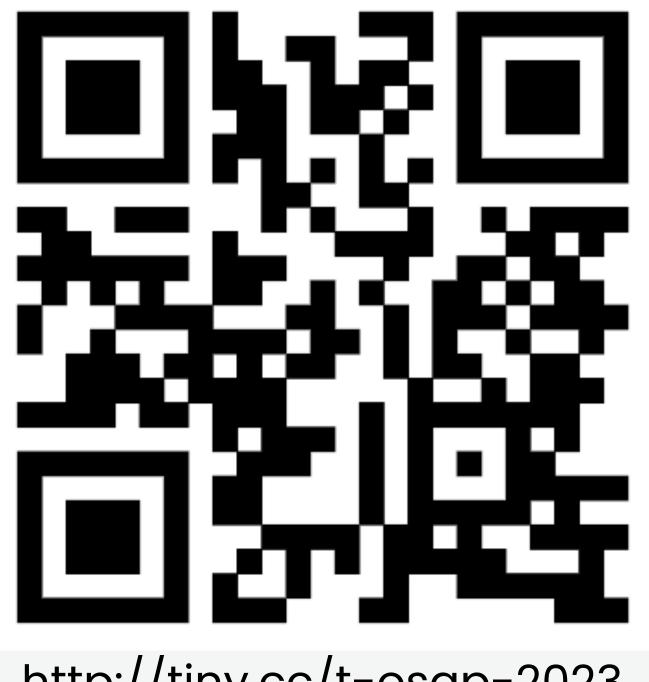
Motivating research transparency in Human-Computer Interaction

- Chat Wacharamanotham
- chat@acm.org
- Twitter: @chatchavan
- Mastodon: @chat@hci.social

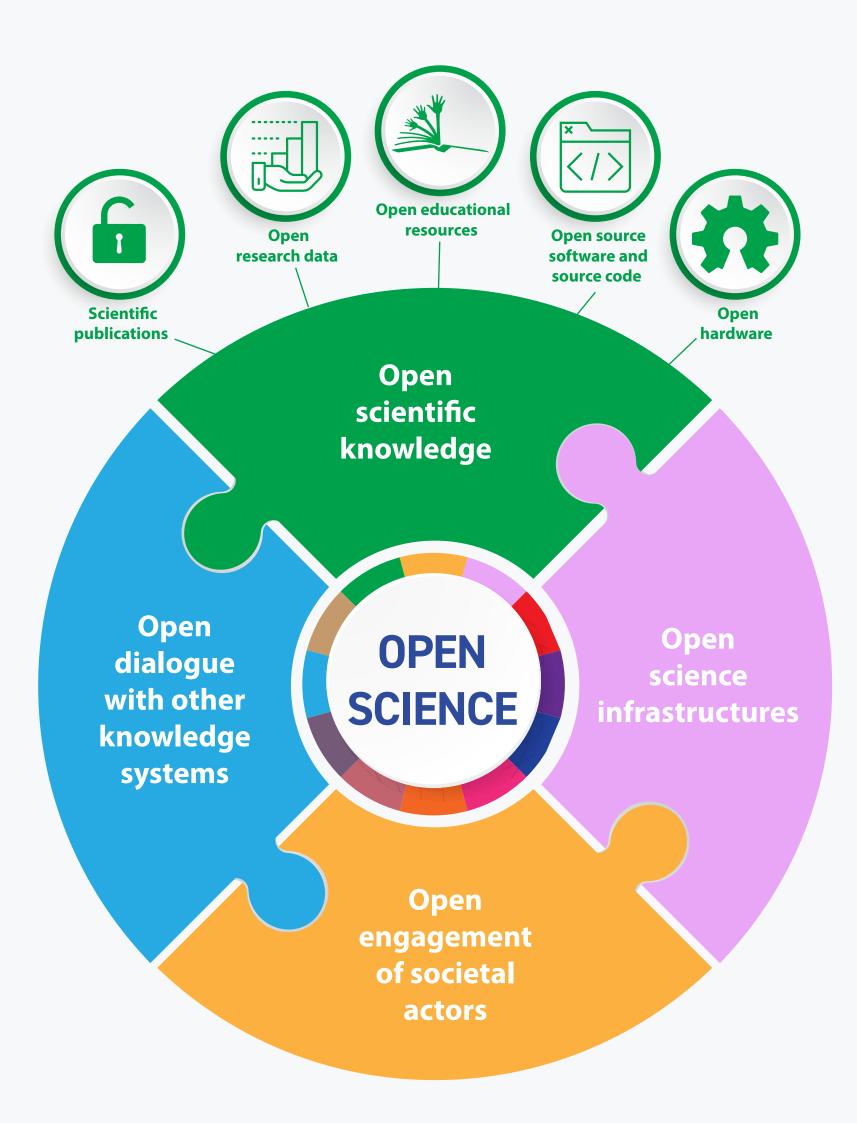
Max Planck Society Open Science Ambassador Meeting 2023 20 September 2023

Slides: http://tiny.cc/t-osap-2023



http://tiny.cc/t-osap-2023 (slides)





[1] UNESCO Recommendation on Open Science

"[Open scientific knowledge] also refers to the possibility of opening research methodologies and evaluation processes."[1]



[1] UNESCO Recommendation on Open Science

[2] From a working article by Yvonne Jansen, Jan B. Vornhagen, Olga larygina, Kavous Salehzadeh Niksirat, Lonni Besançon, Pierre Dragicevic, Julien Gori, and Chat Wacharamanotham; This forthcoming article is based on "A Manifesto for Transparent Quantitative Research – Definition" by Wacharamanotham et al. in Report from Dagstuhl Seminar 22392: Transparent Quantitative Research as a User Interface Problem. https://doi.org/10.4230/DagRep.12.9.220

3

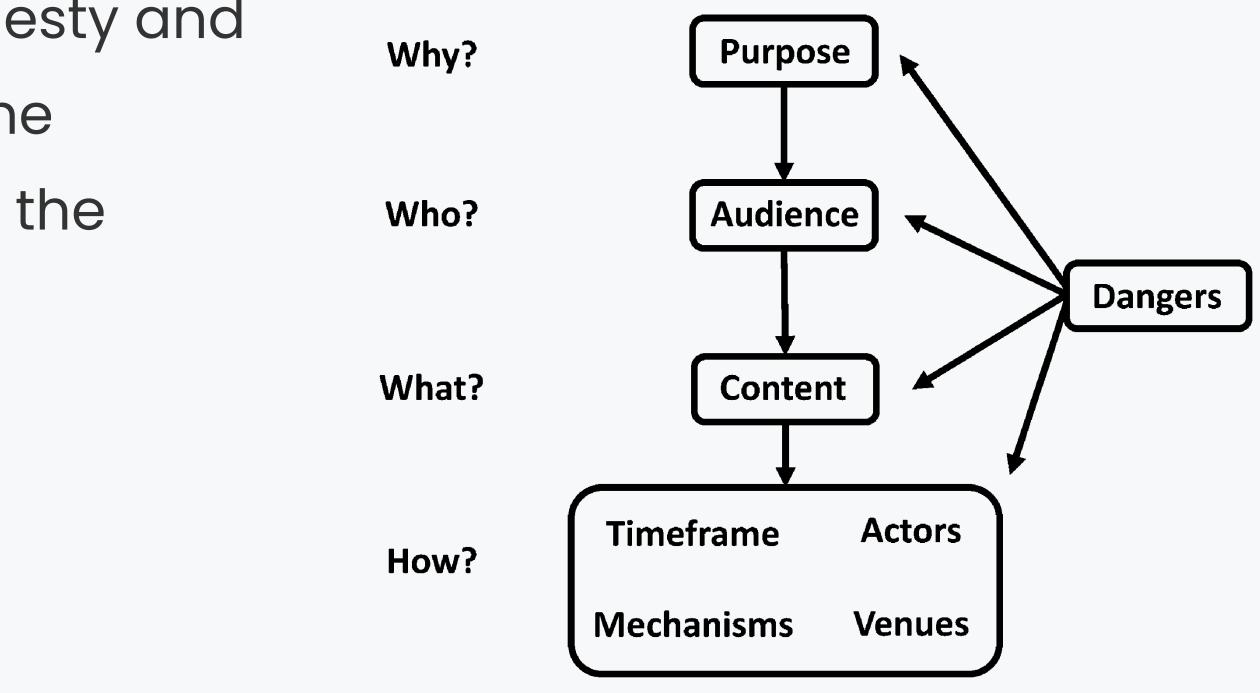
- "[Open scientific knowledge] also refers to the possibility of opening research methodologies and evaluation processes."[1]
- "Research transparency refers to honesty and clarity in all communications about the research processes and outcomes to the extent possible." [2]

Research transparency

"Research transparency refers to honesty and clarity in all communications about the research processes and outcomes to the extent possible."

Slides: http://tiny.cc/t-osap-2023





Elliott (2022) A Taxonomy of Transparency in Science. Canadian Journal of Philosophy, 52: 3, 342–355

Transparency through visualizing research data

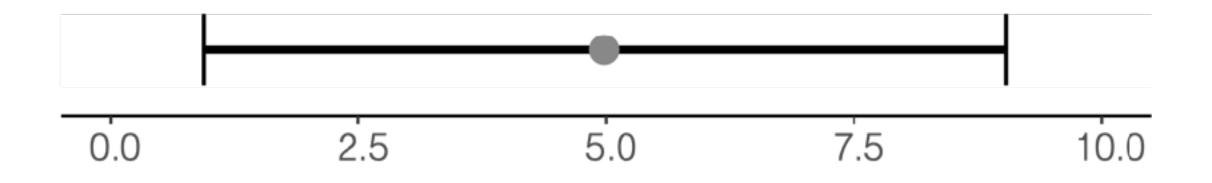


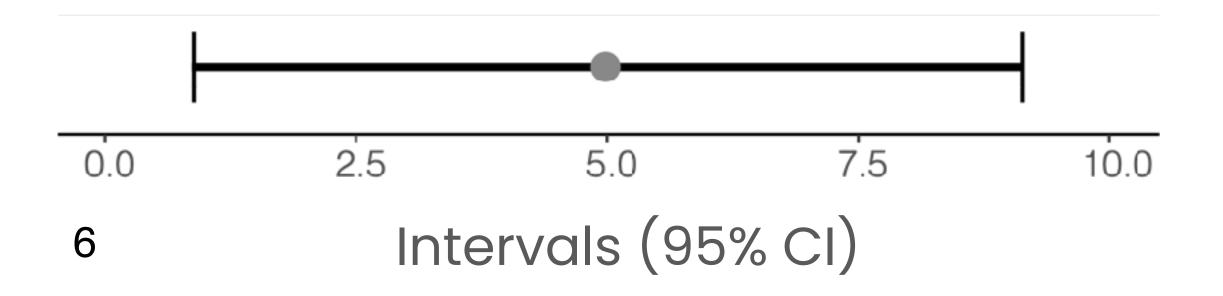
This section is based on the open materials of the courses presented at CHI 2022–23 by Chat Wacharamanotham, Fumeng Yang, Abhraneel Sarma, Xiaoying Pu, and Lace Padilla. https://osf.io/27r5z

Slides: http://tiny.cc/t-osap-2023

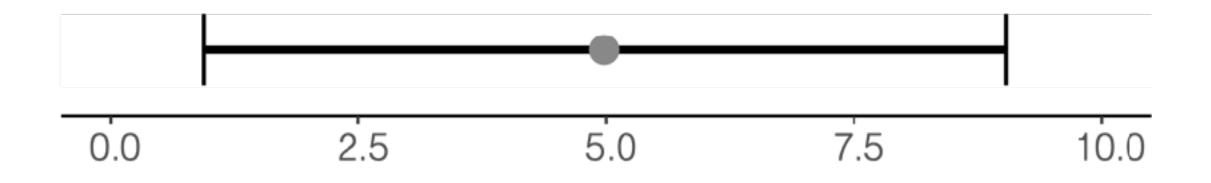


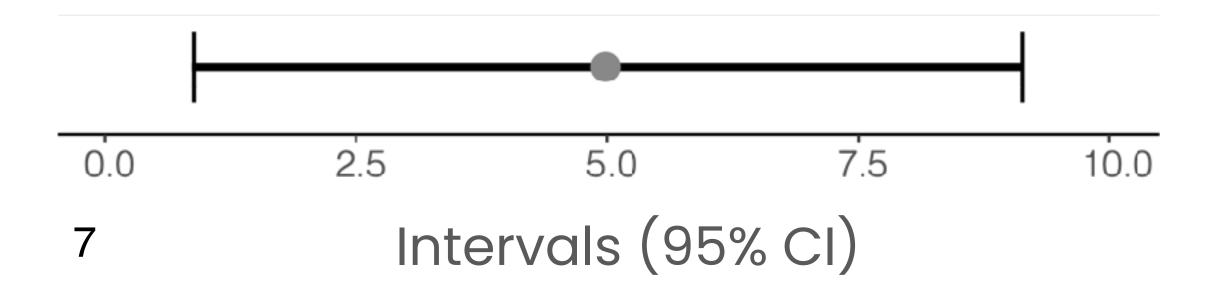
What can you say about these two 95% confidence intervals?

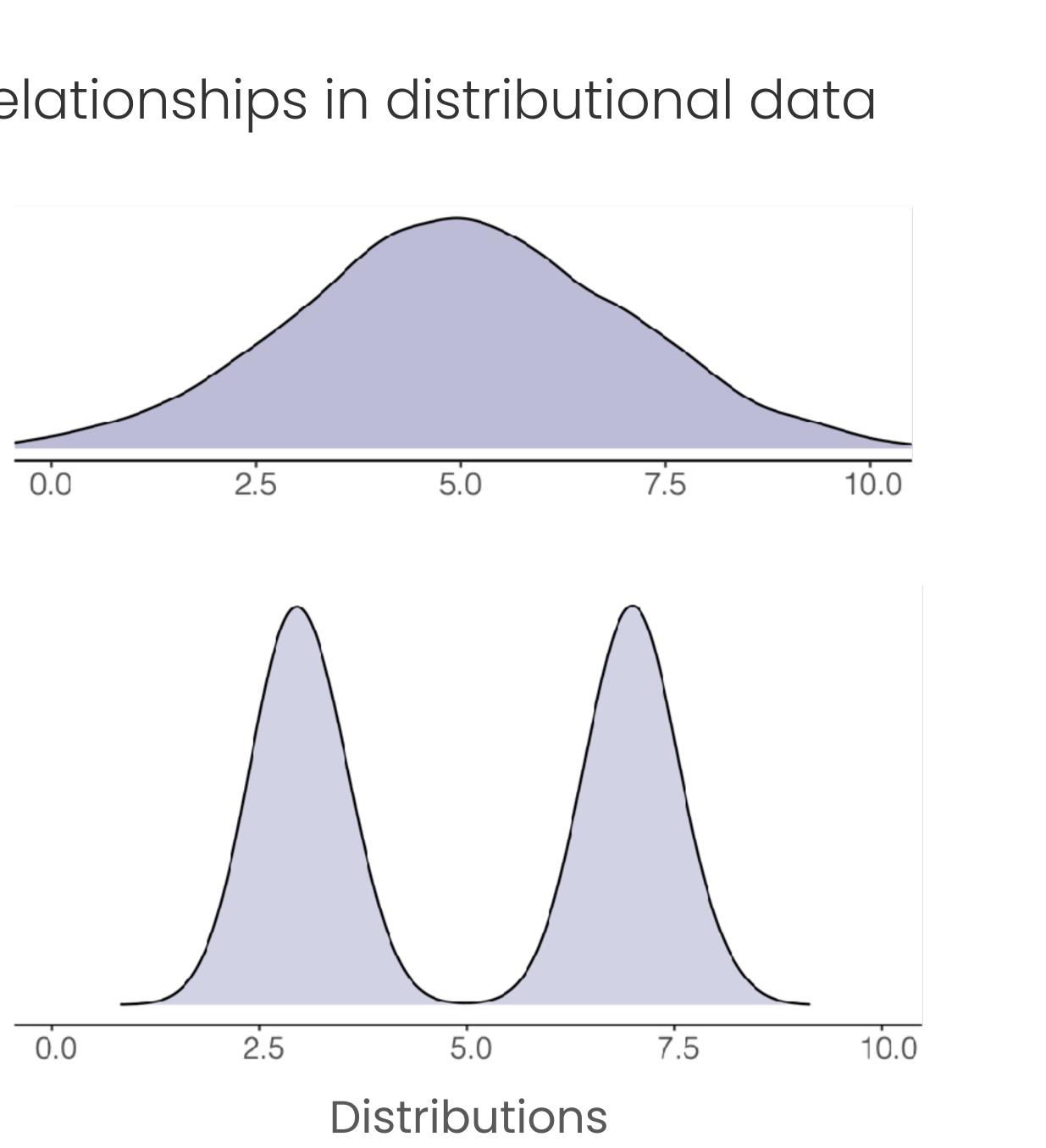




Summaries can obscure important relationships in distributional data







Visualizing uncertainty in the results

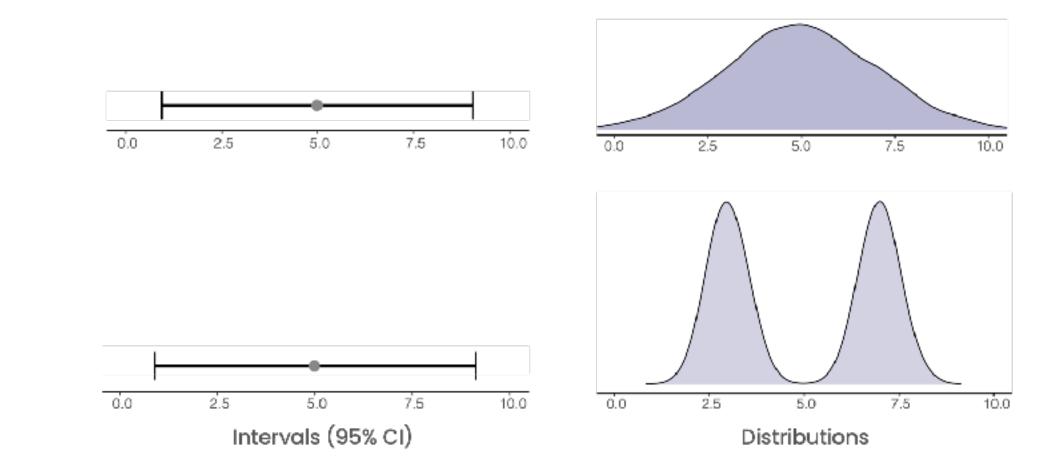
- the relationships that exist in the data^{1,2}

Expressiveness is a proxy to transparency

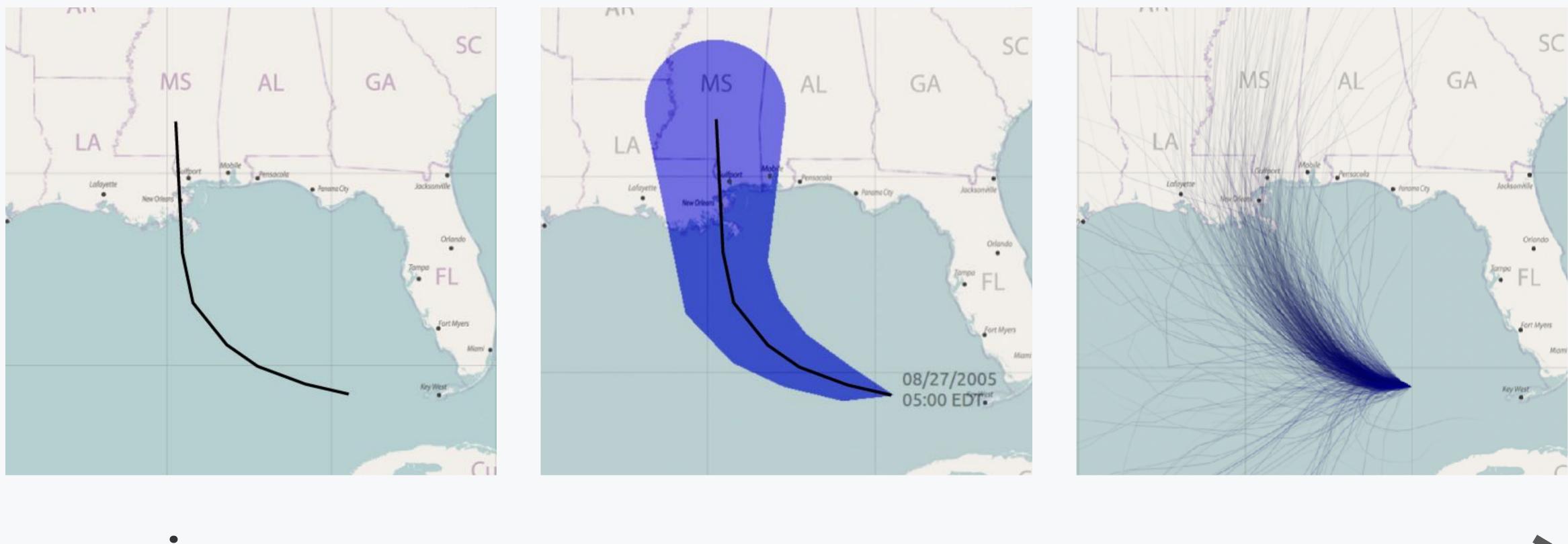
Mackinlay, J. (1986). Automating the design of graphical presentations of relational information. [1] 8 [2] <u>Munzner, T. (2014)</u>. Visualization analysis and design. CRC press.

