



How to Write a Paper

Human-Computer Interaction Exercise

Your Goal: A Scientific Report

- **You are doing an incredible job!**
 - › Let's publish it!
- **But...**
 - › **...it is not your goal to publish** your scientific report.
 - › ...it is your goal to **bring your work in line with standards of scientific practices and scientific writing**
 - › **...and good scientific practice** can only be showed **in a scientific report**
 - › **your grades depend on that**
 - › If your work lead to results that can be published, **we will contact you**
 - › **your grades do not depend on that**

Examples from this course...



Resch, S., Zoufal, K., Akhouaji, I., Abbou, M.-A., Schwind, V., & Völz, D. (2023). Augmented Smart Insoles – Prototyping a Mobile Application: Usage Preferences of Healthcare Professionals and People with Foot Deformities. *Current Directions in Biomedical Engineering*, 9(1), 698–701. doi: <https://doi.org/10.1515/cdbme-2023-1175>

Jessica Sehr, Henrico Putra Neumann, Julian Niclas Wenzel, Luca Kindermann, and Valentin Schwind. 2022. The Negative Effect on Postural Ergonomics of Non-Sedentary Workplace Desks in Virtual Reality. In *Proceedings of Mensch und Computer 2022 (MuC '22)*. Association for Computing Machinery, New York, NY, USA, 365–370. <https://doi.org/10.1145/3543758.3547541>

Jessica Sehr, Feng Yi Lu, Leonard Husske, Anton Roesler, and Valentin Schwind. 2022. WristConduct: Biometric User Authentication Using Bone Conduction at the Wrist. In *Proceedings of Mensch und Computer 2022 (MuC '22)*. Association for Computing Machinery, New York, NY, USA, 371–375. <https://doi.org/10.1145/3543758.3547542>

Resch, S., Zoufal, K., Akhouaji, I., Abbou, M.-A., Schwind, V., & Völz, D. (2023). Augmented Smart Insoles – Prototyping a Mobile Application: Usage Preferences of Healthcare Professionals and People with Foot Deformities. *Current Directions in Biomedical Engineering*, 9(1), 698–701. doi: <https://doi.org/10.1515/cdbme-2023-1175>

Resch, S., Rafati, M., Altomare, A., Raddi, O., Tahmas, A., Schwind, V., & Völz, D. (2023). Correct Foot Positioning in Virtual Reality through Visual Agility Ladder Training. *MuC '23: Proceedings of Mensch und Computer 2023*. Association for Computing Machinery. doi: <https://doi.org/10.1145/3603555.3608558>

Publishing a Paper

- **Peer review** is the process of screening a draft version of a researchers' (**usually anonymously**) by experts (the "peers") in the same field
- Helps **academic publisher** (editors, editorial board, or program committee) **decide** whether the work should be...
 - > **accepted**
 - > **considered acceptable** with revisions, or
 - > **rejected** for official publication
- ...in a **journal** or in the **proceedings** of an academic conference.

