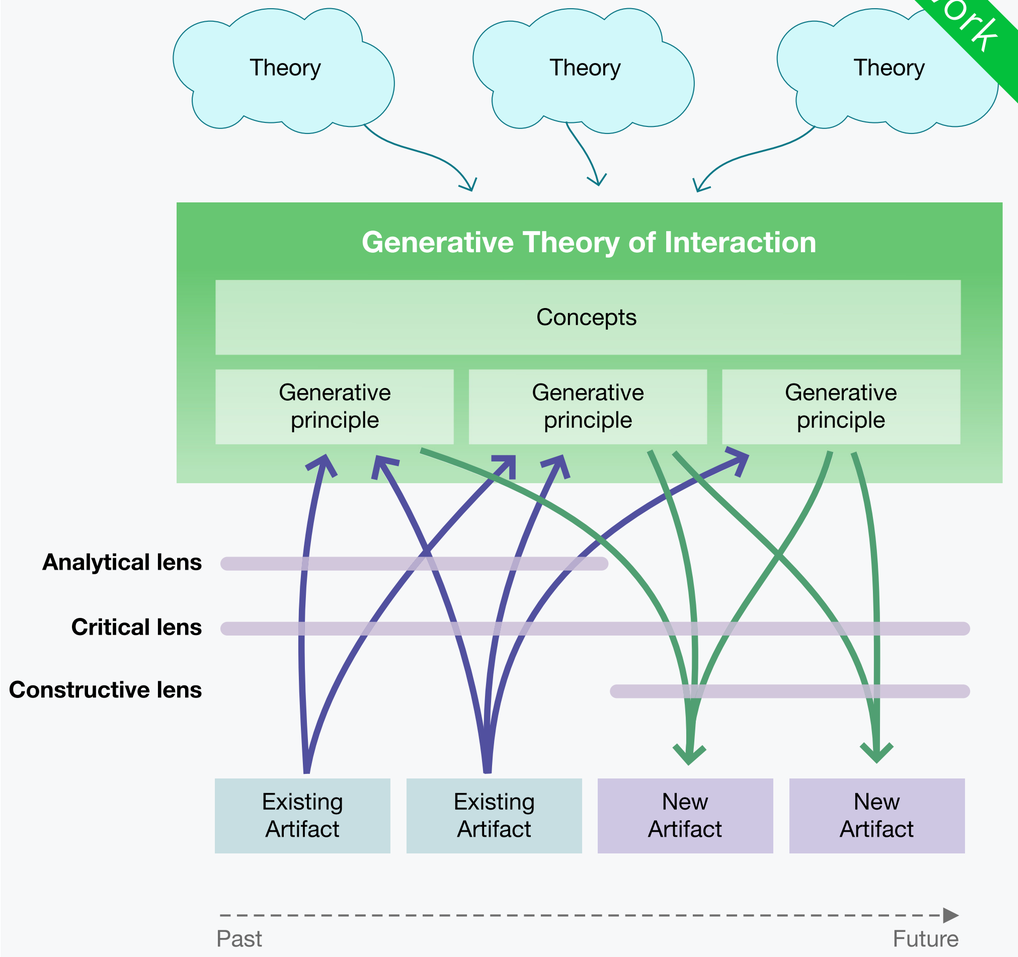
Evaluation:

- Novelty
- Soundness
- Power: describe, predict, explain
- Generalizability

Usually validated through empirical work

EXAMPLE: GENERATIVE THEORIES

reading homework



Beaudouin-Lafon et al. (2021) Generative Theories of Interaction

Dataset contributions

reading homework

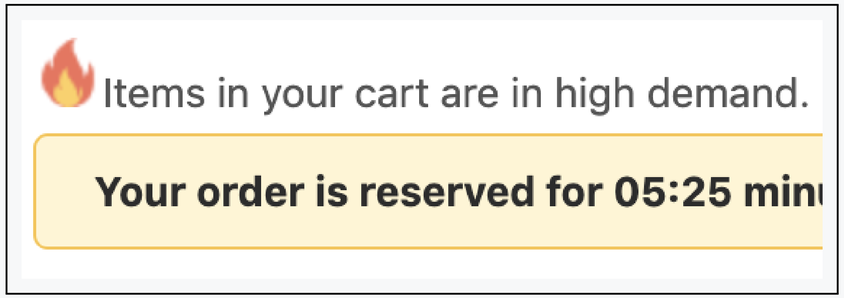
Reference datasets that enable future research (e.g., benchmarking) together with an analysis of the dataset characteristics

Evaluation:

- Representativeness
- Usefulness

Datasets often accompany a methodological contribution or published with a new tools to work with the dataset (artifact contribution)

EXAMPLE: DATASET OF DARK PATTERNS IN SHOPPING WEBSITES



Type	# Instances	# Websites	Asymmetric?	Covert?	Deceptive?	Hides Info?	Restrictive?	Cognitive Biases
Sneak into Basket	7	7	○	○	◐	●	○	Default Effect
Hidden Costs	5	5	○	○	◐	●	○	Sunk Cost Fallacy
Hidden Subscription	14	13	○	○	◐	●	○	None

Mathur et al. (2019) Dark Patterns at Scale: Findings from a Crawl of 11K Shopping Websites