Slides: http://tiny.cc/t-osap-2023

Expressiveness principle: the visual representation should represent **all** and **only**



Slides: http://tiny.cc/t-osap-2023



expressiveness

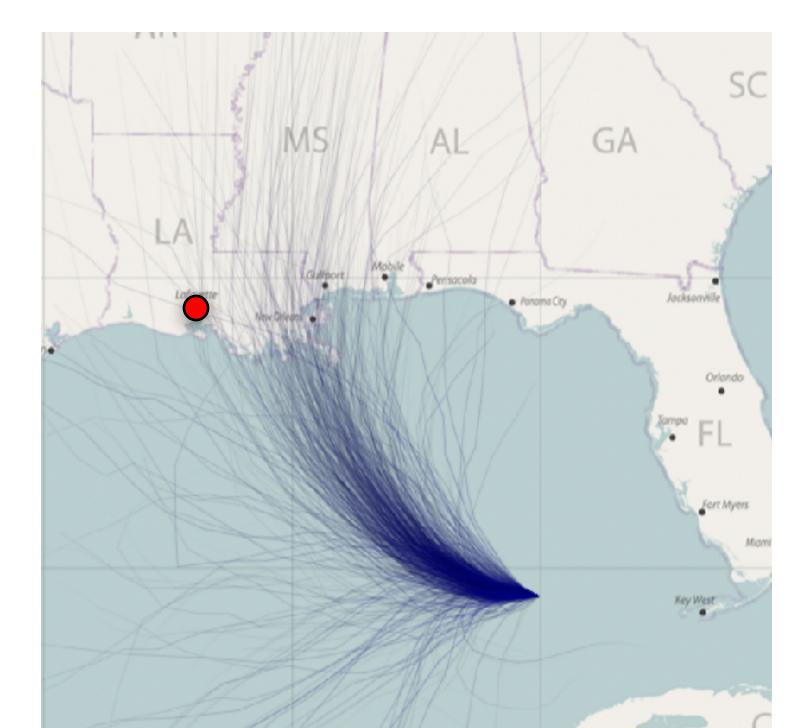
Visualizations of data can vary on a spectrum of expressiveness Choices of visualization is an aspect of research transparency

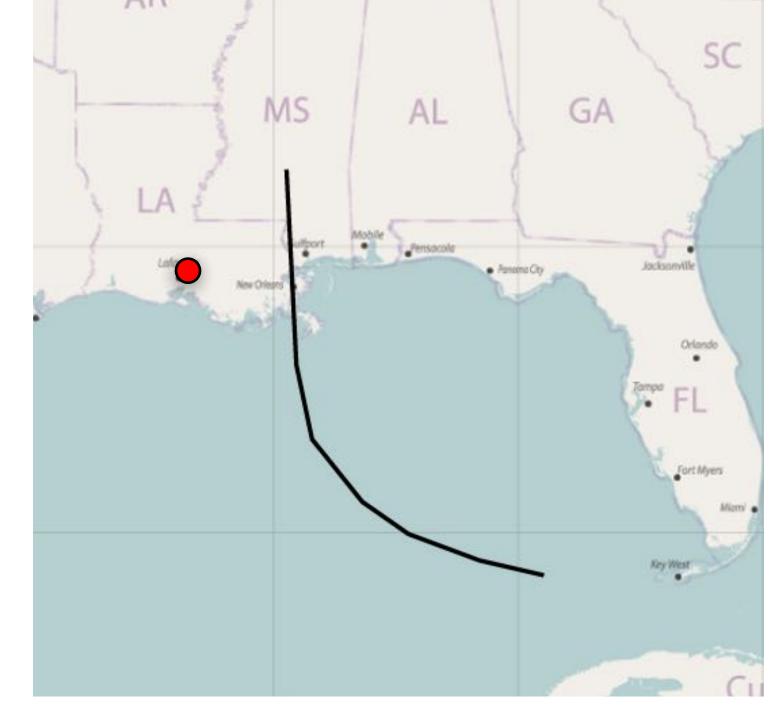


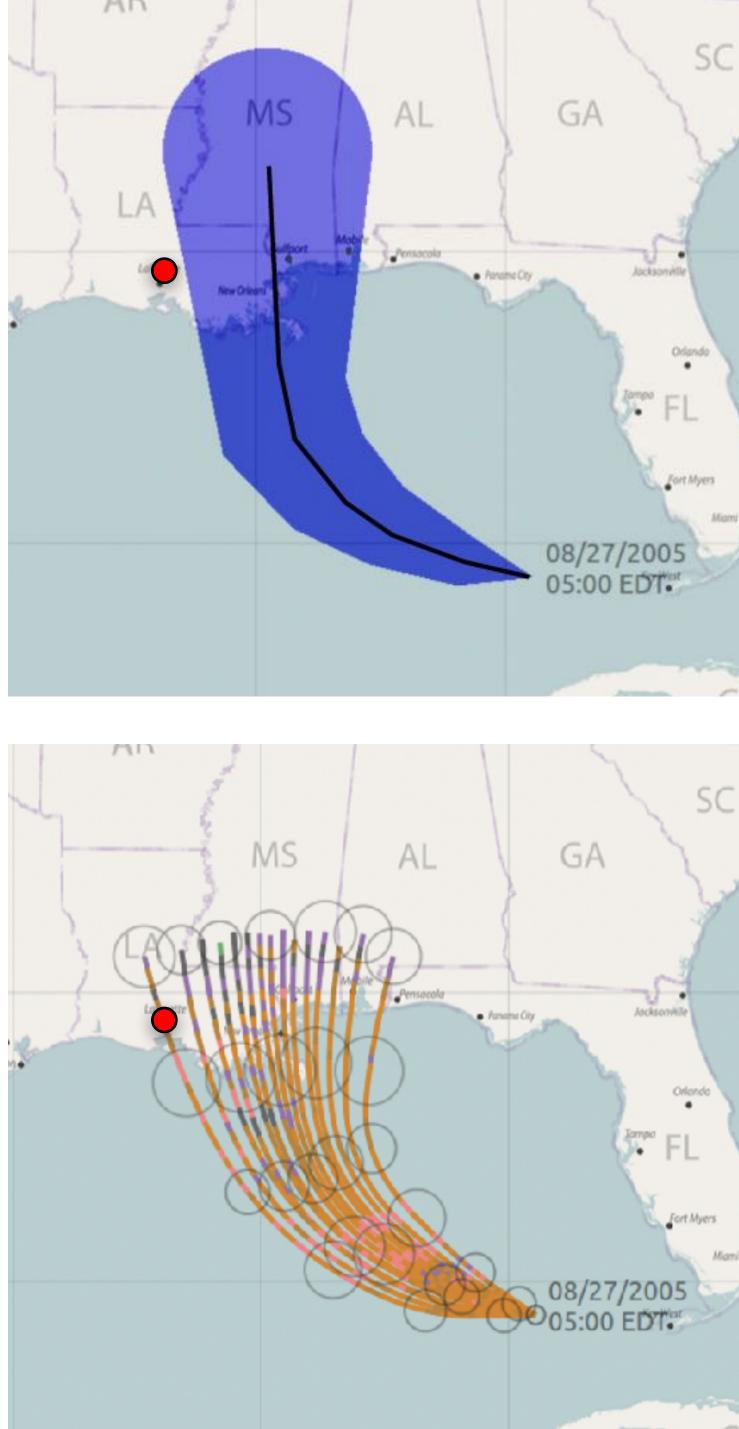
Would you stay or evacuate?

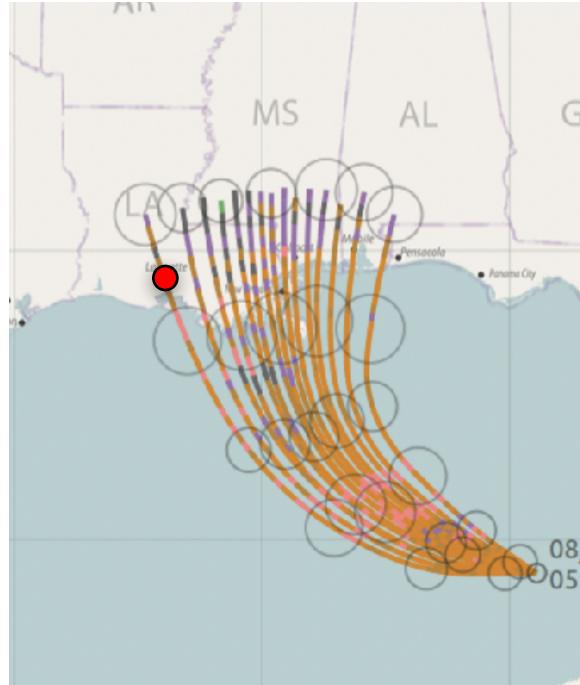
Usable visualizations support users in making accurate inferences

Liu et al., 2018 (IEEE VIS) 10 Padilla et al., 2018 (CRPI)







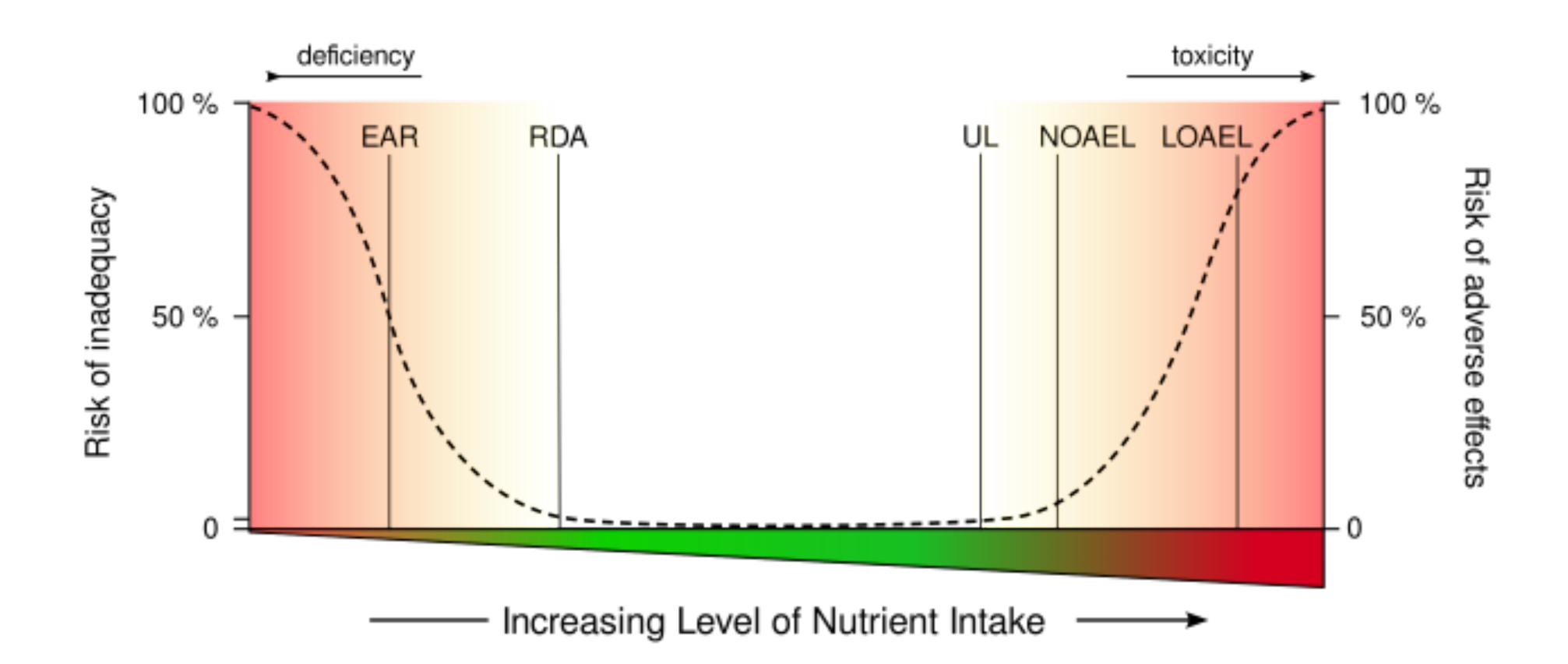


Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and A

Food and Nutrition Board, Institute of Medicine, National Academies

Life Stage Group	Vitamin A (µg/d) ^{<u>a</u>}	Vitamin C (mg/d)	_	Vitamin E (mg/d) ^d	Vitamin K (µg/d)	Thiamin (mg/d)	Ribc (mg/
Infants							
0–6 <u>mo</u>	400*	40*	10*	4*	2.0*	0.2*	
6–12 <u>mo</u>	500*	50*	10*	5*	2.5*	0.3*	
Children							
1—3 у	300	15	15	6	30*	0.5	
4–8 <u>y</u>	400	25	15	7	55*	0.6	
Males							
9–13 <u>y</u>	600	45	15	11	60*	0.9	
14–18 <u>y</u>	900	75	15	15	75*	1.2	

Dietary reference intake (Food and Nutrition Board, Institute of Medicine, National Academies)



Uncertainty matters

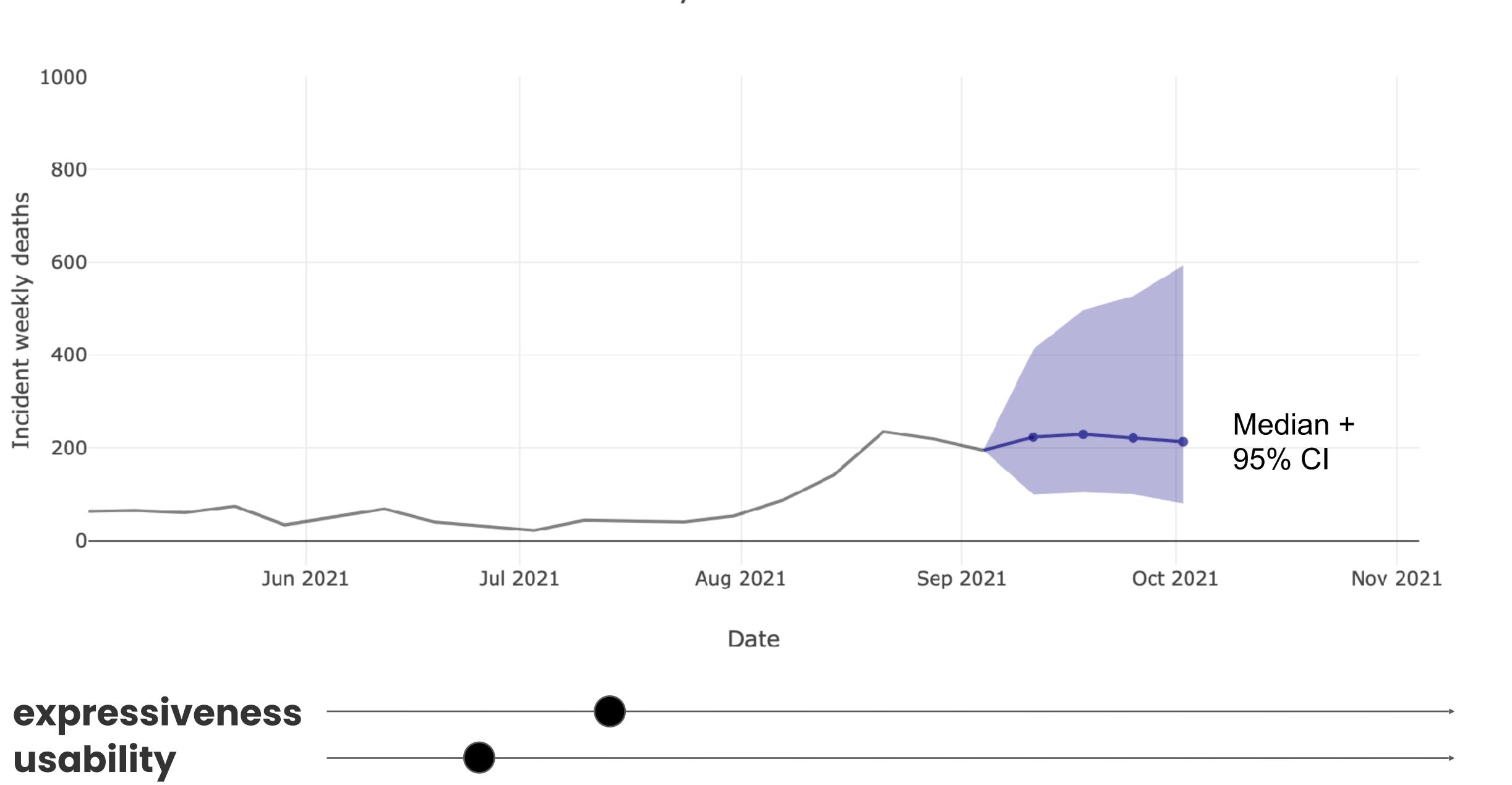
Showing uncertainty:

- Increases scientific credibility
- Increases trust
- Let them tune their expectations and assumptions correctly