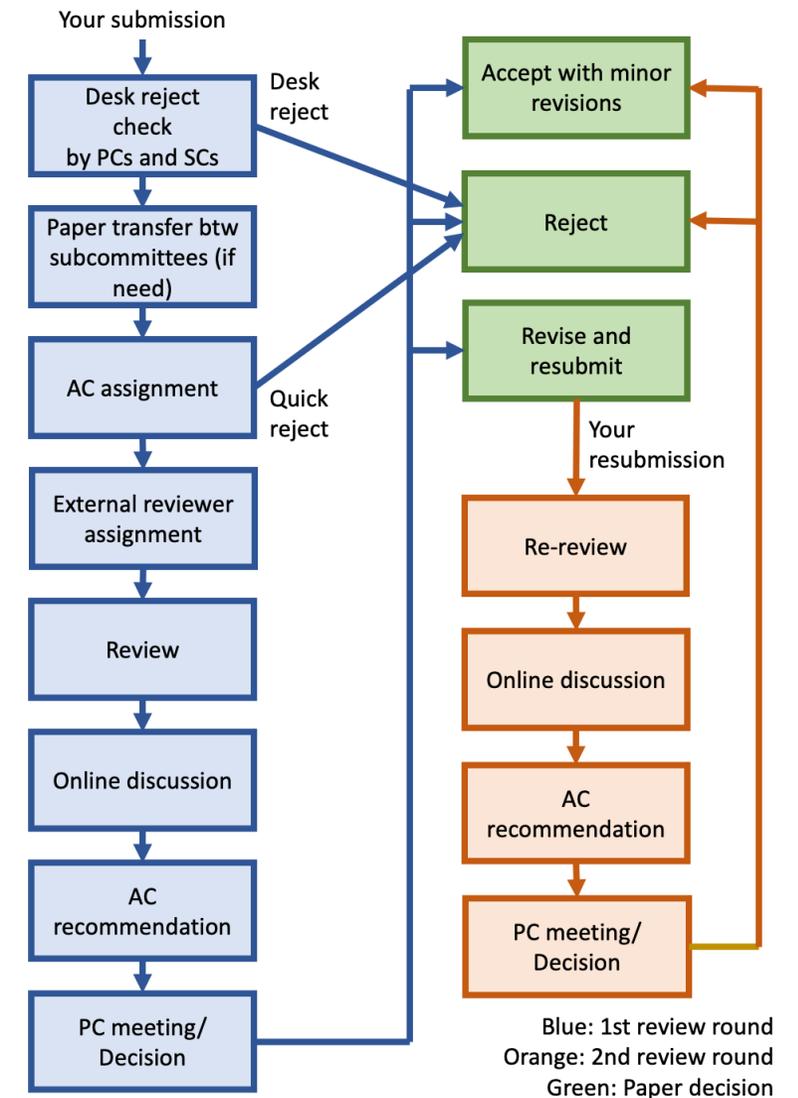
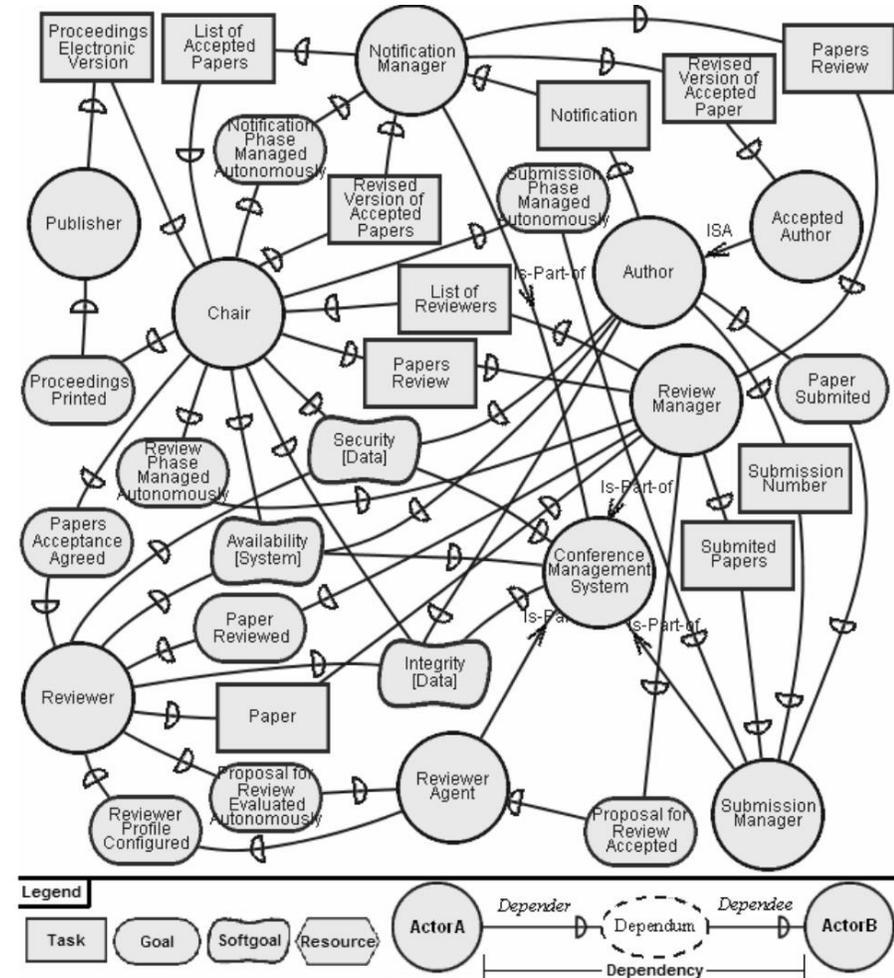