Literature-survey contributions

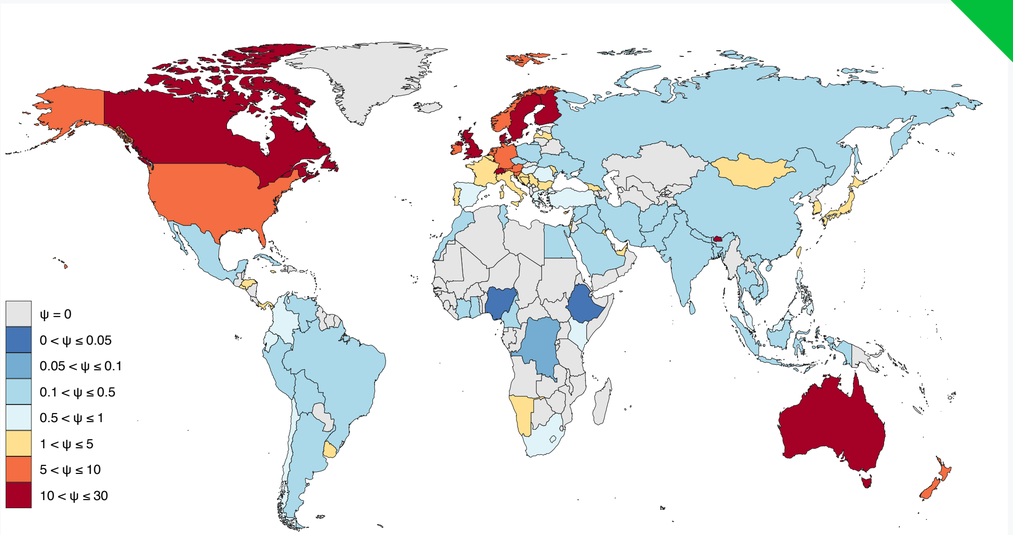
Structured collection of the research literature that gives an overview of the field, exposing trends and gaps

Evaluation: How well they…

- …cover existing works?
- …organize what is currently known about a topic?
- …reveal opportunities for further research?

reading homework

EXAMPLE: OVERREPRESENTED STUDY PARTICIPANTS IN HCI RESEARCH



Linxen et al. (2021) How WEIRD is CHI?

Opinion contributions

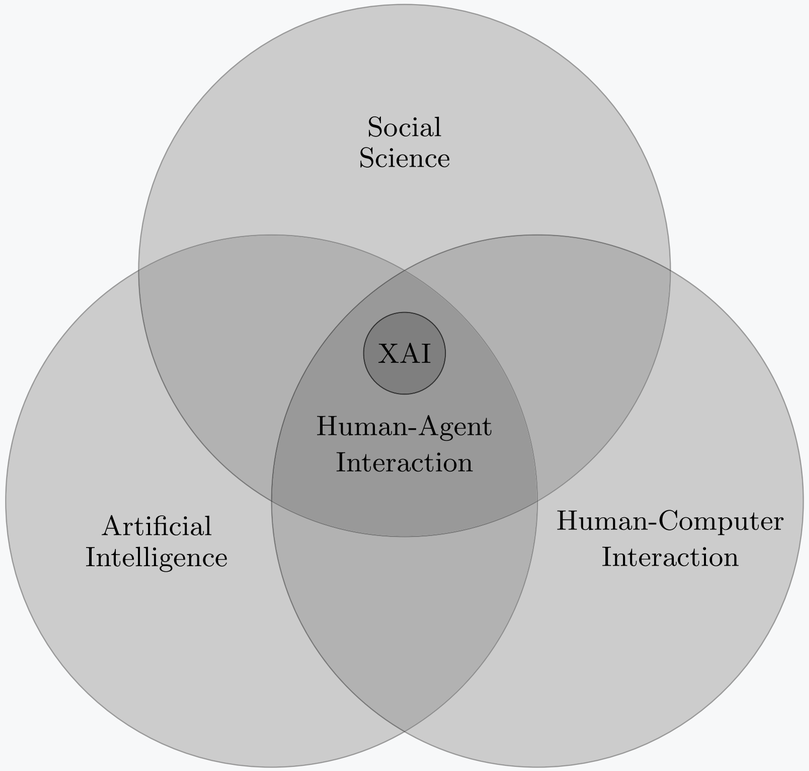
Essay seeking to persuade readers. Compel reflection, discussion, debate

Evaluation:

- Topic of wide interest
- Strength of the argument
  - Supporting evidence
  - Consider opposing perspectives
- Broadly accessible

reading homework

EXAMPLE: EXPLAINABLE AI SHOULD DRAW FROM SOCIAL SCIENCE BODY OF KNOWLEDGE



Miller (2019) Explanation in artificial intelligence: Insights from the social sciences

Exercise: Identify domains and contribution type(s)

(15 minutes)

1. Download the paper first pages from the lecture page
2. Open the linked survey page on a separate window

Work on one paper at a time:

3. Strategically read the first page to identify
    - McGrath's **substantive** and **methodological** domains
    - Wobbrock & Kientz's contribution type(s): **empirical** vs. **artifacts**
4. Write your answer in the survey

https://chatw.ch/fpoc25

Homework

1. Create **your *FPOC workspace* document**
    - Create a document with any software that allow you to add images and create tables (e.g., MS Word, Apple Pages, or Google Doc)
    - We won't ask you to share this file with anyone
    - Keep this file open in the next lectures

2. Come up with **1–3 questions in how people interact with computers**.
    - Follow your curiosity
    - These questions do not need to be new or ground-breaking
    - Formulate them as open-ended questions. It must ends with "?", and it's answer should not be one word (e.g., yes/no).
    - You may change these questions later.
    - Bring it with you in writing (either on screen or on a piece of paper) tomorrow

Course logistics

See the syllabus

https://chatw.ch/fpoc25

Fundamentals of People-Oriented Computing—2025

Instructor: Chat Wacharamanotham (to email, see OLAT) Office hours: https://chatw.ch/h
Course format: Lecture with in-class exercises

COURSE DESCRIPTION

This course is an introductory module for People-Oriented Computing. Students will gain learn knowledge and skills in individual and collaborative work, to work with scholarly literature, and to conduct scholarly discourses. They will learn concepts and processes from cognitive psychology and how to apply them to improve their thinking and work by themselves and with others. Students will learn several conceptual frameworks that could help them understand and assess research contributions. They will learn about components and forms of arguments and critiques. This course will use the scholarly literature from various fields related to People-Oriented Computing.