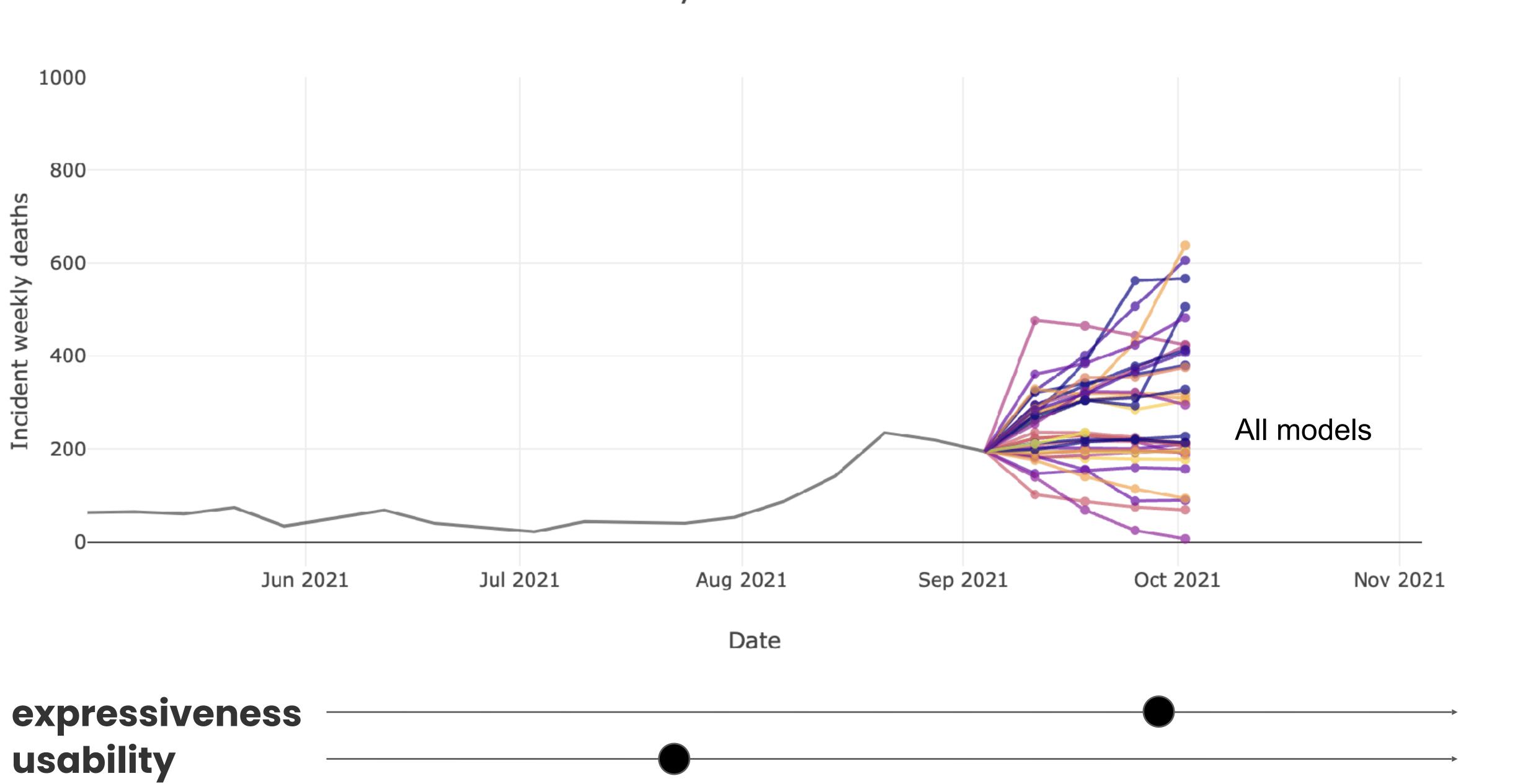
Usable visualizations support users in making accurate inferences Showing uncertainty contributes to usability

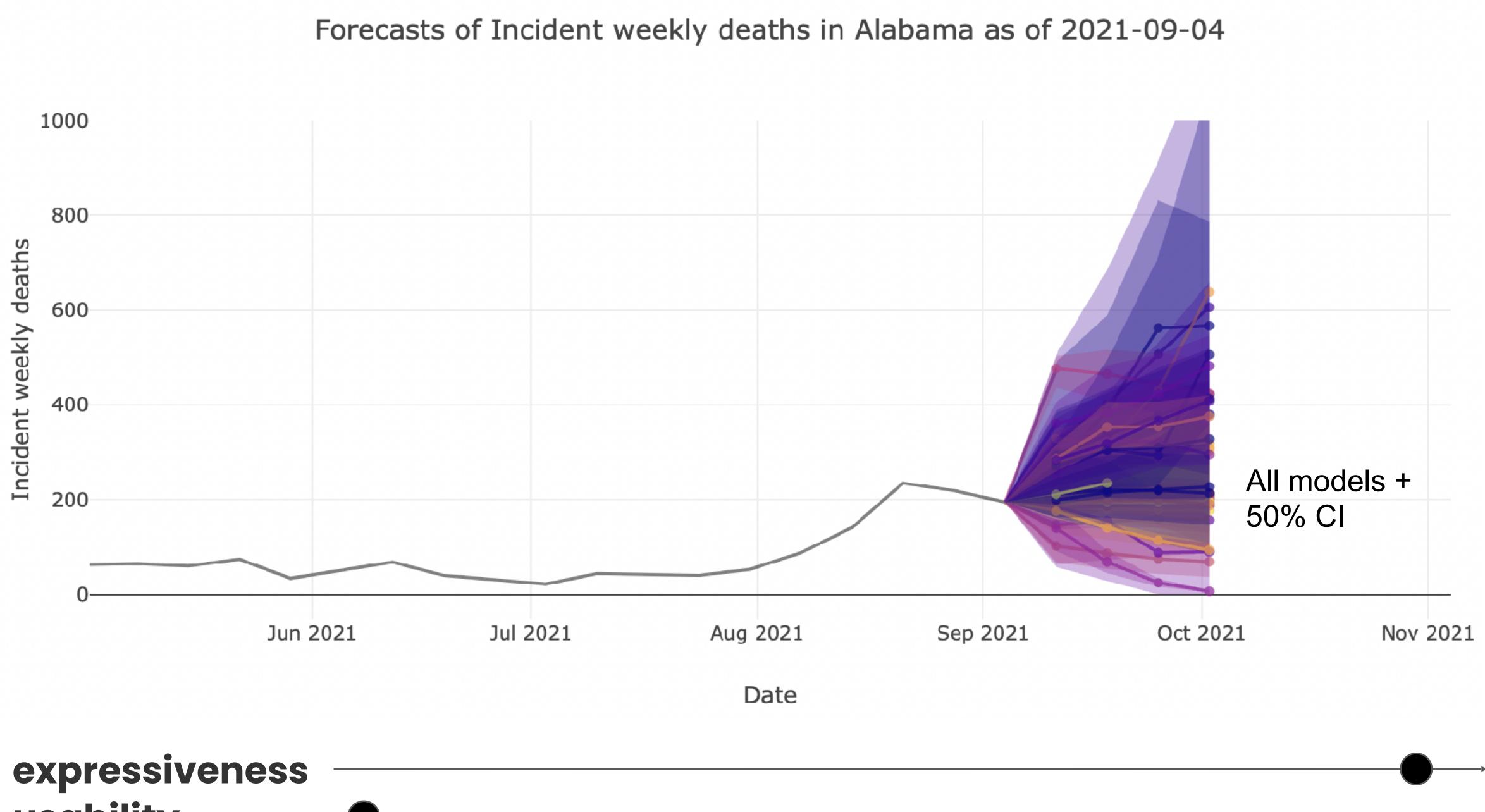
Without uncertainty, viewers may come to **incorrect** conclusions about the data.

Forecasts of Incident weekly deaths in Alabama as of 2021-09-04



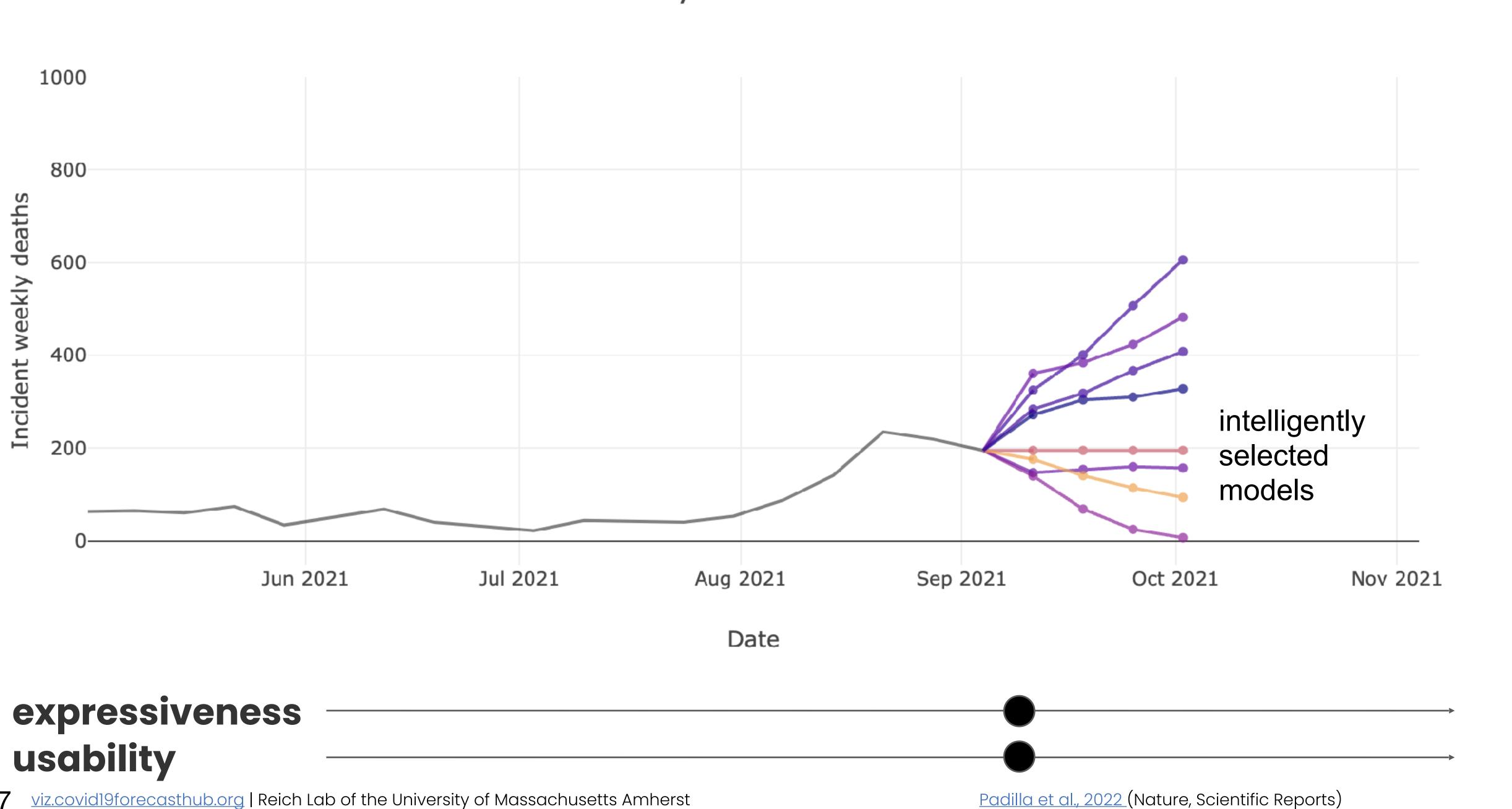
Forecasts of Incident weekly deaths in Alabama as of 2021-09-04





usability

Forecasts of Incident weekly deaths in Alabama as of 2021-09-04

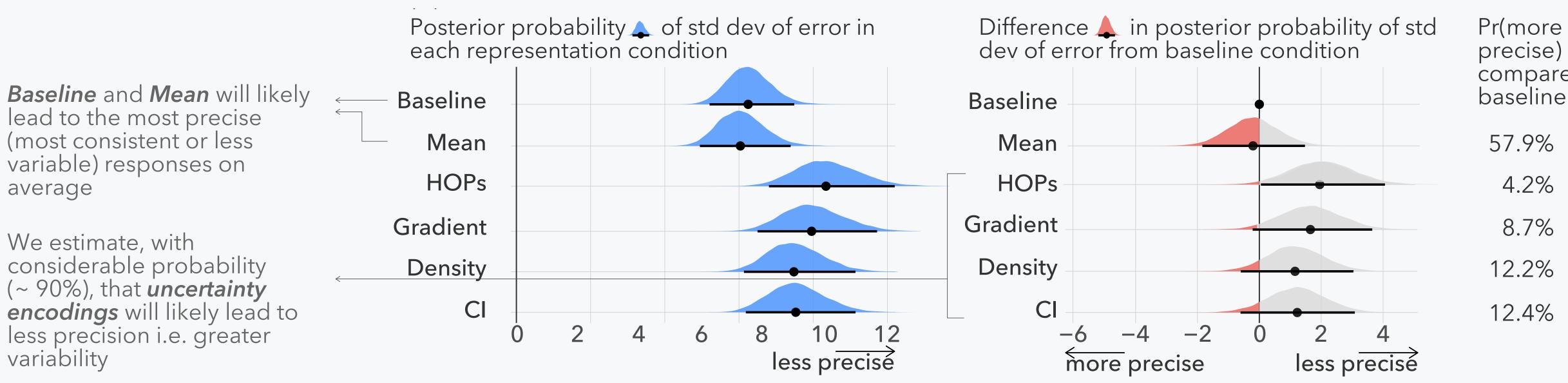


Research transparency through visualization

Balancing tradeoffs between: **Expressiveness:** Faithfully represent the data, and **Usability:** Support users in making accurate inferences from the data

No single best answer Consider context, data set, and audience when making these decisions

Bridge charts to text with annotations

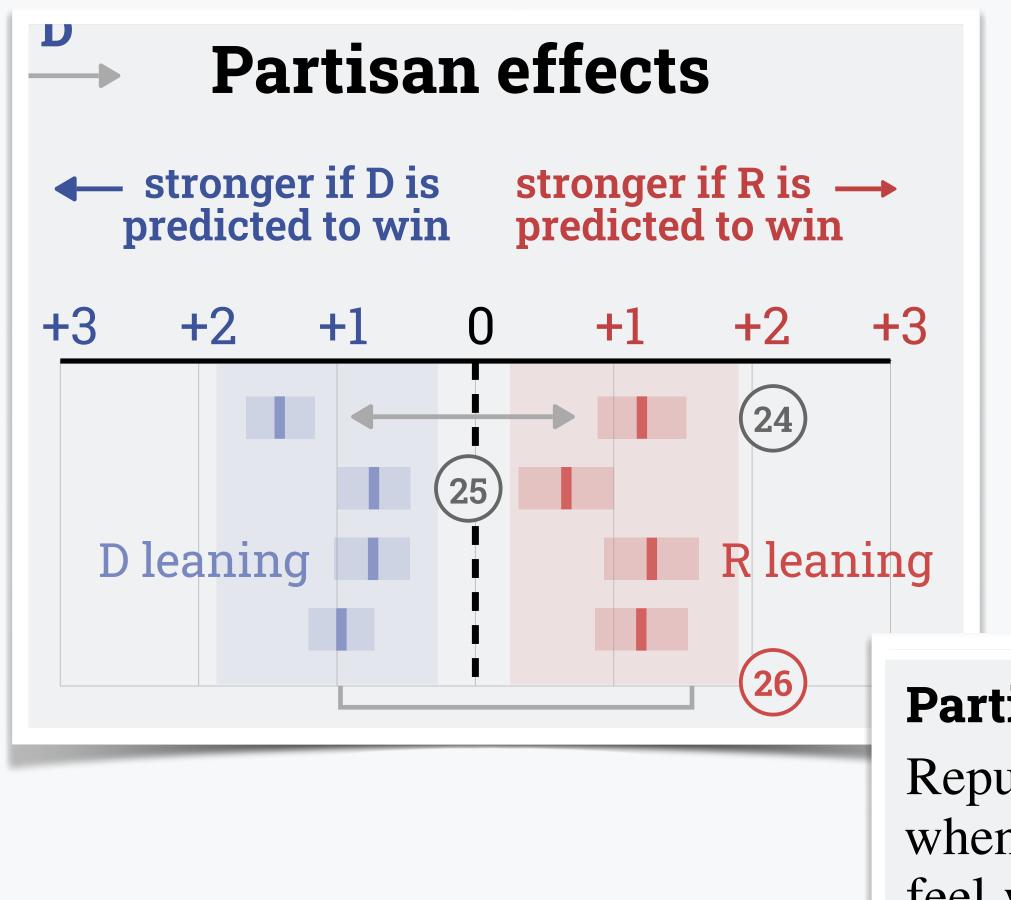


Sarma, A., Guo, S., Hoffswell, J., Rossi, R., Du, F., Koh, E., & Kay, M. (2022). Evaluating the use of uncertainty visualisations for imputations of data missing at random

compared to

¹⁹ in scatterplots. IEEE Transactions on Visualization and Computer Graphics, 29(1), 602-612.

Bridge charts to text with annotations



Slides: http://tiny.cc/t-osap-2023

Partisan effects

Republicans (26) feel more positively and (34) (35) trust the forecasts mo when their candidate is predicted to win, compared to how Democra feel when a Democratic candidate is predicted to win. That said, R

Yang, F., et al. (2023). Swaying the Public? Impacts of Election Forecast Visualizations on Emotion, Trust, and Intention in the 2022 US Midterms. To appear in IEEE TVCG 2024





The field of Human-Computer Interaction

Slides: http://tiny.cc/t-osap-2023

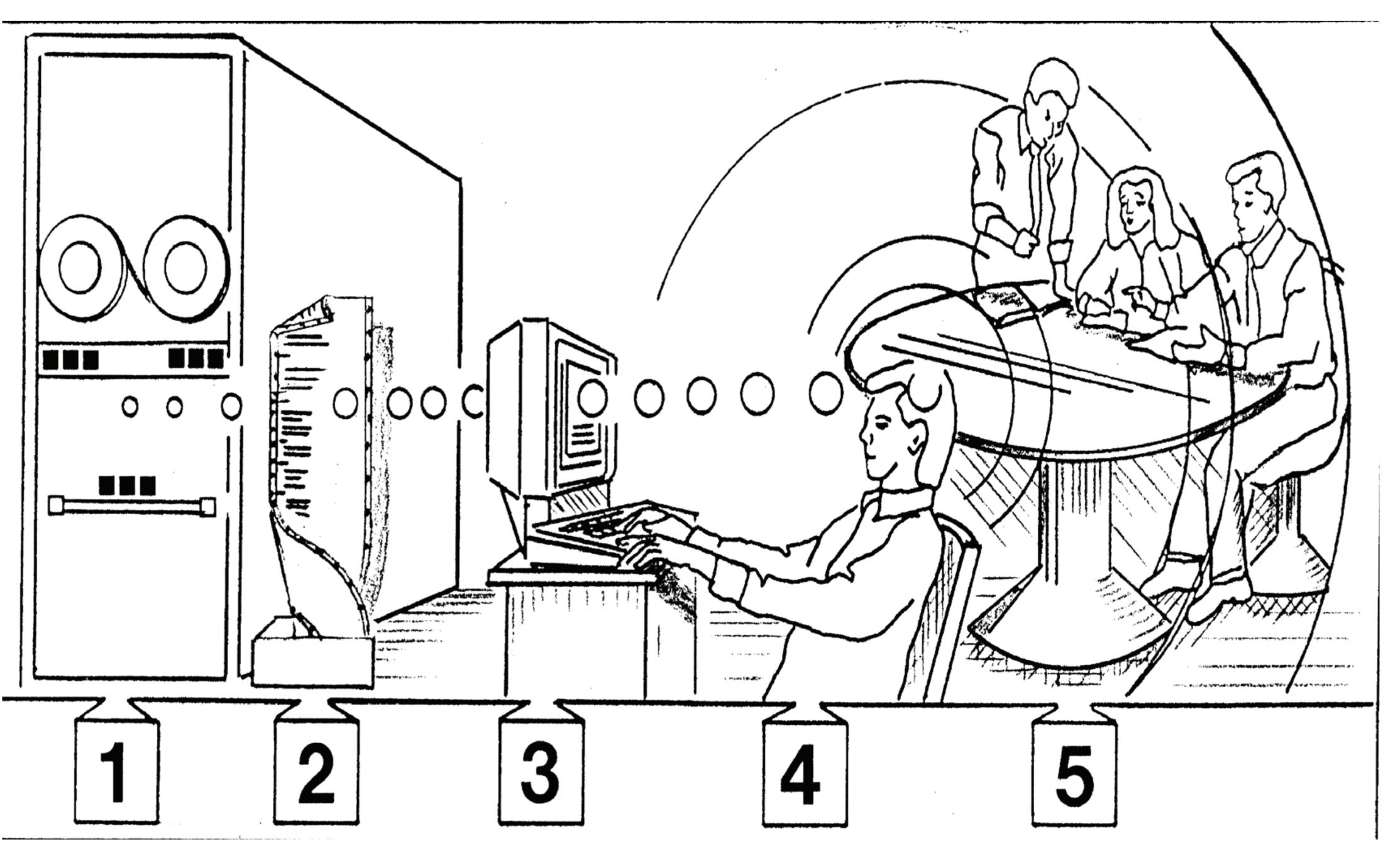


Image from Grudin (2007) From Tool to Partner: The Evolution of Human-Computer Interaction. Morgan and Claypool.