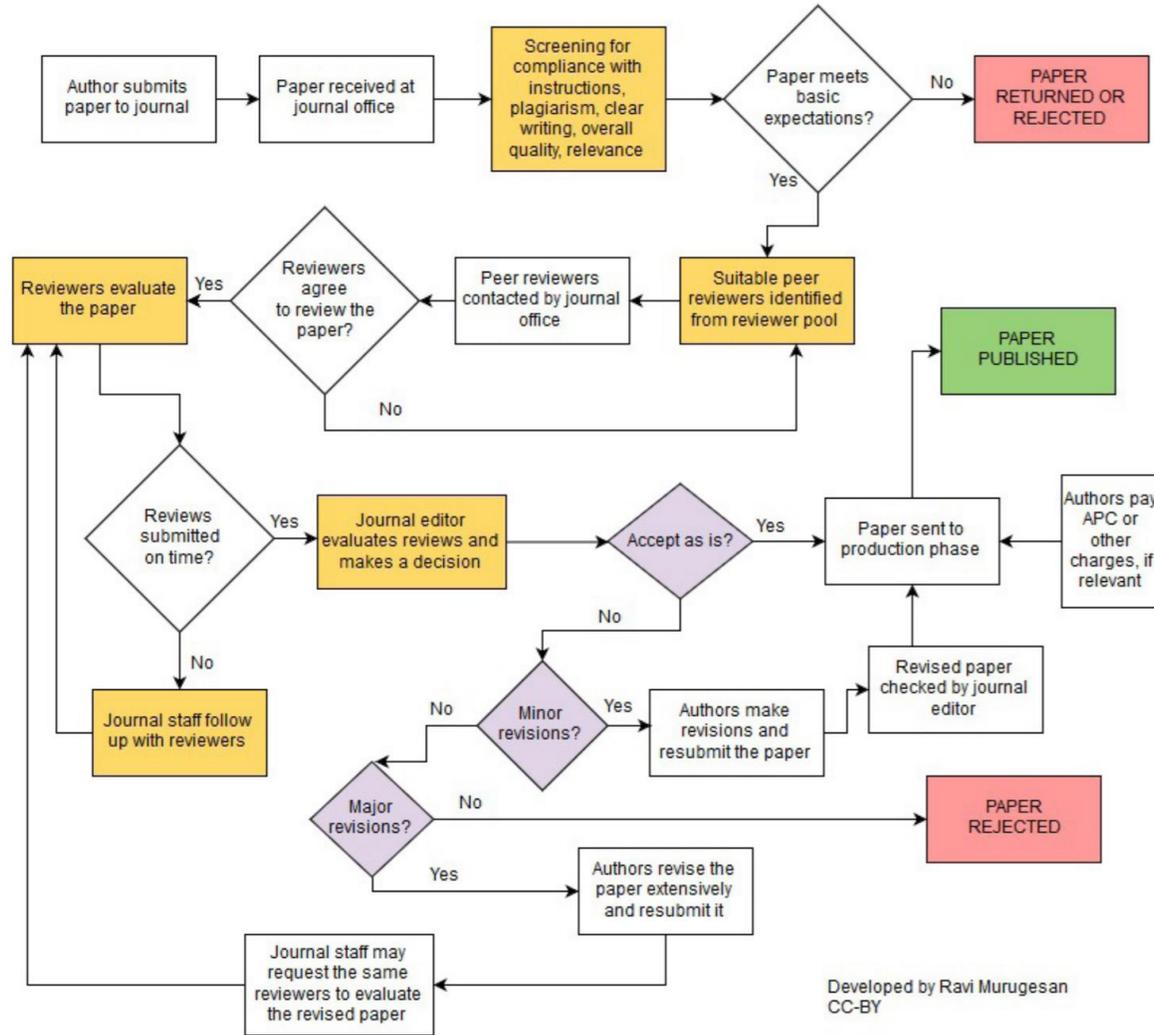
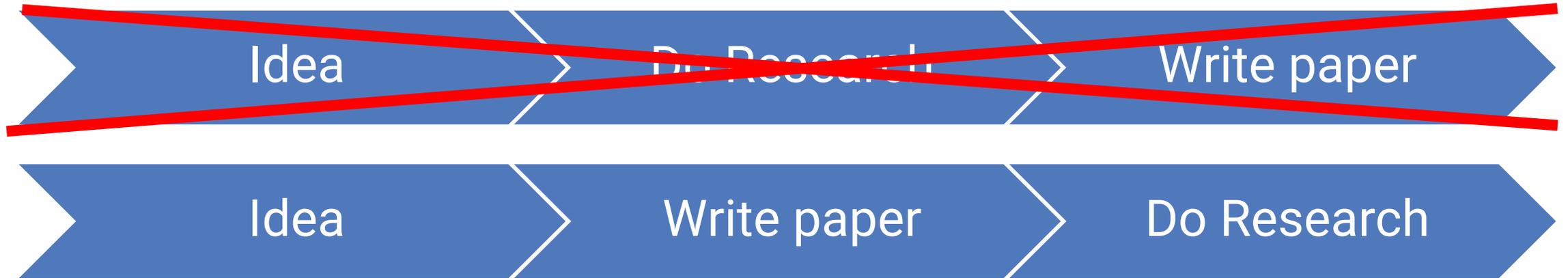