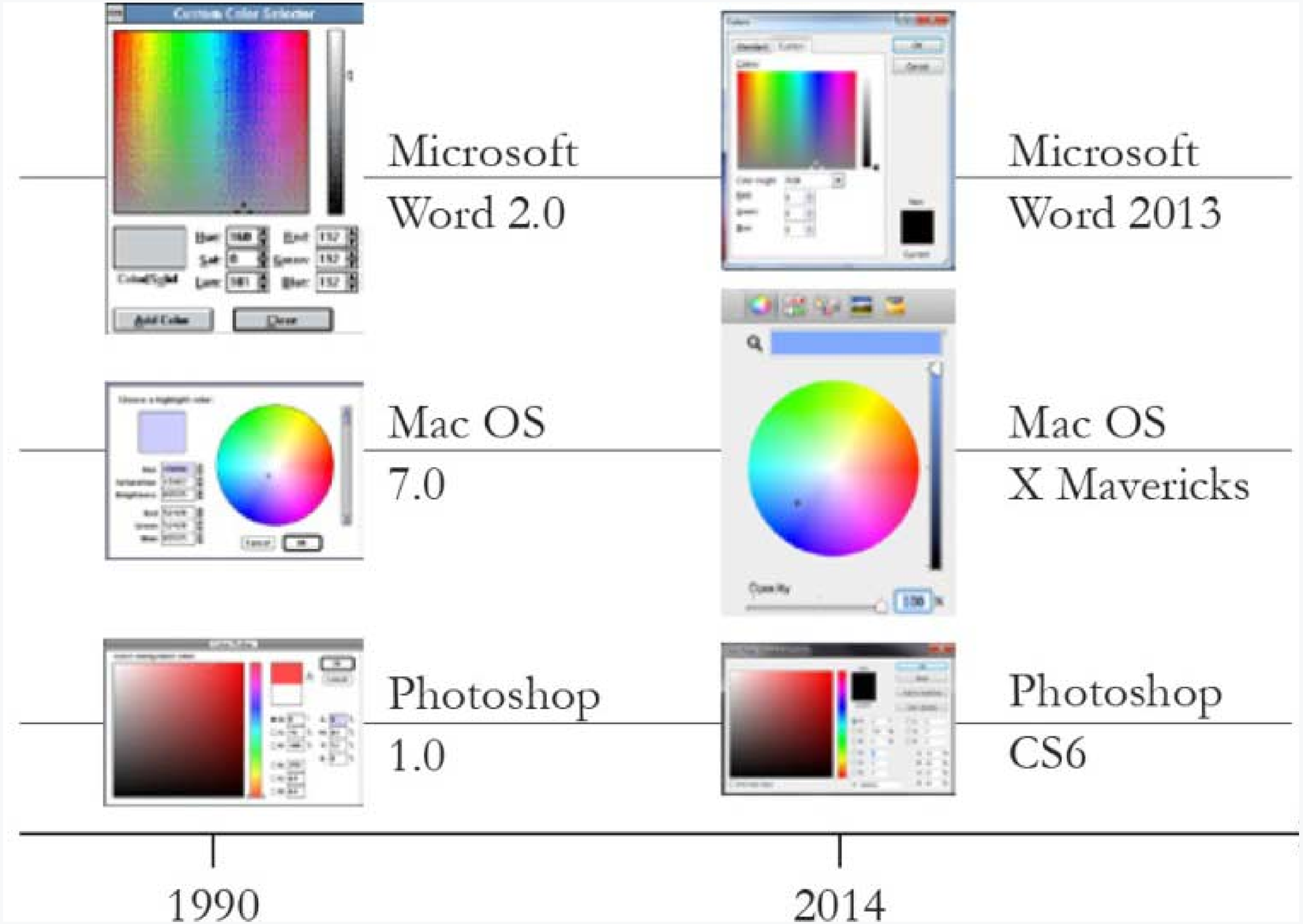
INTENDED LEARNING OUTCOMES

1. Students understand concepts and processes in cognitive psychology and can articulate how these theories apply to work situations.
2. Students know conceptual frameworks for understanding and assessing research contributions.
3. Students can identify the primary contributions of research papers.
4. Students can assess the credibility of sources of scholarly publications.
5. Students can analyze scholarly arguments and assess their quality.
6. Students can synthesize knowledge from multiple readings.
7. Students can formulate and communicate constructive critiques in scholarly contexts.
8. Students can articulate the strengths and weaknesses of selected research methods.