2010

Lorem ipsum

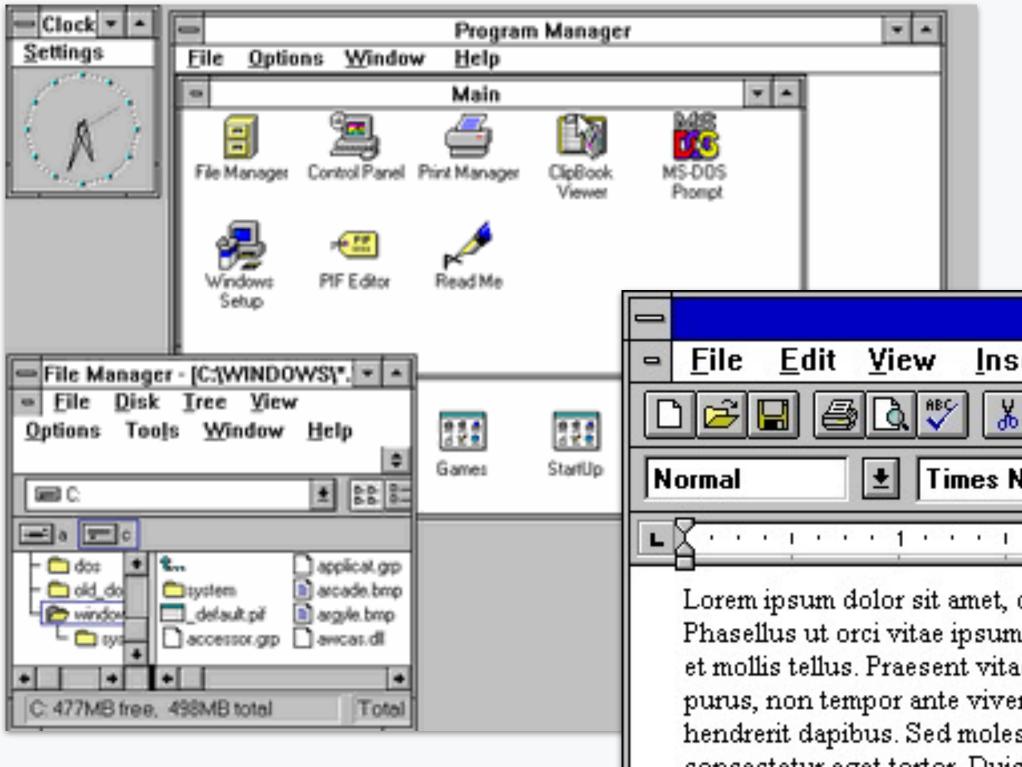
Dolor sit amet, consectetur adipiscing elit. Suspendisse ac tristique ipsum. Nunc tellus justo, eleifend sed fermentum non, interdum id felis. Suspendisse potenti. Nullam porta accumsan nisl vitae condimentum. Donec ipsum nunc, aliquet id pellentesque et, blandit a nisl. Nulla sapien enim, bibendum et mollis non, rhoncus eget ipsum. In han habitasse platea dictumst. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aliquam erat volutpat. Sed gravida ornare tristique.

- 2006 Google Document beta based on "Writely"
- 1993 A study from Judith Olson and colleagues show that brainstorming with ShrEdit as a secondary channel yielded better ideas
- A study from Paul Dourish and Victoria Bellotti found that 1992 awareness of others' cursor position in workspace improved collaboration
- 1992

Google Blog (2010) What's different about the new Google Docs? 23 Dourish, P., & Bellotti, V. (1992, December). Awareness and coordination in shared workspaces. In Proceedings of the 1992 ACM conference on Computer-supported cooperative work (pp. 107-114)

Laura McGuffin and Gary Olson developed "ShrEdit": a real-time synchronous editor running on a network of Apple Macintoshes

Slides: http://tiny.cc/t-osap-2023



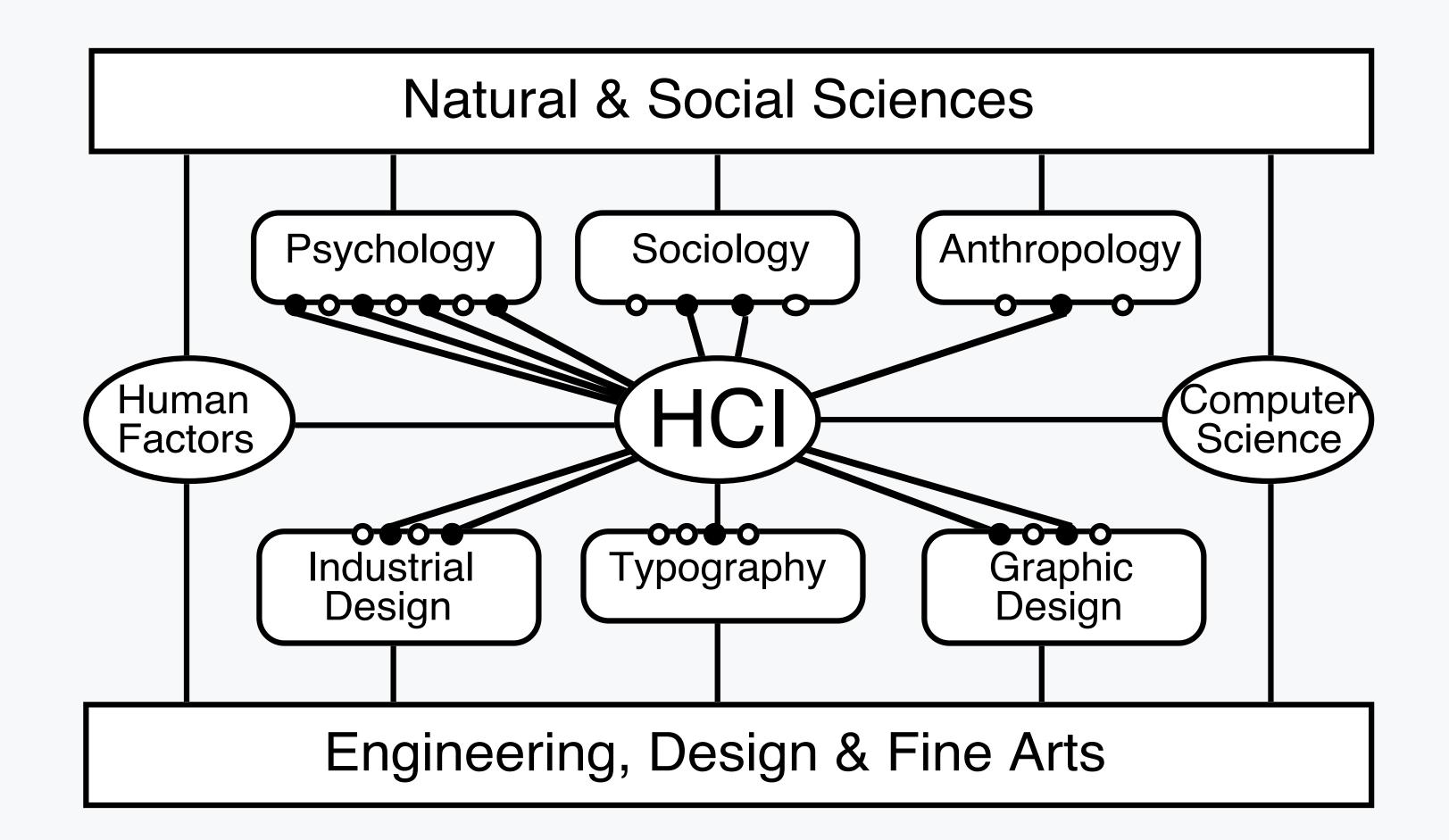
Lorem ipsum dolor sit amet, consectetur adipiscing elit. In non ipsum sed justo pellentesque gravida. Phasellus ut orci vitae ipsum posuere ultrices eu nec odio. Praesent mollis cursus magna et sodales. Morbi et mollis tellus. Praesent vitae lobortis metus. Aliquam tempor tellus nibh. Maecenas tristique vehicula purus, non tempor ante viverra at. Fusce quis nibh nibh, nec mattis mauris. Curabitur quis purus sed ante hendrerit dapibus. Sed molestie fringilla faucibus. Pellentesque lectus nunc, vulputate quis interdum a, consectetur eget tortor. Duis in interdum urna. Aenean libero velit, interdum ac scelerisque sed, fringilla et nisi. Donec tempor nisl a elit posuere sed aliquam neque lobortis. Aliquam consectetur sagittis nibh venenatis varius.

Suspendisse tempor augue vel velit sollicitudin euismod porta nisl volutpat. Duis laoreet accumsa ac semper leo congue ut. Proin blandit venenatis laoreet. Suspendisse non libero risus, eget suscipio gravida ornare aliquet. Donec condimentum, justo ut placerat venenatis, augue turpis condimentum an nec ullamcorper velit neque sit amet arcu. Phasellus ac ante odio. Curabitur neque lorem, sollicitudin quis luctus eget. feugiat ac augue. Nam elementum varius massa nec laoreet. Aliquam vitae tellus et est pos

What's it like in 1992

Microsoft Word - Document1	
sert F <u>o</u> rmat <u>T</u> ools T <u>a</u> ble <u>W</u> indow <u>H</u> elp	
6 🖻 🛍 💅 💌 ± ལ ± 🎦 🖤 🔳 🖉 💷	¶ 100% :
New Roman 🛃 10 🛃 🖪 🖉 📰 📰 🗐	
2	5 • • • • • • •

The field of Human-Computer Interaction



25 Mackay, W. E., & Fayard, A. L. (1997, August). HCI, natural science and design: a framework for triangulation across disciplines. In Proceedings of the 2nd conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 223-234).

The situation of research transparency in Human–Computer Interaction

Replicability

Closely matched method + New data = Consistent results

27 According to Clearbout terminology, which differs from ACM's terminology See discussion in Plesser HE (2018) Reproducibility vs. Replicability: A Brief History of a Confused Terminology. Front. Neuroinform. 11:76.

Reproducibility

Same data analysis method +

Same data

Same results

Reproducibility is a lower bar, but still important for evaluating the claims of research results

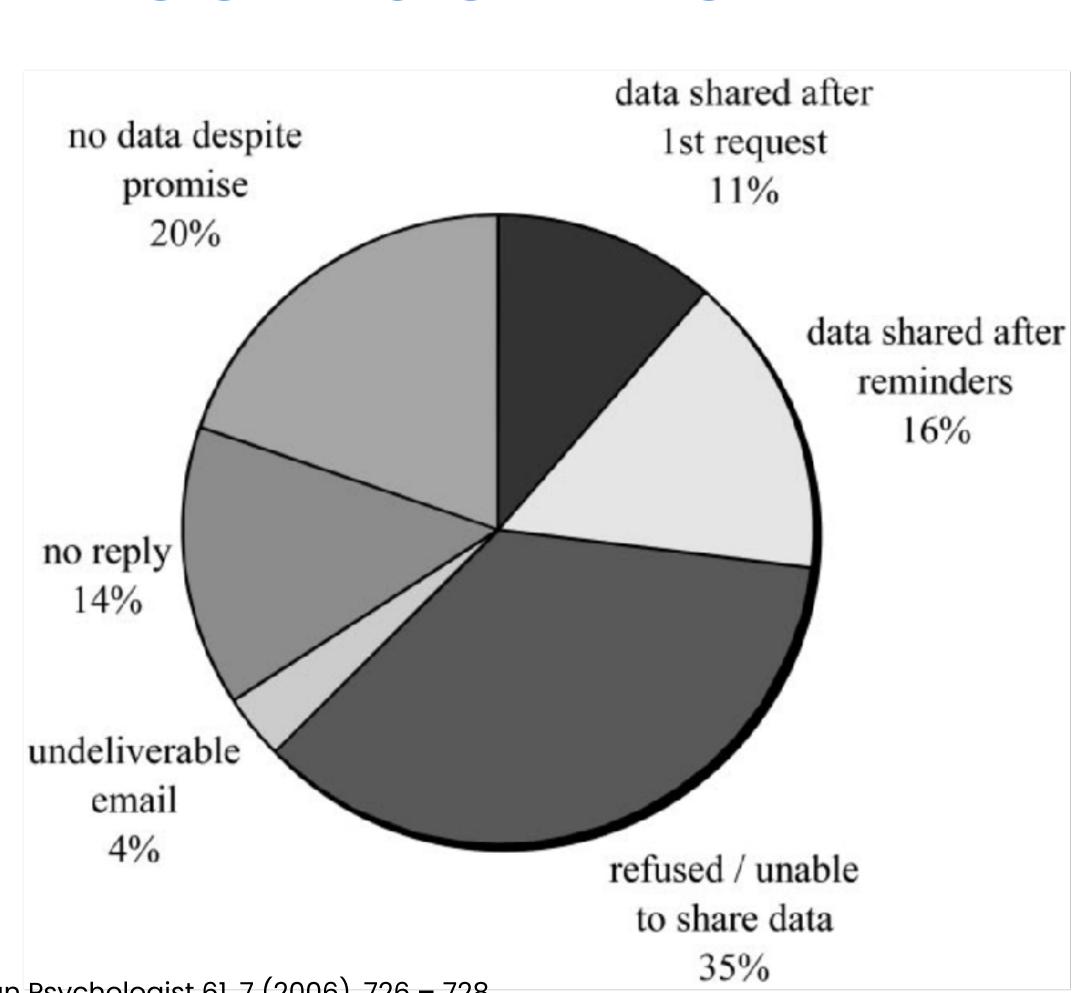


"If researchers want to use data or code from my paper, they can contact me"

A team of psychology researchers requested data from the authors of 141 articles published in prestigious psychology journals in the previous year.

27% success rate

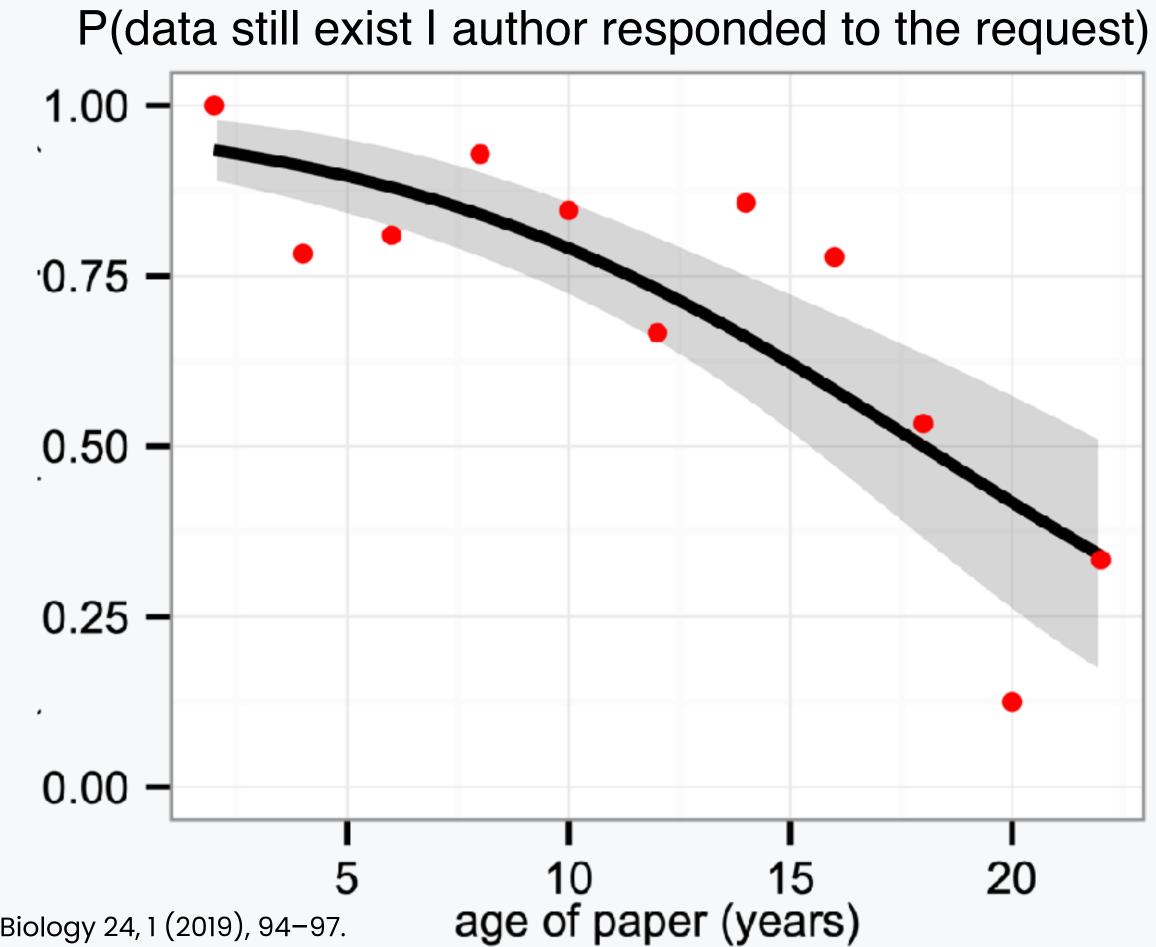
Slides: http://tiny.cc/t-osap-2023



"If researchers want to use data or code from my paper, they can contact me"

Researchers from the field of biology requested data from 516 articles published between 2–20 years

The odds of data still exist fall 17% per year

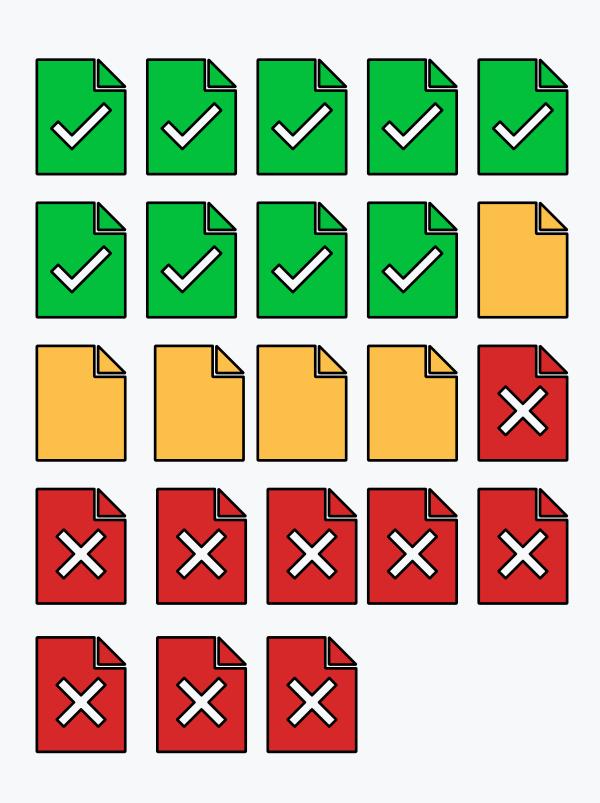




"If researchers want to use data or code from my paper, they can contact me"