Image from <https://chi2022.acm.org/for-authors/presenting/papers/papers-review-process/>

Scientific Reports are Living Documents



Writing Paper Models



- Forces us to be clear, focused
- Crystallises what we don't understand
- Opens the way to dialogue with
- others: reality check, critique, and collaboration

Adapted from Simon Peyton Jones, Microsoft Research Cambridge

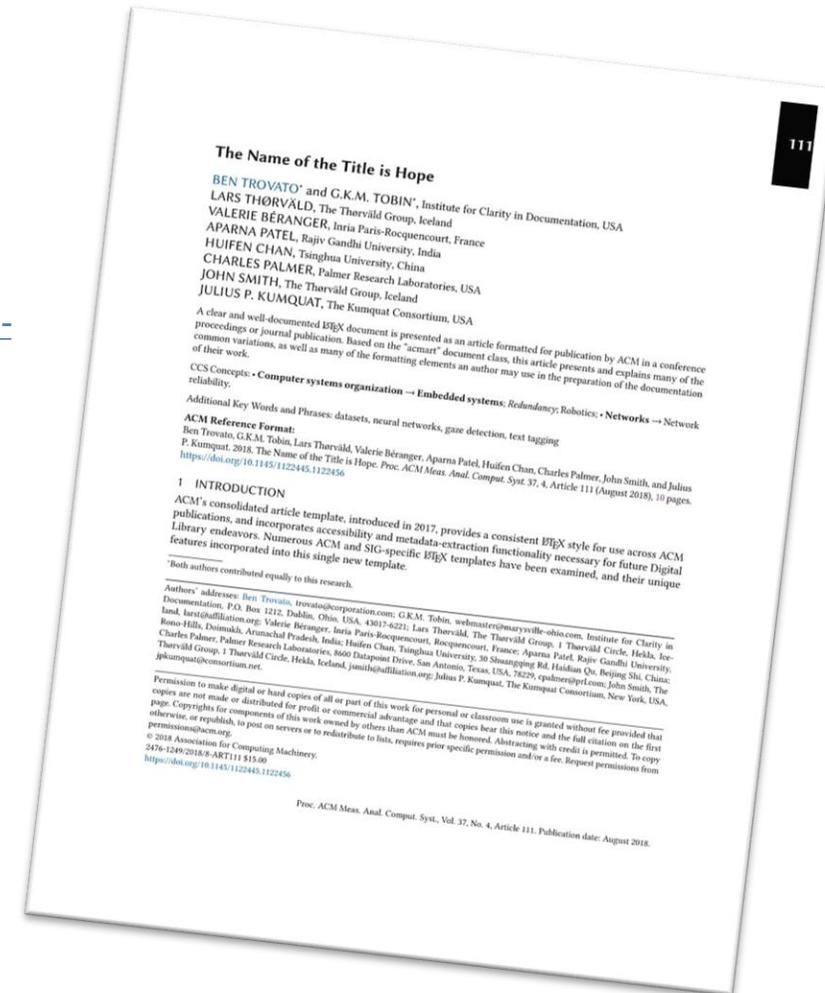
Your Paper Template

- **Scientific report of an empirical study** (6 – 10 pages)