Supplemental slides

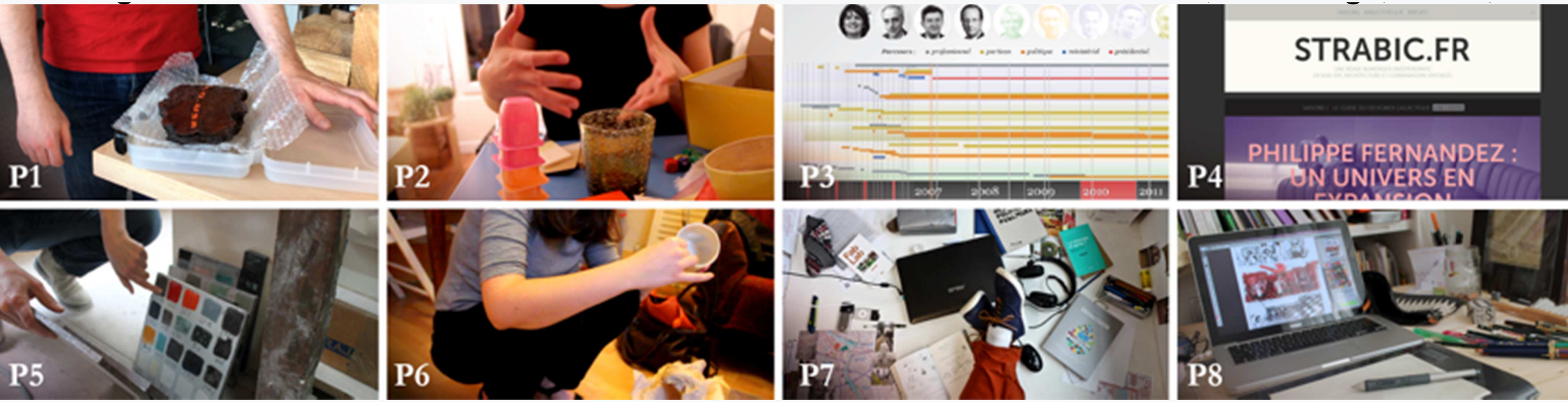
Color Portrait

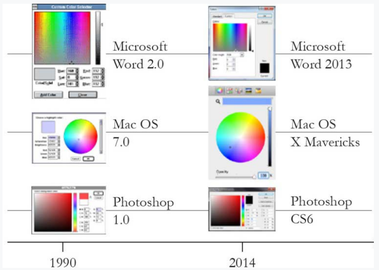
EXAMPLE: COLOR PORTRAITS



 Jalal et al. (2015) Color Portraits: From Color Picking to Interacting with Color

EXAMPLE: COLOR PORTRAITS





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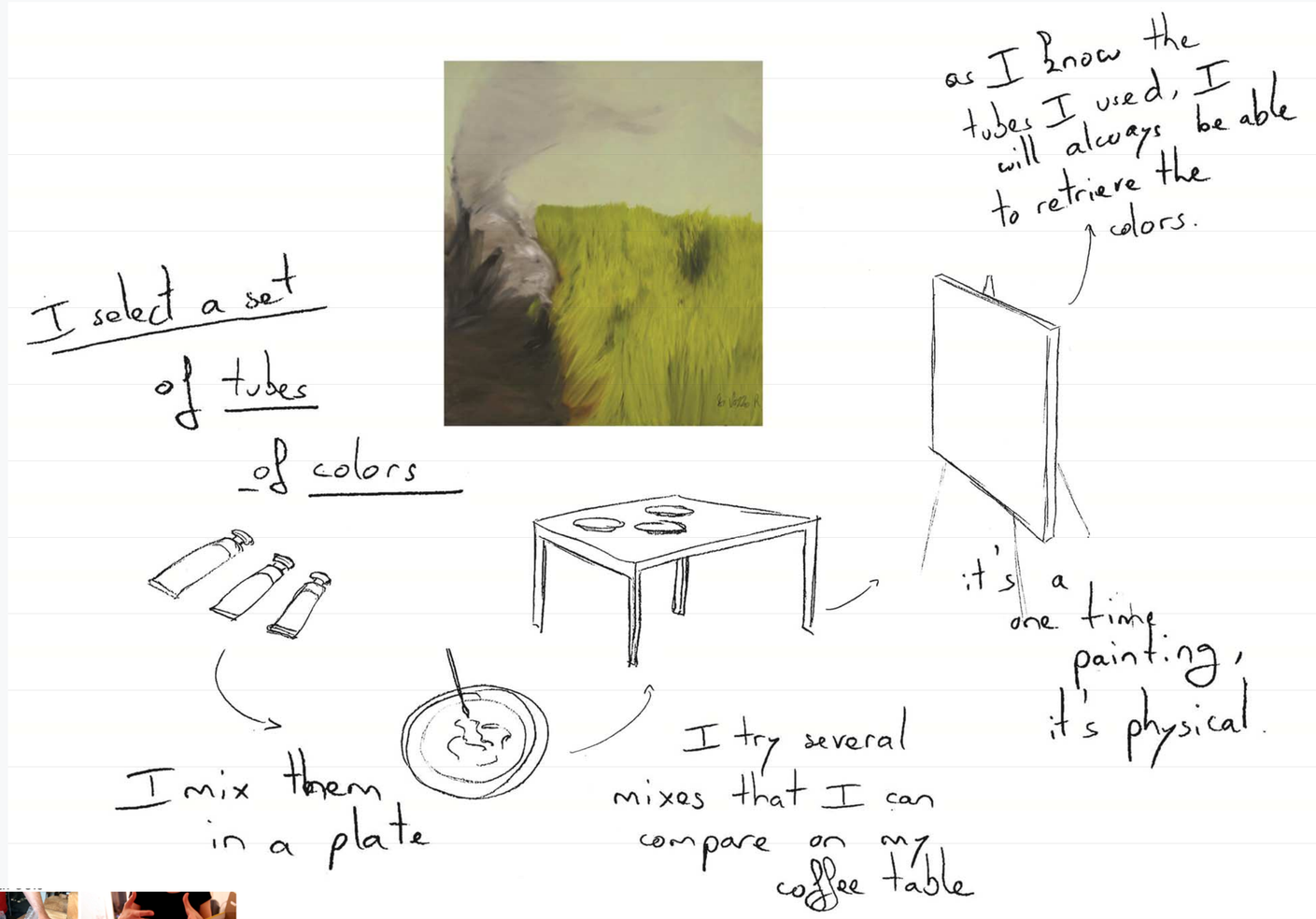