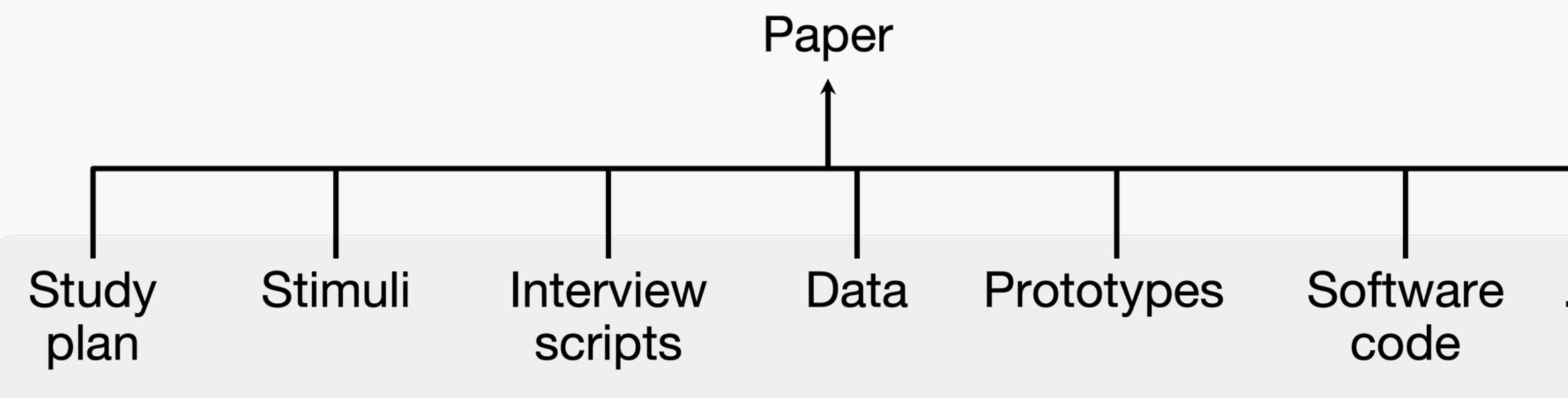
- A meta-analysis of highly-cited HCI text-entry experiments
- 23 papers published in 2008–2020
- 9 complete information for meta analysis
- 5 provided information upon email request
- 9 no/partial responses

Slides: http://tiny.cc/t-osap-2023





HCI research materials





Slides: http://tiny.cc/t-osap-2023





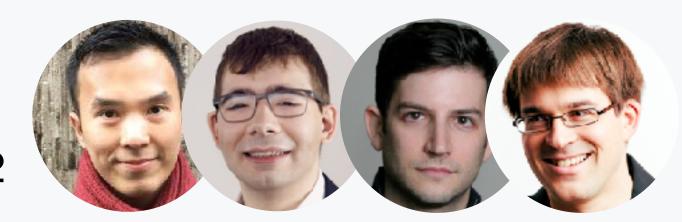
Research artifacts



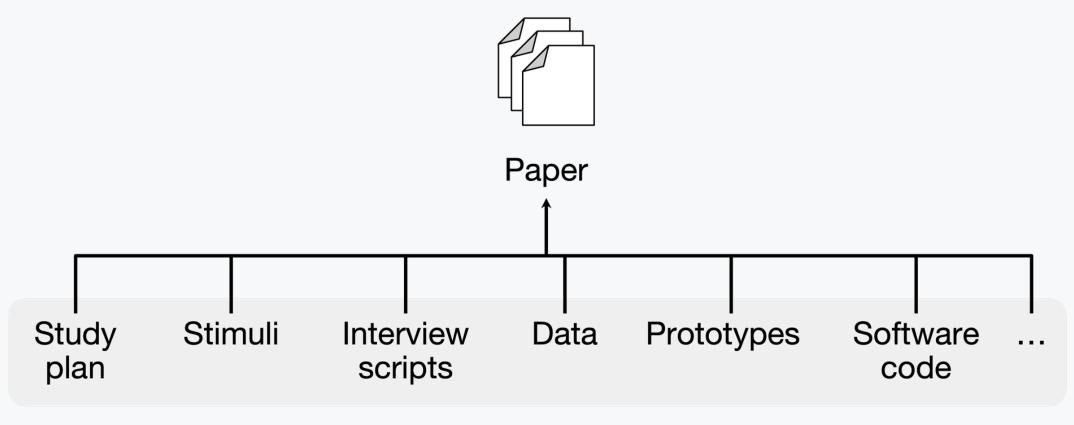
We asked authors of CHI 2018–19

- What types of research artifacts they generate?
- If they share it, how?
- If not, why?

460 responses out of 1356 invitations 34% response rate! (quite high)



Slides: http://tiny.cc/t-osap-2023



Research artifacts

CH of & Echtler, F. (2020, April). Transparency S. C., Eisenring, L., Haroz, Wacharamanotham,

2020 CHI acts: Results of a self-reported survey. In Proceedings of the arti research

on Human Factors in Computing Systems (pp. 1-14) Conference

Slides: http://tiny.cc/t-osap-2023

	Shared	Not shared	
Study materials	34 % 31 %	66 % 69 %	← 2018 ← 2019
Raw data (selective)	20 % 14 %	80 % 86 %	
Raw data (non-selective)	20 % 80 % 84 %		
Qualitative procedure	26 % 24 %		
Quantitative procedure	22 % 33 %	78 % 67 %	
Qualitative output data	15 % 22 %	85 % 78 %	
Quantitative output data	43 % 47 %	57 % 53 %	
Software	36 % 45 %	64 % 55 %	
Hardware	33 % 47 %	67 % 53 %	
0	%	50%	100%
			of the responses

Wacharamanotham, C., Eisenring, L., Haroz, S., & Echtler, F. (2020). Transparency of CHI

research artifacts: Results of a self-reported survey. In Proceedings of the 2020 CHI

Conference on Human Factors in Computing Systems (pp. 1-14).

Slides: http://tiny.cc/t-osap-2023

Survey to authors of CHI 2018, 2019

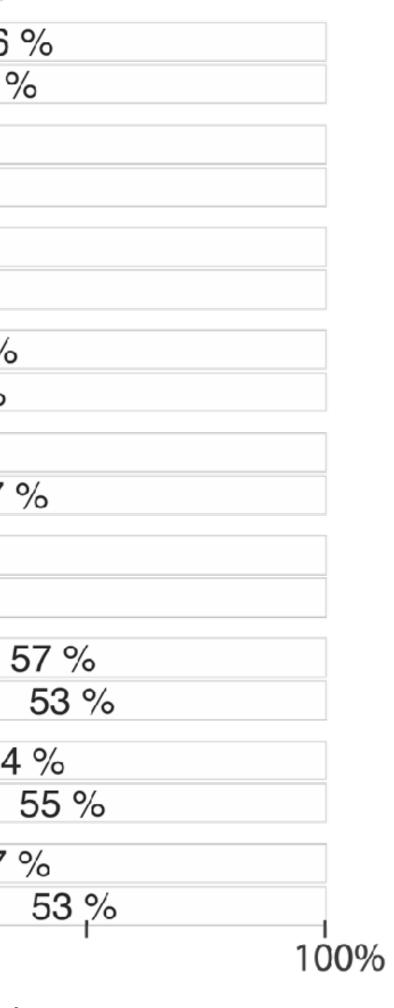
	Shared		Not shared
Study materials	34 % 31 %		66 % 69 %
Raw data (selective)	20 %		80 %
	14 % 20 %		86 % 80 %
Raw data (non-selective)	10 /0		84 %
Qualitative procedure	26 % 24 %		74 % 76 %
Quantitative procedure	22 % 33 %		78 % 67 %
Qualitative output data	15 % 22 %		85 % 78 %
Quantative output data	43 %		57 %
Quantitative output data	47 %		53 %
Software	36 % 45 %		64 % 55 %
Hardware	33 % 47 %		67 % 53 %
0	%	5	0%

Percents of respondents

Wacharamanotham et al. (2020)

Content analysis of papers from CHI 2017, 2022

Mapped to equivalent categories on the left



		100 %	6	
7 %		93	%	
1 %	99 %			
12 %	88 %			
	58 %			42 %
		79 %		21 9
1 %		99 %		
10 %	90 %			
4 % 17 %		96 %		
17 %			83 %	
1 %		99 %		
9 %		91	%	
14 %	86 %			
21 %			79 %	
2 %		98 %		
3 %		97 %	þ	

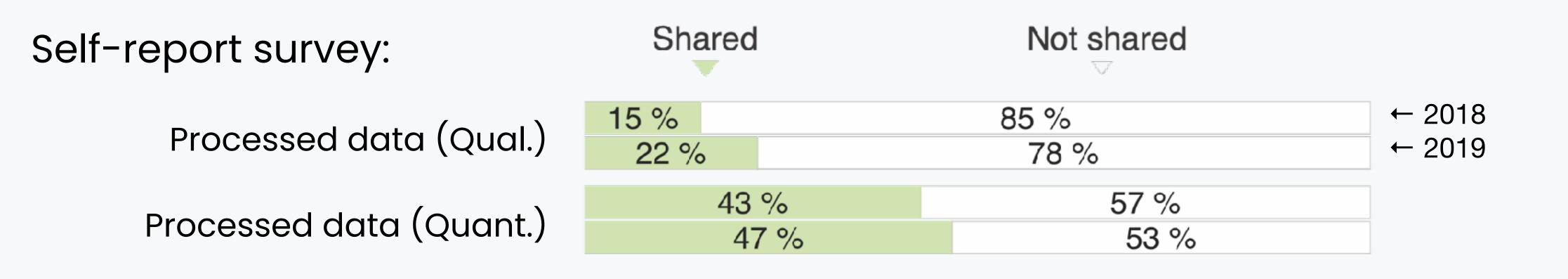
Percents of sampled papers

Niksirat et al. (2023)



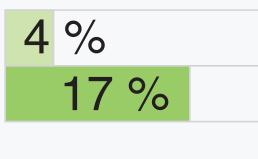


Have CHI papers improved in transparency?

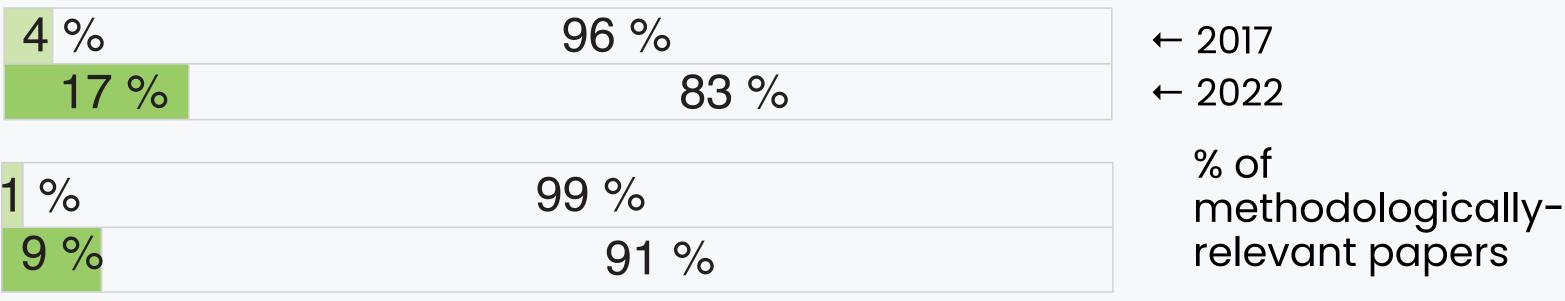


Content of sampled papers:

Processed data (Qual.)



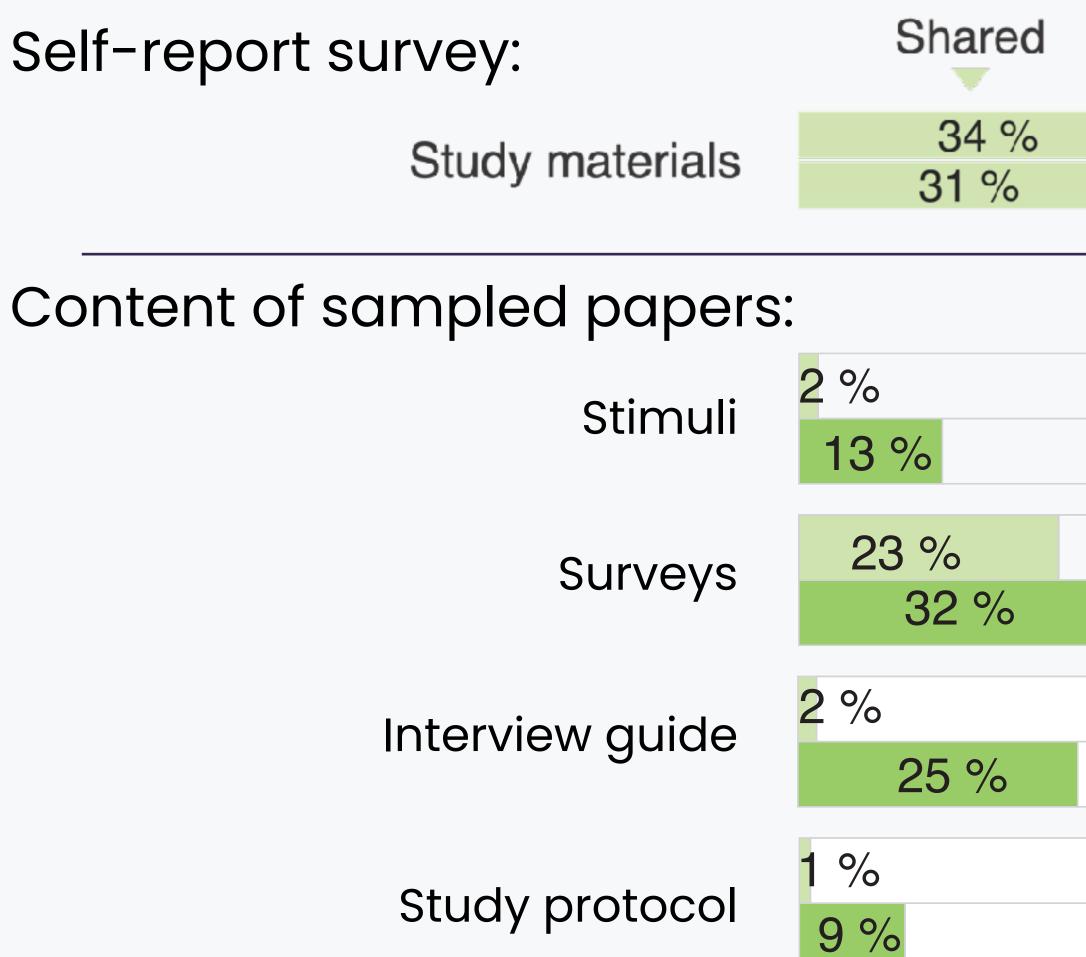
Processed data (Quant.)



35 Niksirat, K. et al. (2023). Changes in Research Ethics, Openness, and Transparency in Empirical Studies between CHI 2017 and CHI 2022. In Proceedings of CHI 2023



Have CHI papers improved in transparency?



Niksirat, K. et al. (2023). Changes in Research Ethics, Openness, and Transparency in Empirical Studies between CHI 2017 and CHI 2022. In Proceedings of CHI 2023 36

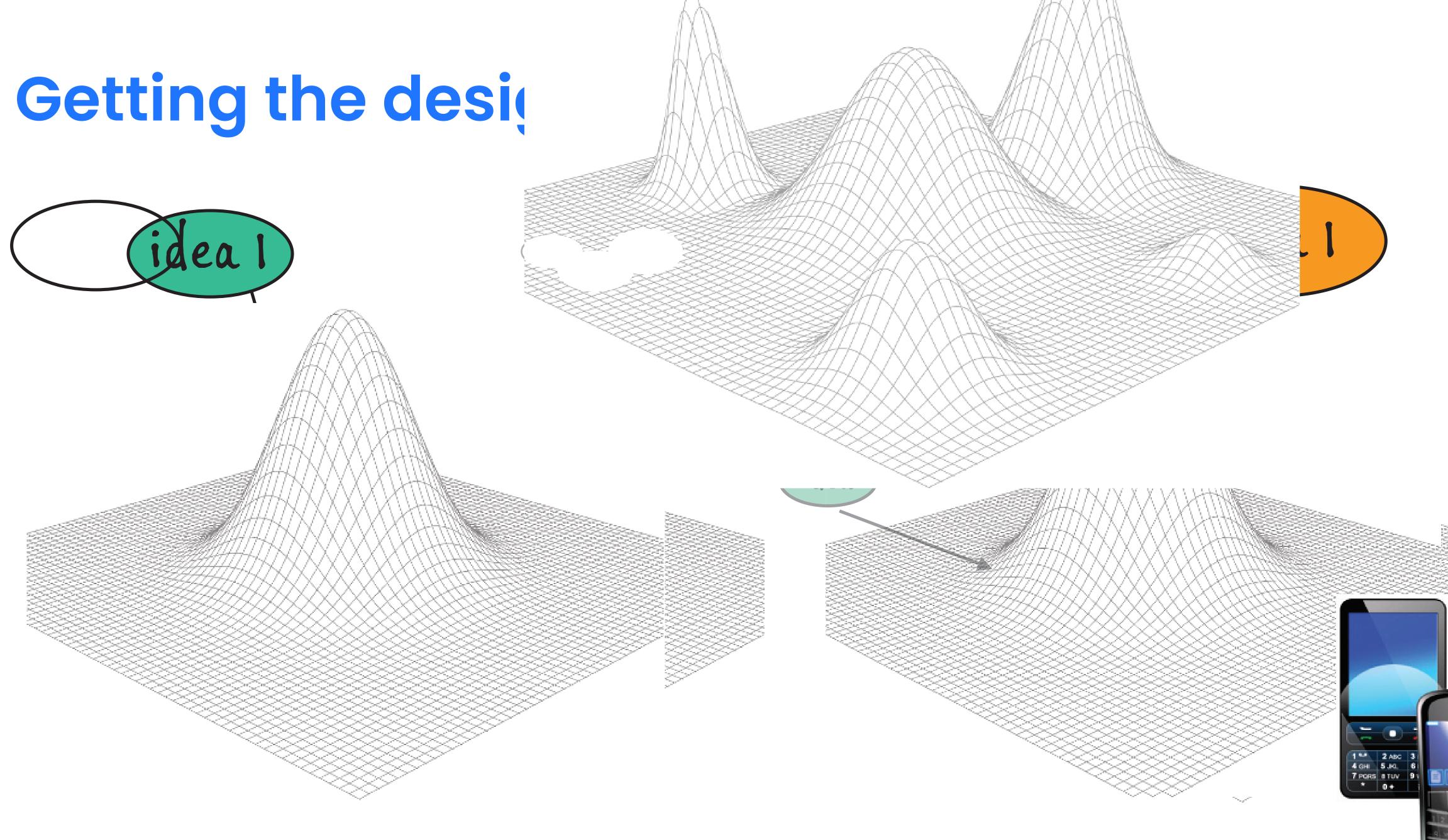
Not shared	
66 %	← 2018
69 %	← 2019

98 %	← 2017
87 %	← 2022
77 % 68 %	% of methodologic relevant pape
98 %	
75 %	
99 %	
91 %	