- › You will learn and use Latex now
- › Template: ACM Single Column Master Template
<https://www.overleaf.com/latex/templates/association-for-computing-machinery-acm-large-1-column-format-template/fsyrjmfzawy>

- **Why** we are using this?

- › You learn Latex
- › You learn to collaborate
- › No backup issues
- › No additional software required
- › Easy to publish a paper later (because it is one!)
- › We like the ACM template because it is super easy

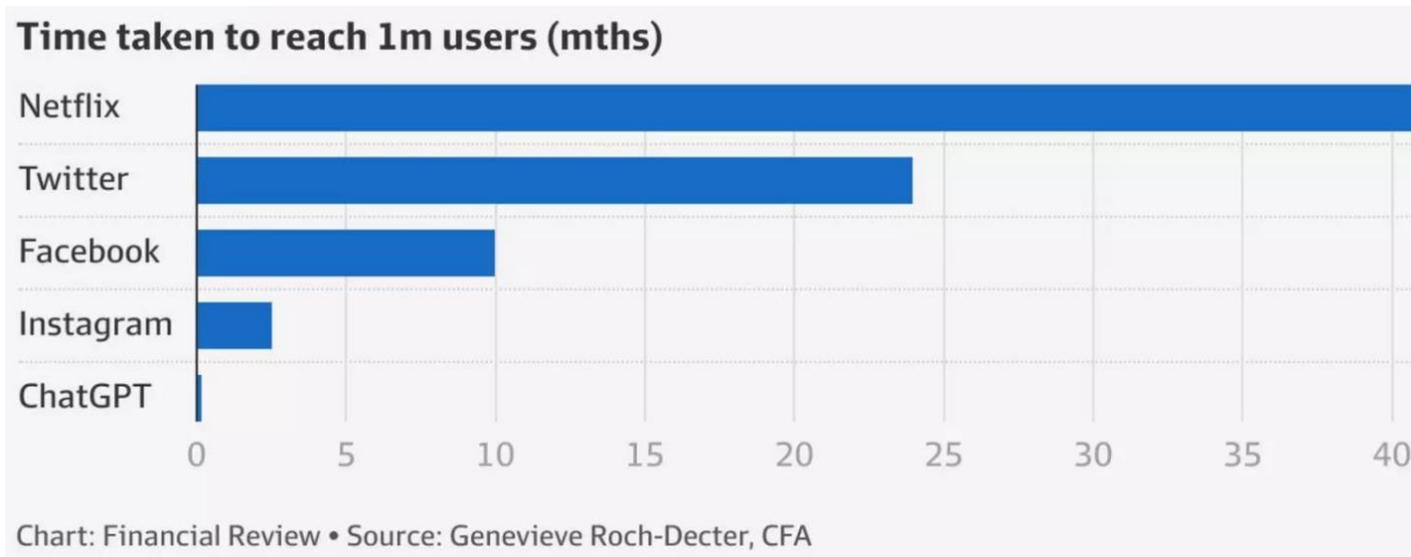


Text Generation using AI

Academic Writing Using ChatGPT

About the Success of Generative AIs

- Generative AI is a type of **artificial intelligence that can create new content** that is similar to or indistinguishable from human-created content.
- By some estimates, **ChatGPT will have more than 90% of the current search market**



Scientific Publishers and ChatGPT (or other AI tools)