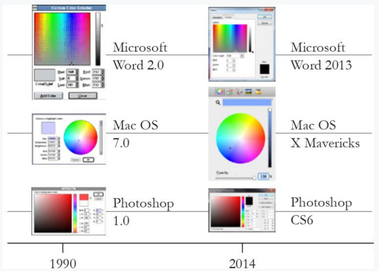

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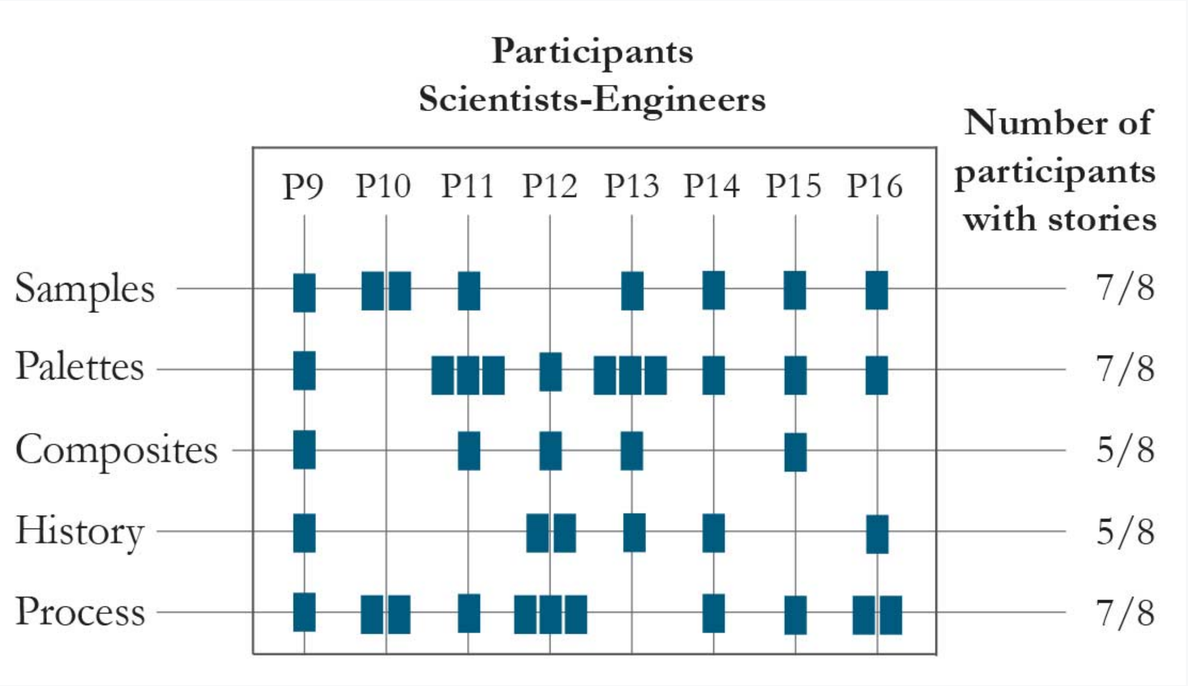
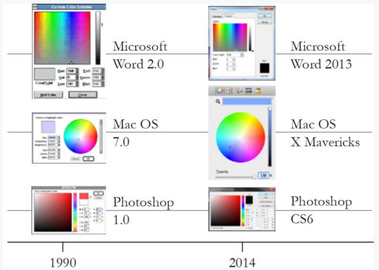
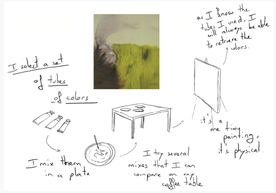
EXAMPLE: COLOR PORTRAITS

Sample	start from an initial color; tweak properties to obtain a final color.
Palette	manipulate relationships among groups of colors.
Composite	combine colors with other elements such as texture; decompose to disparate elements.
History	capture and reuse source and target color contexts; preserve meaningful interim steps.
Process	reveal progress through color changes.