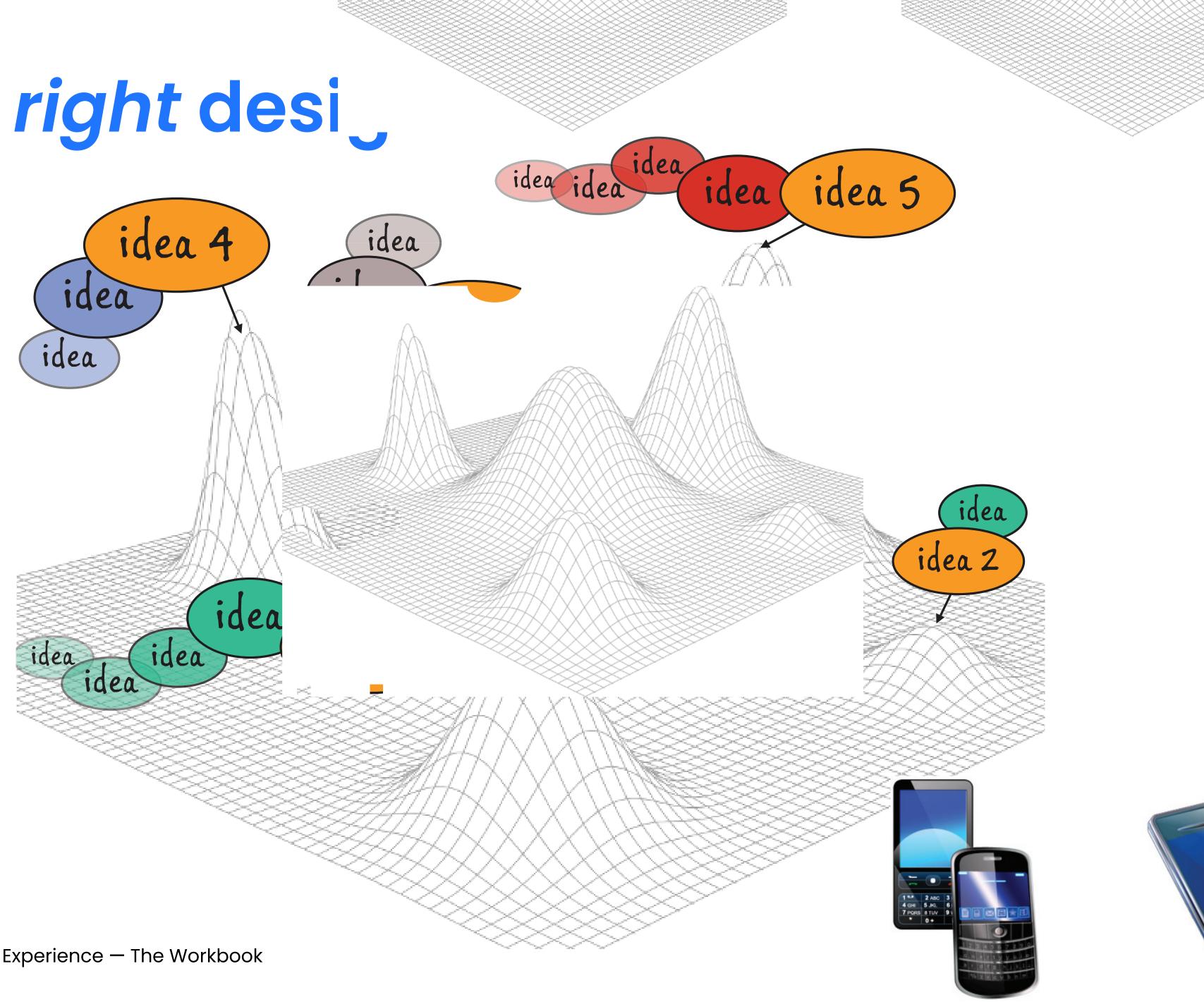
Challenges in motivating Research transparency in Human-Computer Interaction