- Reaction in the scientific community to papers crediting ChatGPT as an author has been predominantly negative.
- ICML bans papers written by ChatGPT and AI Language Tools [1]
- Springer: “ChatGPT can’t be credited as an author” [2]
 - › However, e.g., Springer also says it has no problem with scientists using AI to help write or generate ideas for research, as long as this contribution is properly disclosed by the authors
- “ChatGPT can generate plausible sounding but incorrect information even when trained on a foundation of factual material.” Vint Cerf [3]
 - › **“We can use it, but it would be awesome if nobody noticed.”**

[1] <https://cacm.acm.org/careers/268561-icml-bans-papers-written-by-chatgpt-and-ai-language-tools/fulltext>

[2] <https://cacm.acm.org/careers/269210-chatgpt-cant-be-credited-as-an-author-academic-publisher-says/fulltext>

[3] https://www.cnet.com/tech/computing/computing-pioneer-criticizes-chatgpt-ai-tech-for-making-things-up/?fbclid=IwAR2Qzte8n10jGSmedrsrhCgU_Dy2FbbXFDLfkqyA_XshQtrwZBg9gx6zVMY

Can I use ChatGPT and other Generative AI Tools?

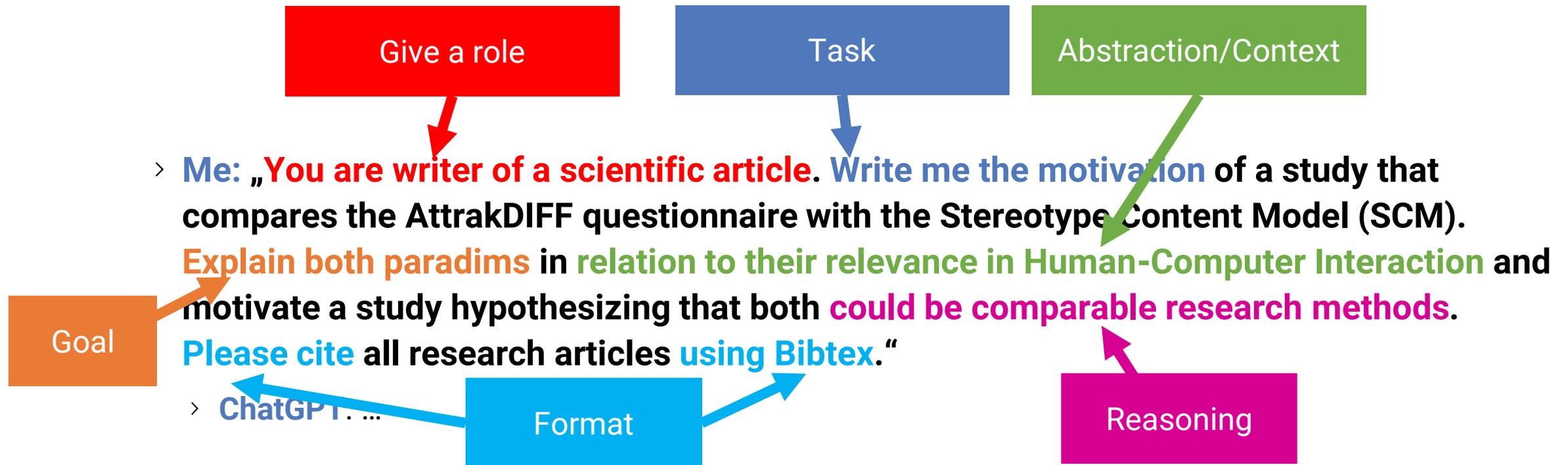
- **You are responsible** for the content and correctness of your paper

<i>Working hypotheses...</i>	People who are...	
	...smart...	...dumb...
... and deny to use AI tools...	...stay smart but waste their potential.	...stay dumb.
... and just use AI toolsrun into risk of being perceived as dumb.	...stay dumb.
... and use AI tools <u>correctly</u>can achieve amazing things.	...can appear smart.

Thus, let's try it anyway...