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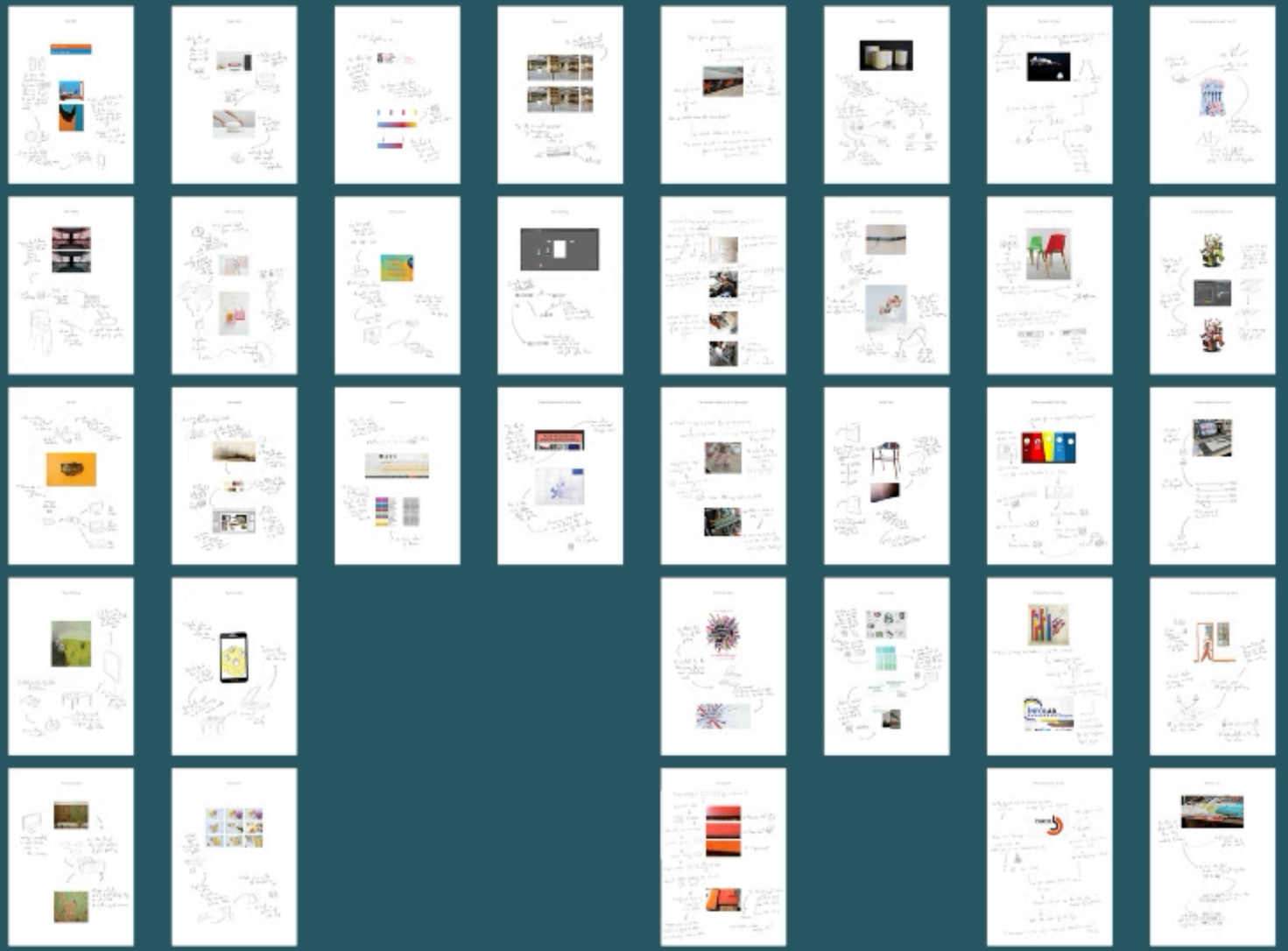
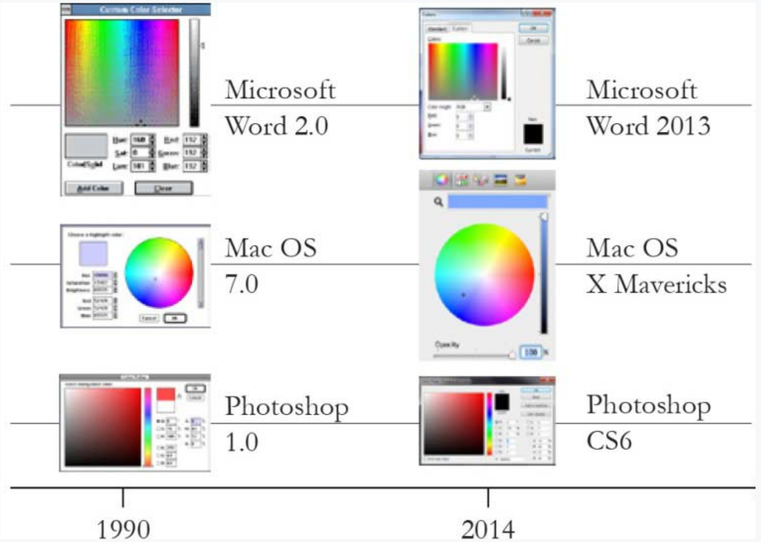
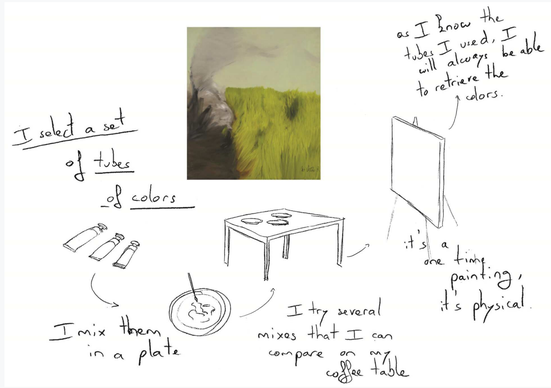


EXAMPLE: COLOR PORTRAITS



- Substantive:
- Conceptual:
- Methodological:



Observation + Interview

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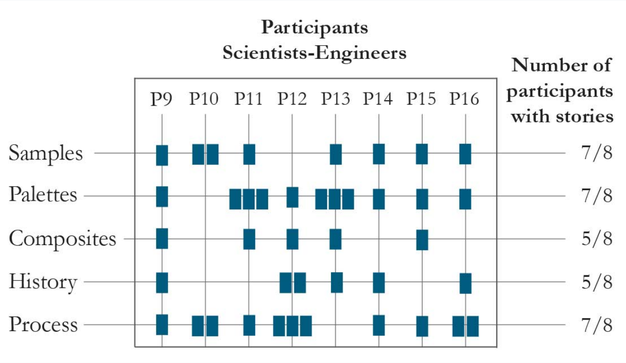
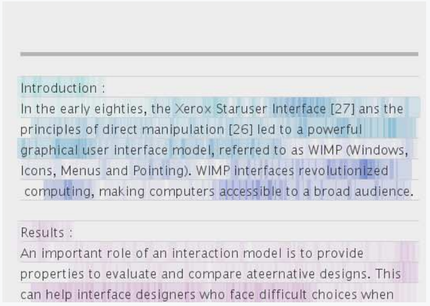