Slides: http://tiny.cc/t-osap-2023





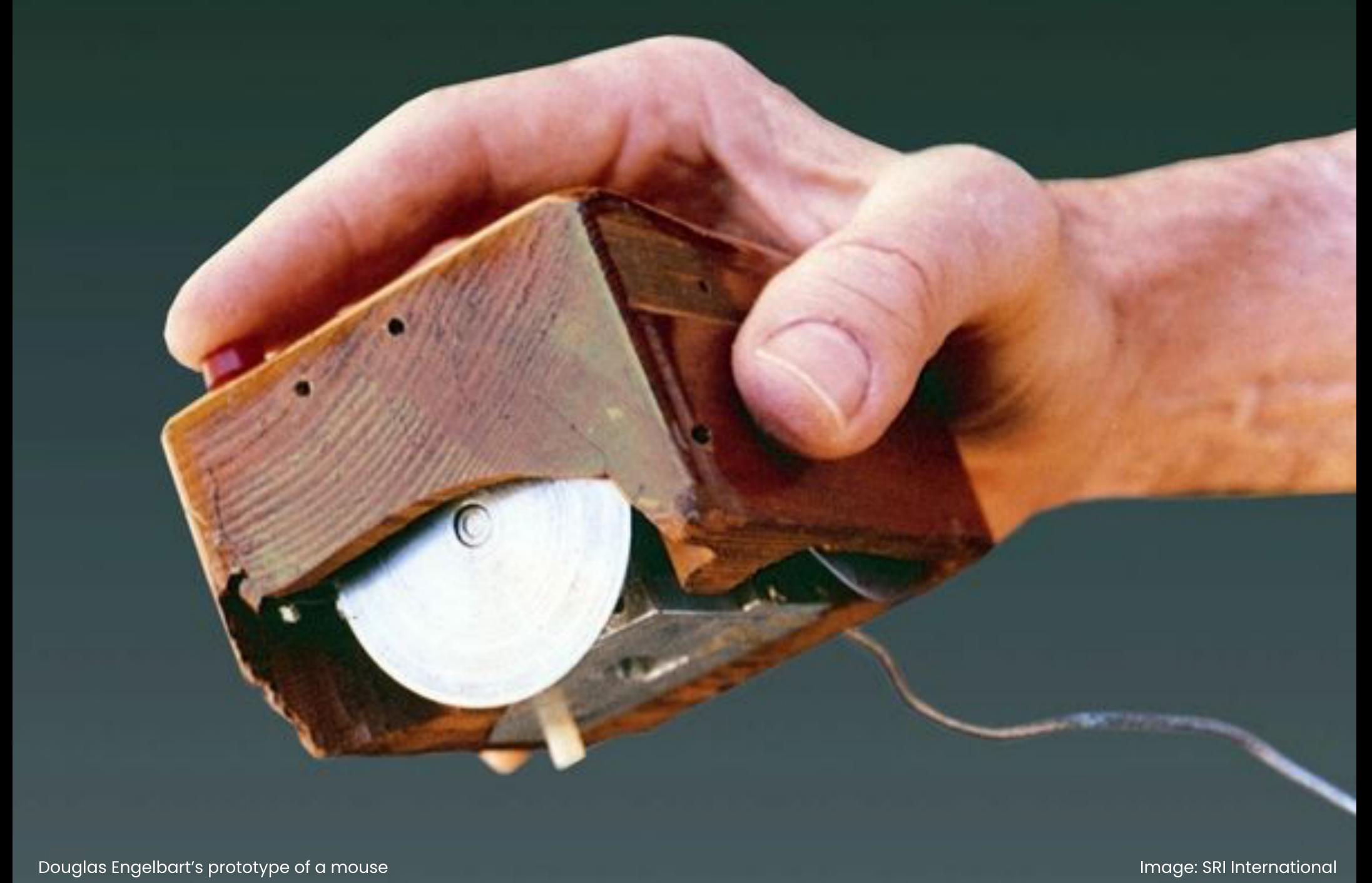
Getting the right desi



~~~

S





Douglas Engelbart's prototype of a mouse

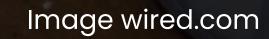


Image wired.com

0

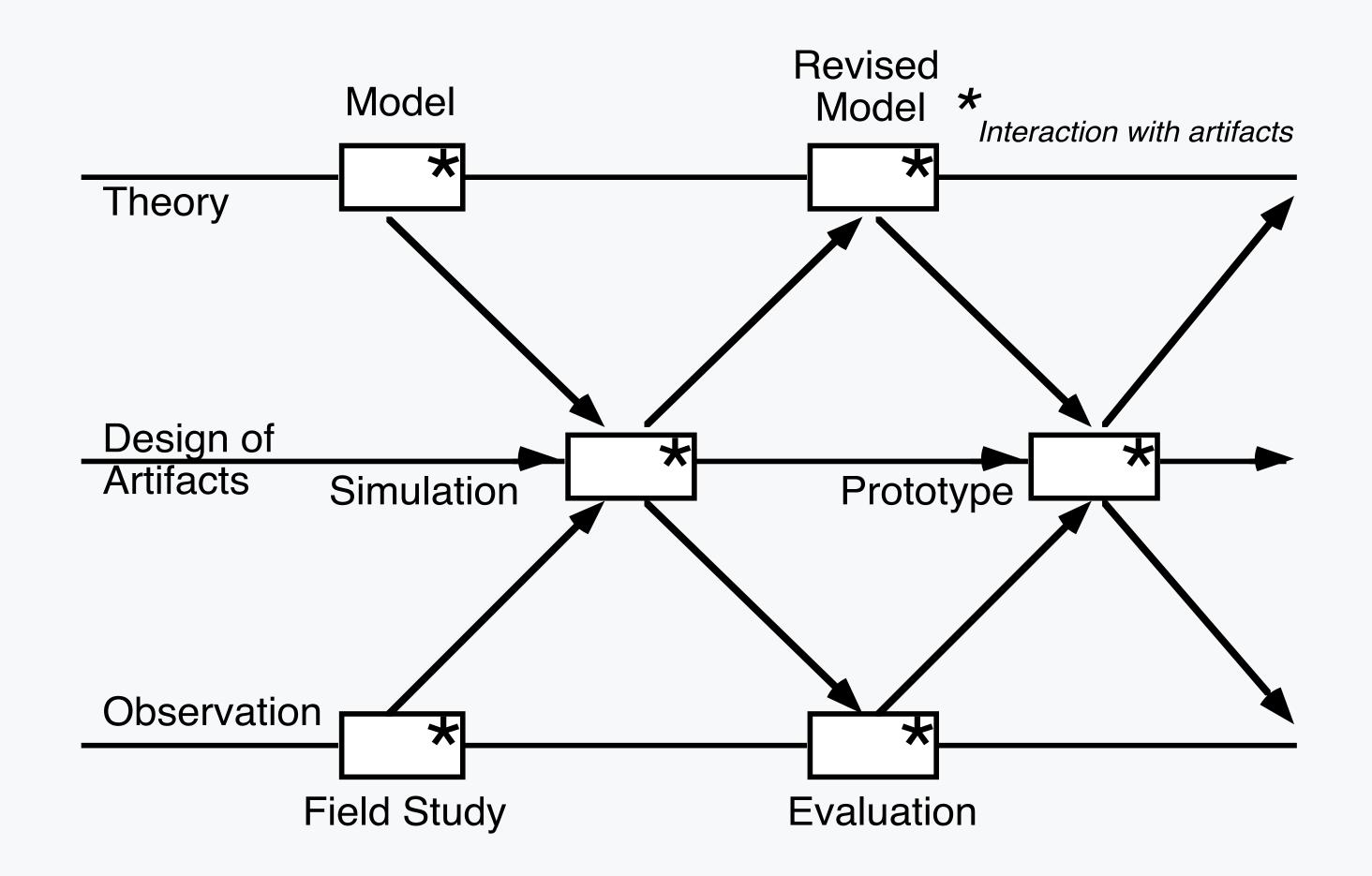


Prototypes of Microsoft Touch Mouse.



Should research transparency require making all these prototypes available?

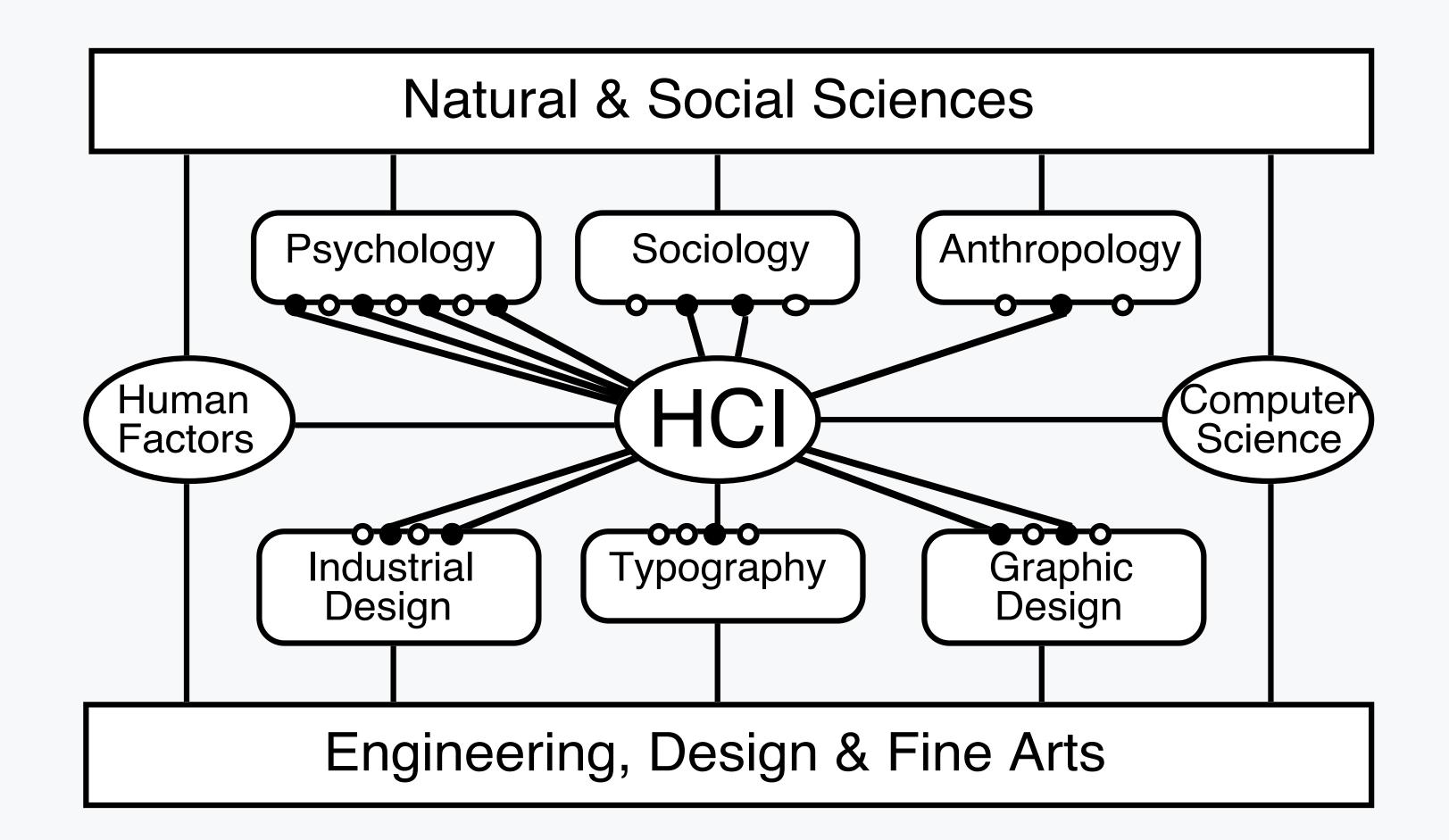
# HCI integrates science and design to create knowledge



43 Mackay, W. E., & Fayard, A. L. (1997, August). HCI, natural science and design: a framework for triangulation across disciplines. In Proceedings of the 2nd conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 223-234).



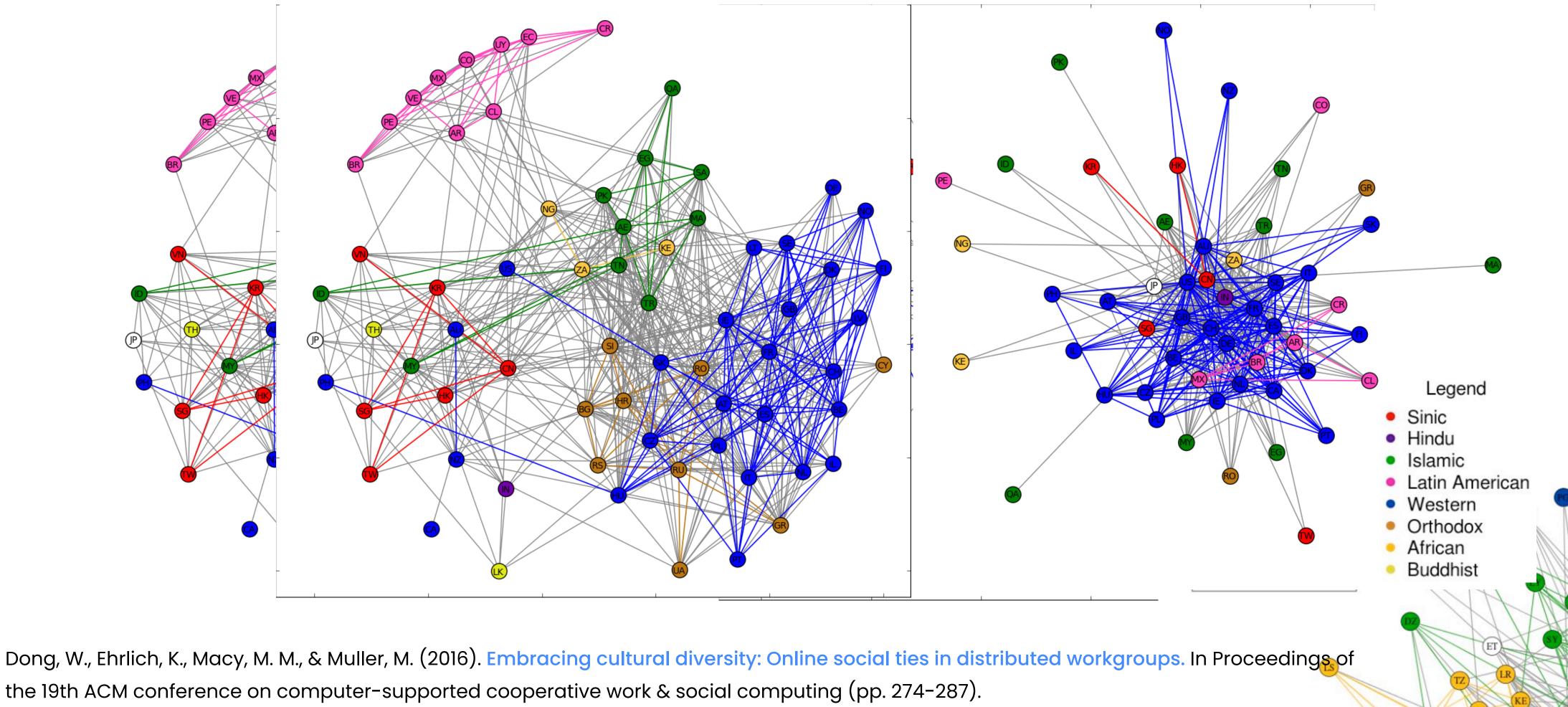
# The field of Human-Computer Interaction



44 Mackay, W. E., & Fayard, A. L. (1997, August). HCI, natural science and design: a framework for triangulation across disciplines. In Proceedings of the 2nd conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 223-234).

# Social network use in a large multi-national company

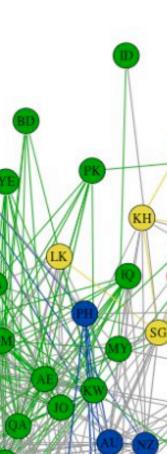
## Company-wide



45

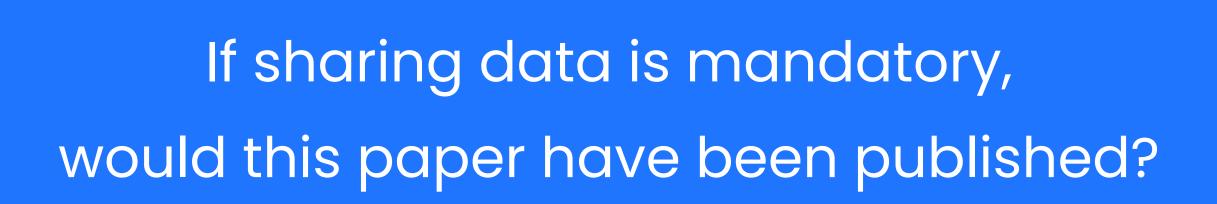
## Sales workgroup

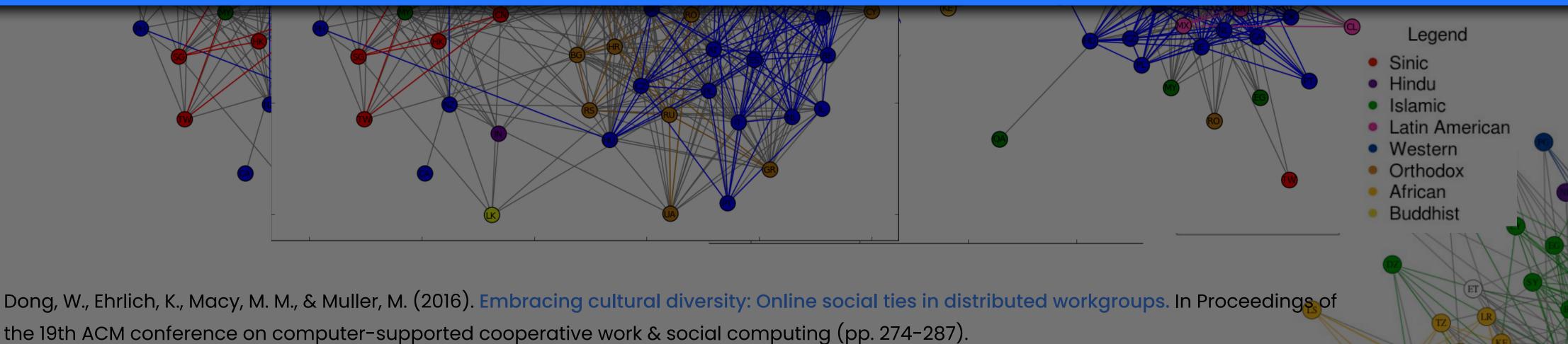




# Social network use in a large multi-national company

## Company-wide





46 the 19th ACM conference on computer-supported cooperative work & social computing (pp. 274-287).

## Sales workgroup





# Inquiry paradigms

## Positivism

Apply methods from natural science (posit, observe, derive logical truth)

## Post-positivism

All methods are imperfect for apprehending reality; At best, research can identify a valid belief

For more in-depth discussion on paradigms, epistemology, ontology Moon, K., & Blackman, D. (2014). A guide to understanding social science research for natural scientists. Conservation biology, 28(5), 1167-1177. Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. Handbook of qualitative research, 2(163-194), 105.

## Constructivism et al.

Meaning is in humans' construction of reality or in the human mind. Research could only arrive at truth claims

## Critical theory et al.

Research & theory should be used to understand power relations and change situations



# Identifying opportunities for design for women in patriarchal societies

 Interview and focus group studies; 90 participants in Bangladesh

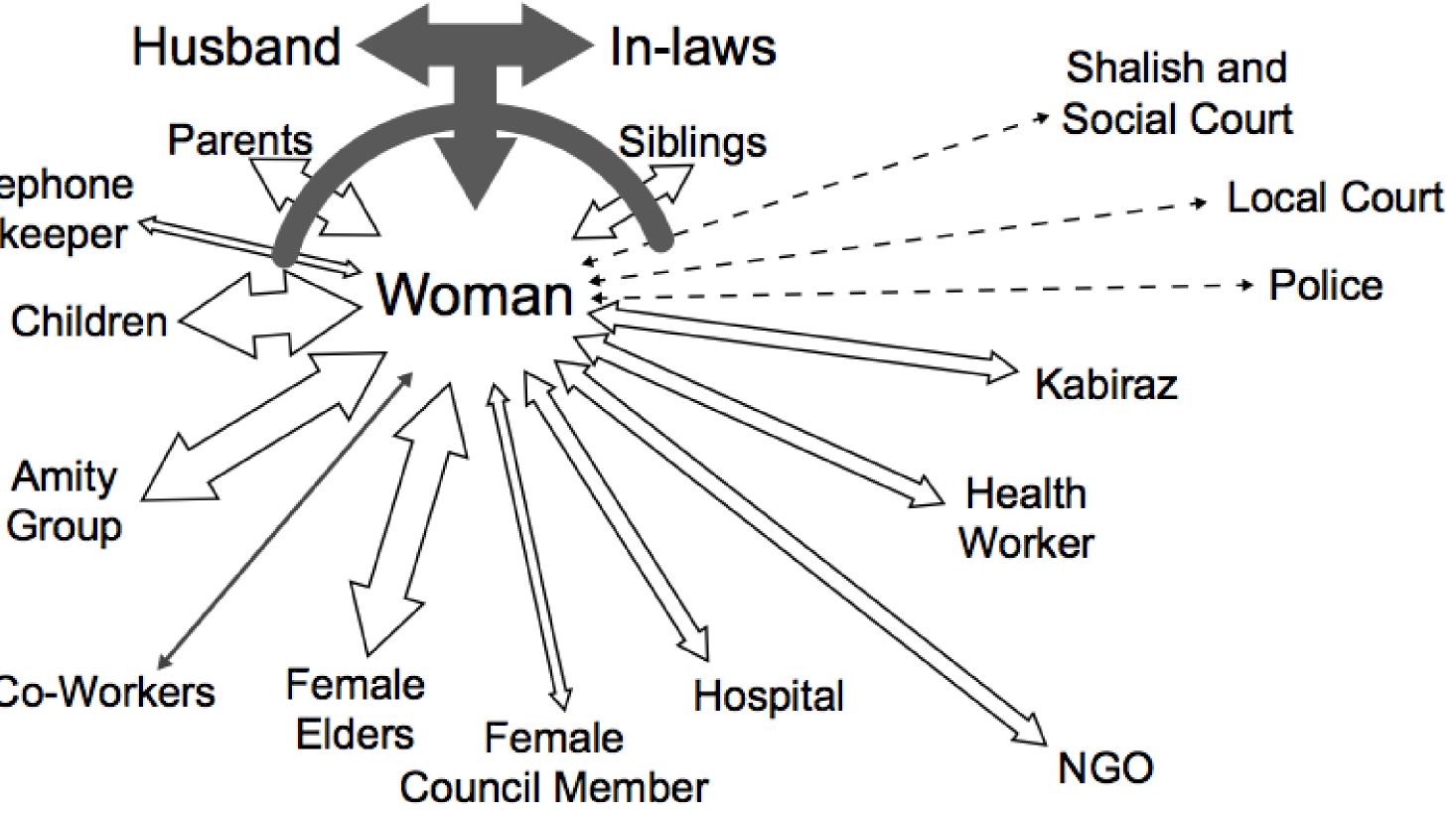
Mobilephone Shopkeeper 🗢

Children <

Diagram arrows

- Width: Frequency
- Length: Intimacy **Co-Workers**
- Grey arc: meditated relationship
- 48 Sultana, S., Guimbretière, F., Sengers, P., & Dell, N. (2018, April). Design within a patriarchal society: Opportunities and challenges in designing for rural women in Bangladesh. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-13).

### Slides: http://tiny.cc/t-osap-2023







# Identifying opportunities for design for women in patriarchal societies

 Interview and focus group studies; 90 participants in Bangladesh

Mobilephone Shopkeeper 🤝

Children

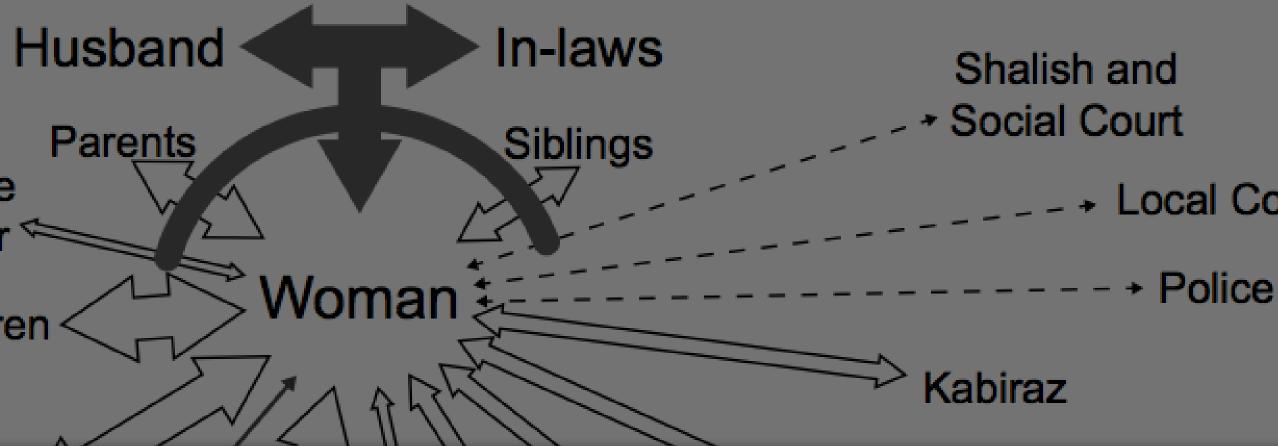
## If researchers were all Caucasian male, can we trust the research findings?

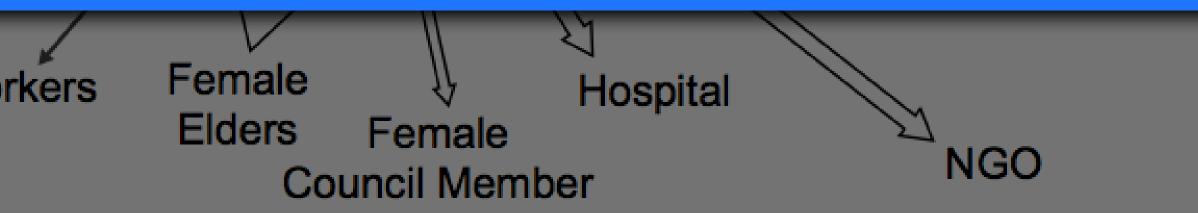
Length: Intimacy

- **Co-Workers**
- Grey arc: meditated relationship

49 Sultana, S., Guimbretière, F., Sengers, P., & Dell, N. (2018, April). Design within a patriarchal society: Opportunities and challenges in designing for rural women in Bangladesh. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-13).

## Slides: http://tiny.cc/t-osap-2023







Local Court

# Identifying opportunities for design for women in patriarchal societies

 Interview and focus group studies; 90 participants in Bangladesh

Mobilephone Shopkeeper 🤝

Children

Diagram arrows

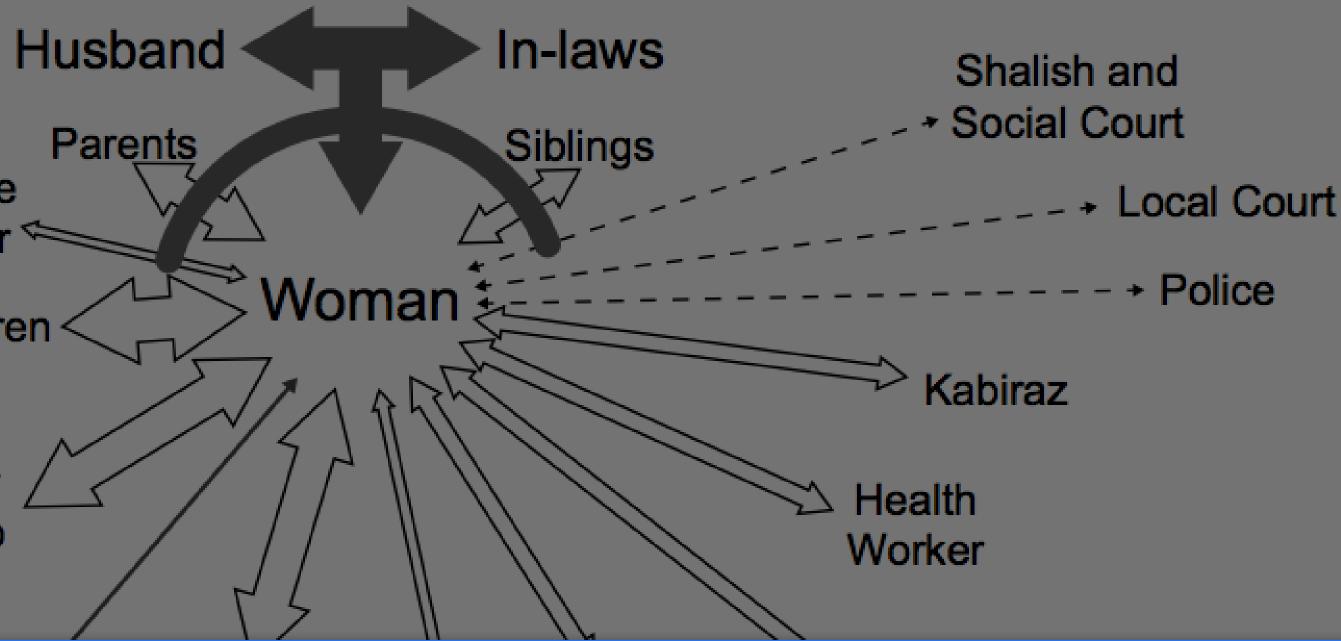
Amity Group

• Width: Frequency

## If the funding body mandate that all research data has to be public, is it safe to conduct this work?

50 Sultana, S., Guimbretière, F., Sengers, P., & Dell, N. (2018, April). Design within a patriarchal society: Opportunities and challenges in designing for rural women in Bangladesh. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-13).

## Slides: http://tiny.cc/t-osap-2023





# Inquiry paradigms

## Positivism

Apply methods from natural science (posit, observe, derive logical truth)

## Post-positivism

All methods are imperfect for apprehending reality; At best, research can identify a valid belief

For more in-depth discussion on paradigms, epistemology, ontology Moon, K., & Blackman, D. (2014). A guide to understanding social science research for natural scientists. Conservation biology, 28(5), 1167-1177. Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. Handbook of qualitative research, 2(163-194), 105.

## Constructivism et al.

Meaning is in humans' construction of reality or in the human mind. Research could only arrive at truth claims

## Critical theory et al.

Research & theory should be used to understand power relations and change situations



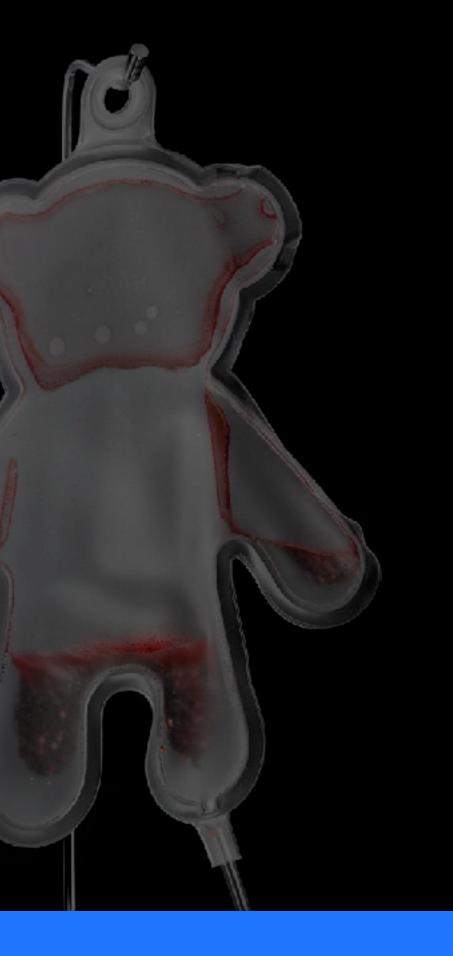




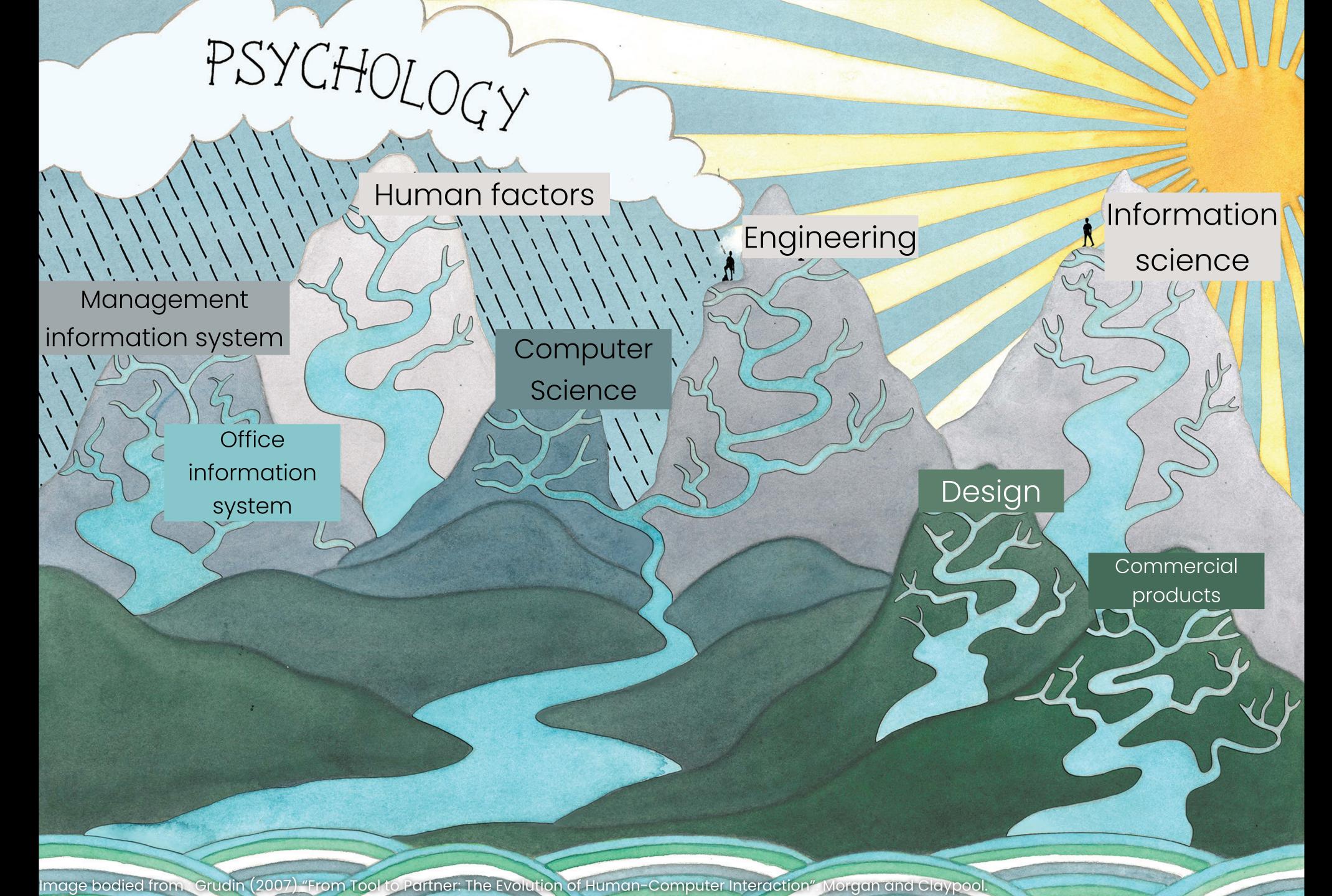
Teddybear blood radio by Fiona Raby and Anthony Dunne Image UK Science Museum Group



What research materials could have been transparent in this project? How relevant to research process and outcome are those materials?



Teddybear blood radio by Fiona Raby and Anthony Dunne Image UK Science Museum Group



# **Replicability**<sup>[1]</sup>

## Closely matched method ╉ New data

## **Consistent results**

[1] Replicability definition is according to Clearbout terminology, which differs from ACM's terminology See discussion in Plesser HE (2018) Reproducibility vs. Replicability: A Brief History of a Confused Terminology. Front. Neuroinform. 11:76.

## Slides: http://tiny.cc/t-osap-2023

# **Replicability**<sup>[1]</sup>

## **Closely matched method** +New data **Consistent results**

56

[1] Replicability definition is according to Clearbout terminology, which differs from ACM's terminology See discussion in Plesser HE (2018) Reproducibility vs. Replicability: A Brief History of a Confused Terminology. Front. Neuroinform. 11:76. [2] Starting in Wilson et al. (2011) RepliCHI - CHI should be replicating and validating results more: discuss



# **RepliCHI** award

- RepliCHI movements in meetings and workshops [2]
- RepliCHI award implemented in CHI Conference 2023 by the conference organizers that year
- Received push-backs
- How about research where replicability is irrelevant?



# Scenarios

- code and found an error. What will you do?
- fine. But Paper B does not share their statistical analysis code. What will you do?

• You are a reviewer of a paper. The paper looks fine. But you looked into the statistical analysis

• You are an editor who solicited reviews for Paper A from a panel of reviewers. A reviewer pointed out that an error in statistical analysis in the code—whereas it looks fine in the paper. This observation came in the very last minute in the reviewing process. What will you do?

 Continuing the previous point: At the present, there is no expectation of sharing code and data in your field. Paper B is in the same area, using the same statistical analysis; it also looks



# A balancing act?

Transparency

## Slides: http://tiny.cc/t-osap-2023



Truth

### Workload



# Why motivating transparency is not straight-forward

Established researchers



Junior researchers

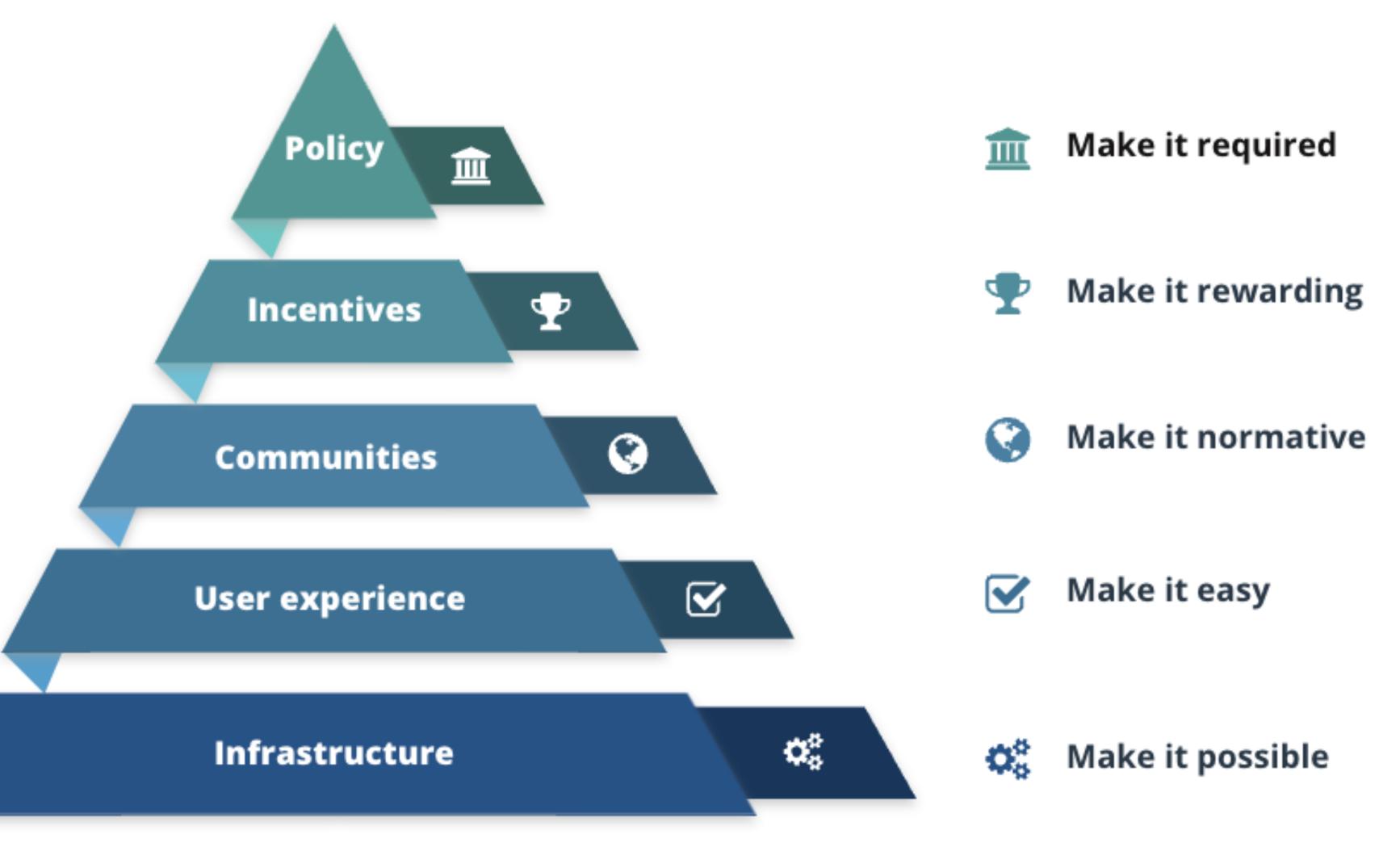
income countries

# Transparency-aware **Resourceful institutes** reviewers Institutes in low-Transparency-unaware reviewers



## Slides: http://tiny.cc/t-osap-2023

# Motivating research transparency in HCI



Source: Center for Open Science strategy for scale sustainable adoption of open behaviors by researchers

# **Progressive process of research transparency**

- Become aware and set realistic expectations
- Learn from materials and examples in- and outside of your field
- Adopt step-by-step: "be better in your next paper"
- Educate your peers and students
- Influence your institutions downward and upward

"A Manifesto for Transparent Quantitative Research – Transparency could be progressive" by Duong Nhu, Lahari Goswami, Theophanis Tsandilas, and Viktorija Paneva in



## Slides: http://tiny.cc/t-osap-2023





<.05

# **Transparent Statistics Guidelines**

Transparent Statistics in HCI Working Group (http://transparentstatistics.org/)

### Preface

This document grew out guidelines for transpare research. The recomme in the practice of statist

this version 10.5281/zenodo

### **Proposal for amending CHI guides for authors** and reviewers

The text below was a community-led effort to improve the Guide to a Successful Submission on the CHI conference website. The proposal was

accepted and integrated i proposed changes are are

### Transparency

CHI papers should strive for type and methodology. Diffe quantitative studies, and qua September 25 – 30 , 2022, Dagstuhl Seminar 22392 transparency.

Contributions that are tech contributions that are quan Organizers analyzed results) are expected able to rerun the interactive

## and many more...

Transparent Quantitative Research as a User Interface Problem