- **First**, let's have a look how well it works...
 - › **Me:** „Write me a paper of my study“
 - › **ChatGPT:** „I'm sorry, but as an AI language model, I cannot write an entire paper for you“
 - › **Me:** „Write me an introduction of my study“
 - › **ChatGPT:** „Sure, I can provide some guidance on how to write an introduction for your study. The introduction sets the stage for your research ...“
 - › **Me:** „You are writer of a scientific article. Write me the motivation of a study that compares the AttrakDIFF questionnaire with the Stereotype Content Model (SCM). Explain both paradims in relation to their relevance in Human-Computer Interaction and motivate a study hypothesizing that both could be comparable research methods. Please cite all research articles using Bibtex.“
 - › **ChatGPT:** ...

Thus, let's try it anyway...



Bäm! ...okay not perfect, but a good basis...

The field of Human-Computer Interaction (HCI) is concerned with the design, development, and evaluation of interactive systems that aim to support and enhance human activities. One key aspect of this field is to understand how users perceive and interact with technology, which can be assessed through various user-centered design and evaluation methods. Two popular paradigms in HCI research are the AttrakDIFF questionnaire \cite{Hassenzahl2003} and the Stereotype Content Model (SCM) \cite{Fiske2007}.

The AttrakDIFF questionnaire is a user-centered design and evaluation method that assesses users' subjective experiences and perceptions of interactive products. It focuses on evaluating the attractiveness and hedonic qualities of the product, as well as its usability and pragmatic qualities. The questionnaire consists of several dimensions, including attractiveness, hedonic quality, stimulation, novelty, and usability.

On the other hand, the SCM provides a lens for understanding how social stereotypes may influence users' attitudes and behaviors towards interactive products. The SCM is a theoretical framework that categorizes social groups into four types based on their perceived warmth and competence: high-warmth/high-competence groups (admired), high-warmth/low-competence groups (pitied), low-warmth/high-competence groups (envied), and low-warmth/low-competence groups (disliked). The model suggests that people have different expectations and emotions towards each of these groups, which may impact their attitudes and behaviors towards products associated with them.

While the AttrakDIFF questionnaire and the SCM have different theoretical underpinnings, both have been used in HCI research to understand users' perceptions and attitudes towards interactive products. However, to our knowledge, no study has directly compared the two paradigms in terms of their ability to predict users' attitudes and behaviors towards products.

Therefore, the aim of our study is to compare the AttrakDIFF questionnaire and the SCM in terms of their ability to predict users' attitudes and behaviors towards interactive products. We hypothesize that the two paradigms will show comparable results, suggesting that they could be used interchangeably in HCI research.

To test our hypothesis, we will recruit a sample of participants and ask them to interact with a set of interactive products while completing both the AttrakDIFF questionnaire and the SCM. We will then compare the results of the two paradigms and examine their predictive power in terms of users' attitudes and behaviors towards the products.

In conclusion, the comparison of the AttrakDIFF questionnaire and the SCM has the potential to provide insights into the relative strengths and weaknesses of these two paradigms in understanding users' perceptions and attitudes towards interactive products. Our study can inform the choice of research methods in HCI research and contribute to a better understanding of how social stereotypes and user-centered design factors influence users' interactions with technology.

@article{Hassenzahl2003, author={Hassenzahl, Marc and Tractinsky, Noam}, title={User experience - a research agenda}, journal={Behaviour & Information Technology}, volume={22}, number={2}, pages={91-97}, year={2003}, publisher={Taylor & Francis}, doi={10.1080/0144929031000073554} }

@article{Fiske2007, author={Fiske, Susan T. and Cuddy, Amy J.C. and Glick, Peter and Xu, Jun}, title={A Model of (Often Mixed) Stereotype Content: Competence and Warmth Respectively Follow From Perceived Status and Competition}, journal={Journal of Personality and Social Psychology}, volume={82}, number={6}, pages={878-902}, year={2007}, publisher={American Psychological Association}, doi={10.1037/0022-3514.82.6.878} }

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While the AttrakDIFF questionnaire and the SCM have different theoretical underpinnings, both have been used in HCI research to understand users' perceptions and attitudes towards interactive products. However, to our knowledge, no study has directly compared the two paradigms in terms of their ability to predict users' attitudes and behaviors towards products.