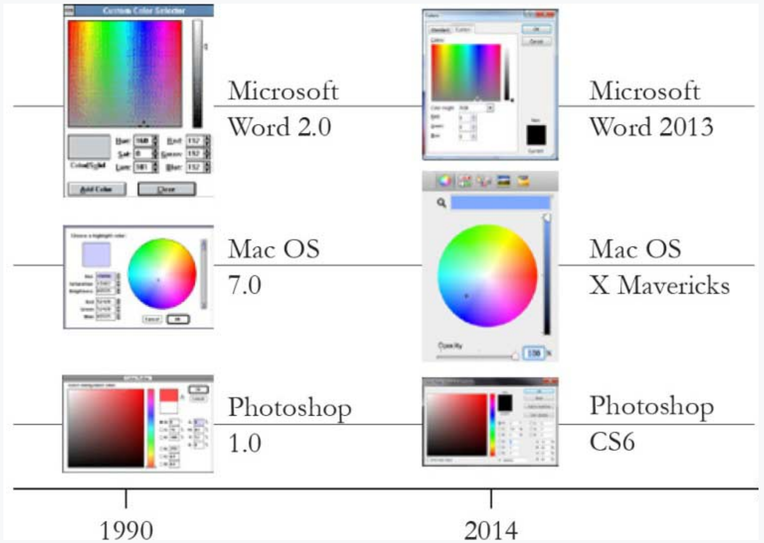
Create the design space

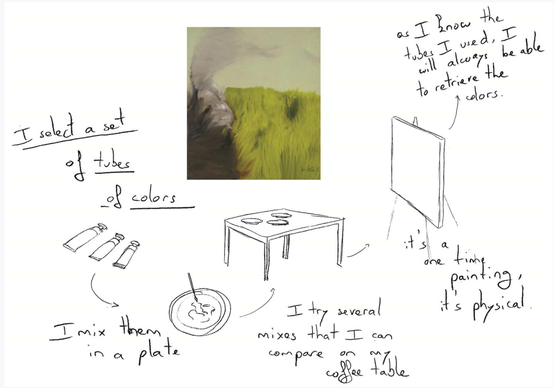


Create design probes + interviews

 Jalal et al. (2015) Color Portraits: From Color Picking to Interacting with Color

EXAMPLE: COLOR PORTRAITS





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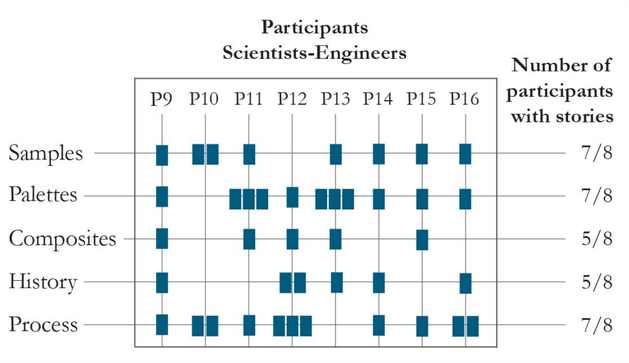
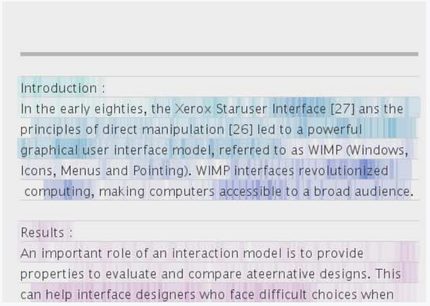
History	capture and reuse source and target color contexts; preserve meaningful interim steps.
Process	reveal progress through color changes.



Create the design space

- Substantive: Expert users (artists, scientists) + colors
- Conceptual: The design space for color manipulation
- Methodological: Observation, interview, design probes



Create design probes + interviews

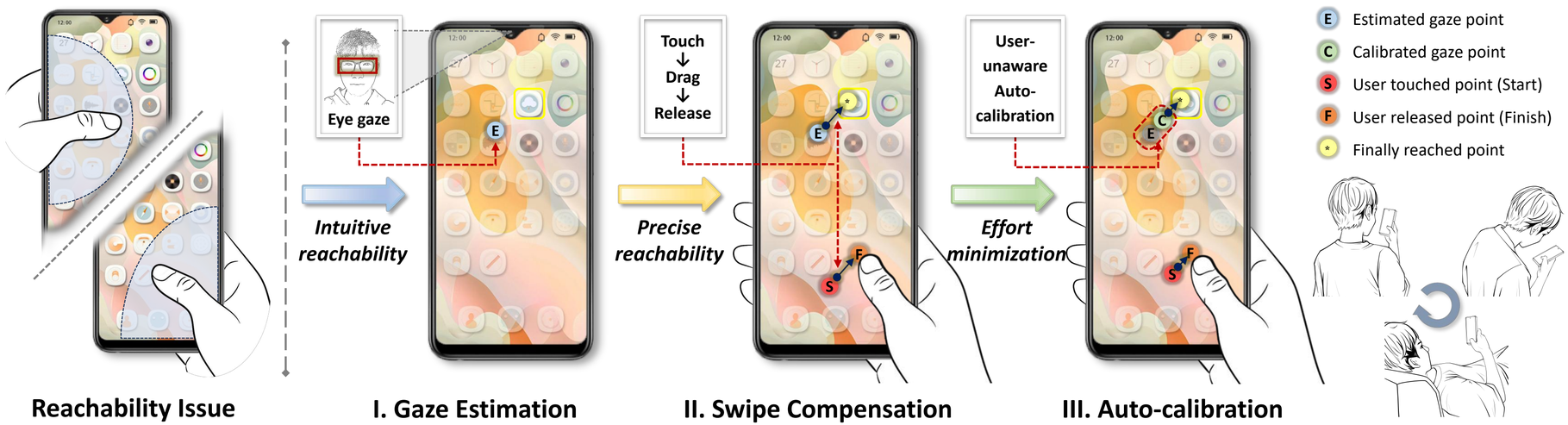
Jalal et al. (2015) Color Portraits: From Color Picking to Interacting with Color

RealitySketch

Embedding Responsive Graphics and Visualizations in AR through Dynamic Sketching

Ryo Suzuki, Rubaiat Habib Kazi, Li-Yi Wei
Stephen DiVerdi, Wilmot Li, Daniel Leithinger