Kasper Hornbaek (University of Copenhagen, DK) Yvonne Jansen (Sorbonne University – Paris, FR) Amelia A. McNamara (University of St. Thomas - St. Paul, US) Judy Robertson (University of Edinburgh, GB) Chat Wacharamanotham (Universität Zürich, CH)

### Motivation

Many research fields are currently rethinking their research methods towards more transparent practices. The most rapid progress towards transparency can be observed in fields that were heavily affected by a replication crisis, like psychology, while changes are slower and receive more resistance in interdisciplinary fields, such as human-computer interaction (HCI) and visualization (VIS). In this Dagstuhl Seminar, we want to address the issue of hesitant adoption of transparent research methods by framing it as a user interface problem: the 'interface' of using transparent methods is ill-







# Tutorials at CHI 2022, 2023, MuC 2023, VIS 2023

- Planning research and sharing research artifacts
- Introduction to Transparent Bayesian Data Analysis
- Introduction to Transparency-oriented Visualizations
- Hands-on exercises with transparency practices

## Materials available for reuse https://osf.io/27r5z





# Journal of Visualization and Interaction

- Registered reports
   Nove
- Open access
   Open,
   (Diamond)
   review

Organizers: Lonni Besançon, Florian Echtler, Matthew Kay, and Chat Wacharamanotham.

Novel article formats
Open, continuous review



## journalovi.org

## **Gatherplot: A Non-Overlapping Scatterplot**

| AFFILIATIONS<br>University of Texa |
|------------------------------------|
| Dong-eui Univers                   |
| University of Mar                  |
|                                    |

### 🕛 Under Review

This paper is under review on the experimental track of the Journal of Visualization and Interaction.

### Abstract

### Introduction

Scatterplots are a common tool for exploring multidimensional datasets, especially in the form of scatterplot matrices (SPLOMs). However, scatterplots suffer from overplotting when categorical variables are mapped to one or two axes, or the same continuous variable is used for both axes. Previous methods such as histograms or violin plots use aggregation, which makes brushing and linking difficult.

### Conclusion

We propose gatherplots, an extension of scatterplots to manage the overplotting problem. Gatherplots are a form of *unit visualization*, which avoid aggregation and maintain the identity of individual objects to ease visual perception. In gatherplots, every visual mark that maps to the same position coalesces to form a packed entity, thereby making it easier to see the overview of data groupings. The size and aspect ratio of marks can also be changed dynamically to make it easier to compare the composition of different groups. In the case of a categorical variable vs. a categorical variable, we propose a heuristic to decide bin sizes for optimal space usage. Results from a crowdsourced user study show that gatherplots enable people to assess data distribution more quickly and more correctly than when using jittered scatterplots.

### Materials

Source code for Gatherplots can be found at <u>https://github.com/intuinno/gatherplot</u>. Research materials associated with the crowdsourced user study can be found on OSF at <u>https://osf.io/bk9cx/</u>.

### Data Collection

We conducted a crowdsourced user study on <u>Amazon Mechanical Turk</u> involving participants drawn from the general population. We collected completion time, accuracy, and confidence for five different retrieval, ranking, and comparison tasks under four conditions: scatterplots with jittering, gatherplots with absolute mode, gatherplots with normalized mode, and gatherplots with a toggle to switch between absolute and normalized mode.

### Data Analysis

xas at Arlington

rsity

aryland, College Park

 $\sim$ 

</>
CODE

### Table of contents

### 1 Introduction

2 Background

3 The Gather Transformation

4 Gatherplots: A 2D Gathering Representation

5 Evaluation

6 GatherLens: A Gathering Magic Lens

7 Conclusion and Future Work

References

Research Material Statements

Authorship

License

Conflict of Interest

| Journalovi / 2023-park-gatherplots Public                   |
|-------------------------------------------------------------|
| Code O Issues 9 1 Pull requests 1 O Act                     |
|                                                             |
| Q is:issue is:open                                          |
| O 9 Open ✓ 3 Closed                                         |
| Author - Label - Projects - Milestones - A                  |
| ① [REVIEW] Gatherplot Review                                |
| #16 opened 4 days ago by jov-anonymous-reviewer-AAAA 3 of 3 |
| ① [REVIEW] Gatherplot Review 2                              |
| #15 opened on Aug 20 by facet-fan 3 of 8 tasks              |
| Opportunity to capitalize on interactivity to showca        |
| #13 opened on Aug 12 by mjskay                              |
| ① [REVIEW] [Accessibility] Gatherplots review               |
| #10 opened on Aug 4 by domoritz () 17 of 31 tasks           |
| O [REVIEW] Gatherplot review                                |
| #7 opened on Jul 12 by joviewer-xyz   े 2 of 8 tasks        |
|                                                             |

| Q Notifications              | 양 Fork 1       | Star 2 -  |
|------------------------------|----------------|-----------|
| ctions 田 Projects 민 Security | 🗠 Insights     |           |
| C Labels 11                  | 中 Milestones 1 | New issue |
|                              |                |           |
| Assignee 🚽 Sort 🚽            |                |           |
| f 8 tasks                    |                |           |
|                              |                |           |
| case GatherLens?             |                |           |
|                              |                | Γ 3       |
|                              |                |           |
|                              |                |           |

https://github.com/journalovi/2023-park-gatherplots/issues

Journal of Visualization

About Articles - Submissions - Code of Conduct People News

### Writing Your Review

JoVI reviews should be thorough but kind: aim for completeness and clarity of critique, but also think about how the authors will read your review (write the kind of review you would appreciate receiving). JoVI does not have a set rejection rate, so any work meeting our key criteria (above) should be a candidate for acceptance.

### **Modular Reviews**

To facilitate understanding by the editor and responses by the authors, reviewers are encouraged to organize concerns into numbered sections. Each section should include:

- 1. A description of the concern
- 2. Where the issue occurs
- 3. Severity: Is this a threat to validity? Or is it a suggestion?
- 4. How to fix the issue, or how an editor would know if the issue has been fixed

Please put minor issues and typos into one "minor issues" section at the end of your review.

### Intentional Citations

Each citation should have a clear purpose: to offload evidence or to build on existing progress.

- References should be used to explain the rationale, methods, and claims.
- Avoid telling authors to add references without stating what evidence or prior use that reference would support. A laundry list of references that "should be cited" is not helpful. If the reviewer wishes to suggest additional references, they must make a clear argument why.
- References can also be used to contrast the article with other very similar articles. However, this style of citation should be kept to a minimum and only used to clarify differences.
- A designated "Related Work" section is not required.
- Missing citations that could be easily remedied in revision is generally not grounds for rejection.

### 🔰 🛛 🔿 🖾 🔍

Before Agreeing to Review First Impression Key Assessment Criteria Writing Your Review Modular Reviews Intentional Citations Do's and Don'ts Registered Reports

On this page

Possible Review Outcomes

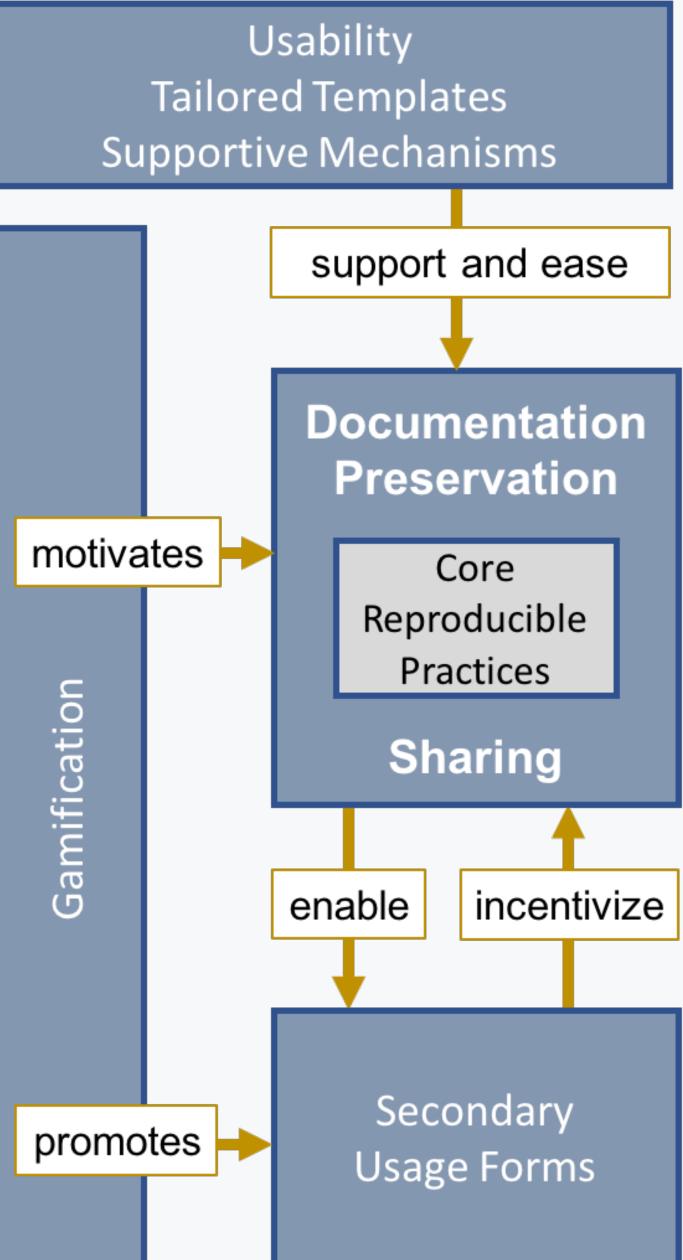
O Edit this page Report an issue

# How HCI can contribute to Open Science

- Mapping and understanding current research practices
- Lowering efforts for Open Science practices
- Ensuring usability of services
- Making connections between researchers and technology developers

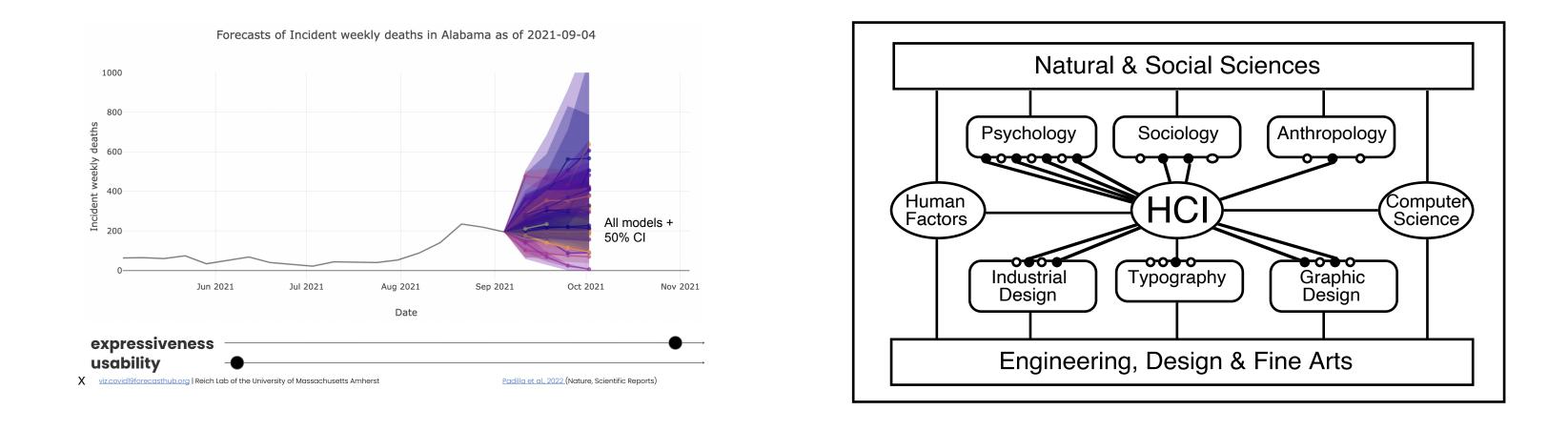
Feger, S. et al. (2019). The Role of HCI in Reproducible Science: Understanding, Supporting and Motivating Core 68 Practices. In Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems (pp. 1-6).

## Slides: http://tiny.cc/t-osap-2023



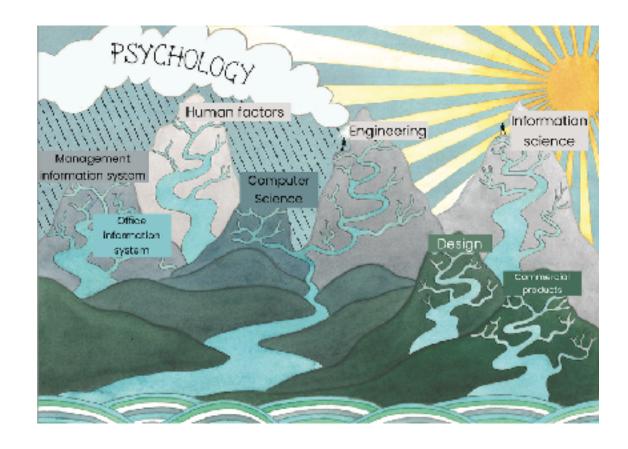
# **Opportunities for MPI policymakers**

- Recognize Open Science as a group of phenomena that can be studied
- Recognize research into designing and developing infrastructure
  - Cross-cutting
  - Specific field
- Fund these research!



"Research transparency refers to honesty and clarity in all communications about the research processes and outcomes to the extent possible."





- How could you be more transparent in your next paper?
- How could you contribute to encourage your field to be more transparent in the long run?