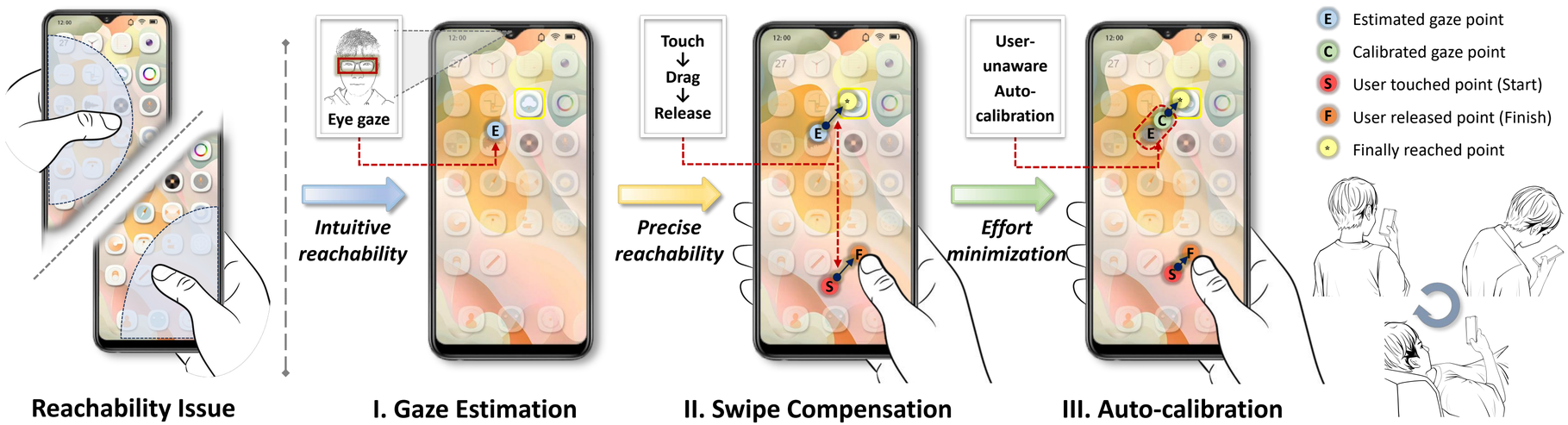
University of Calgary, Adobe Research, CU Boulder



Abstract

Smartphones with large screens provide users with increased display and interaction space but pose challenges in reaching certain areas with the thumb when using the device with one hand. To address this, we introduce GazeSwipe, a multimodal interaction technique that combines eye gaze with finger-swipe gestures, enabling intuitive and low-friction reach on mobile touchscreens. Specifically, we design a gaze estimation method that eliminates the need for explicit gaze calibration. Our approach also avoids the use of additional eye-tracking hardware by leveraging the smartphone's built-in front-facing camera. Considering the potential decrease in gaze accuracy without dedicated eye trackers, we use finger-swipe gestures to compensate for any inaccuracies in gaze estimation. Additionally, we introduce a user-unaware auto-calibration method that improves gaze accuracy during interaction. Through extensive experiments on smartphones and tablets, we compare our technique with various methods for touchscreen reachability and evaluate the performance of our auto-calibration strategy. The results demonstrate that our method achieves high success rates and is preferred by users. The findings also validate the effectiveness of the auto-calibration strategy.

*Both authors contributed equally to this research.
†Feng Lu is the corresponding author.



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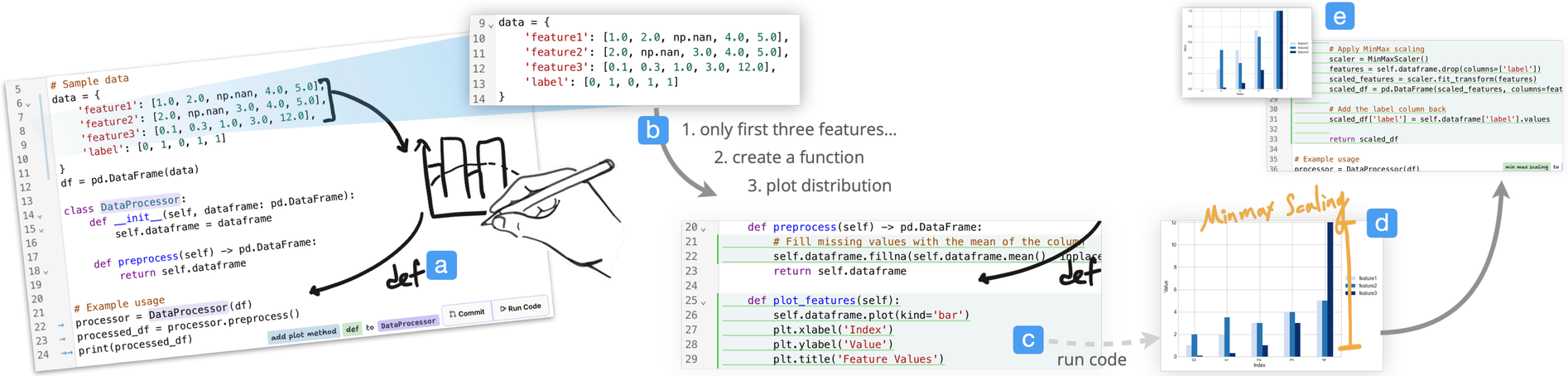

Abstract

We introduce the concept of code shaping, an interaction paradigm for editing code using free-form sketch annotations directly on top of the code and console output. To evaluate this concept, we conducted a three-stage design study with 18 different programmers to investigate how sketches can communicate intended code edits to an AI model for interpretation and execution. The results show how different sketches are used, the strategies programmers employ during iterative interactions with AI interpretations, and interaction design principles that support the reconciliation between the code editor and sketches. Finally, we demonstrate the practical application of the code shaping concept with two use case scenarios, illustrating design implications from the study.

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