Therefore, the aim of our study is to compare the AttrakDIFF questionnaire and the SCM. We hypothesize that the two paradigms will show comparable results, suggesting that they could be used interchangeably to understand users' attitudes and behaviors towards interactive products. We hypothesize that the two

To test our hypothesis, we will recruit a sample of participants and ask them to evaluate the attractiveness and usability of a set of interactive products. We will then compare the results of the two paradigms and examine their predictive power in terms of users' attitudes and behaviors towards interactive products. We will then compare the

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```

Ohoh, we need evidence for that claim (it is unfounded!)

Supporting Claims...

- Me: “Can you find scientific evidence for the claim that the SCM model suggests that people have different expectations and emotions towards each of group stereotype, which may impact their attitudes and behaviors towards products associated with them?”
- ChatGPT: „[...]”

Govers, P. C., & Schoormans, J. P. (2005). Product personality and its influence on consumer preference. Journal of consumer marketing, 22(4), 189-197.

This study shows that people tend to attribute personality traits to products, and that these personality traits are related to their preferences for these products. Specifically, the study found that people tend to prefer products that are perceived as warm and competent, and that they tend to avoid products that are perceived as cold and incompetent. These findings are consistent with the predictions of the SCM. [...]

Let's check

Home / Journals / Journal of Consumer Marketing / Volume 22 Issue 4 / Product personality and its influence on consumer preference

Product personality and its influence on consumer preference

P.C.M. Govers, J.P.L. Schoormans

Journal of Consumer Marketing

ISSN: 0736-3761

Article publication date: 1 June 2005

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23443

PDF (268 KB)

Abstract

Products as symbols

Self-congruence

Product-personality congruence

Hypotheses

Methodology

Results

Discussion

Limitations

Managerial implications

Abstract

Purpose

Beyond their functional utility products have a symbolic meaning. Parts of this symbolic meaning are accounted for by concepts like brand personality and product-user image, which describe the symbolic meaning associated with the brand or product class. However, the physical product also carries symbolic meaning. That part of the symbolic meaning that refers to the physical product itself, and is described with human personality characteristics, is called product personality. The purpose of this article is to show that product personality positively influences consumer preference through a congruence effect.

Design/methodology/approach

A two-phase study was conducted. In the first phase, product-personality congruence was measured. The second phase was used to establish user-image congruence.

Findings

The results indicate that people prefer products with a product personality that matches their self-image. Moreover, this positive effect of product-personality congruence is found to be independent of the user-image congruence effect.

Product personality and its influence on consumer preference

P.C.M. Govers

Nyenrode University, Breukelen, The Netherlands, and

J.P.L. Schoormans

Faculty of Industrial Design Engineering, Delft University of Technology, Delft, The Netherlands

Abstract

Purpose – Beyond their functional utility products have a symbolic meaning. Parts of this symbolic meaning are accounted for by concepts like brand personality and product-user image, which describe the symbolic meaning associated with the brand or product class. However, the physical product also carries symbolic meaning. That part of the symbolic meaning that refers to the physical product itself, and is described with human personality characteristics, is called product personality. The purpose of this article is to show that product personality positively influences consumer preference through a congruence effect.

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Findings – The results indicate that people prefer products with a product personality that matches their self-image. Moreover, this positive effect of product-personality congruence is found to be independent of the user-image congruence effect.

Originality/value – Previous research has shown that product variants can be designed to have a specific personality. This study has shown that product-personality congruence has a positive effect on consumer preference.

Keywords Consumers, Brands, Product image, Consumption

Paper type Research paper

An executive summary for managers and executive readers can be found at the end of this article.

Products as symbols

Products have a significance that goes beyond their functional utility. This significance stems from the ability of products to communicate meaning (Hirschman, 1981; McCracken, 1986). Products are symbols by which people convey something about themselves to themselves and to others (Holman, 1981; Solomon, 1983). This symbolic meaning is known to influence consumer preference.

All commercial objects have a symbolic character, and making a purchase involves an assessment – implicit or explicit – of this symbolism ... (Levy, 1959, p. 119).

The symbolic meaning of products has become increasingly important. Nowadays, differentiating products based on their technical functions or quality is difficult (Dumaine, 1991; Veryzer, 1995). Since the wave of the quality controls in the 1980s, products can be expected to fulfill their functions reasonably well. Symbolic meaning provides another way to differentiate products. Due to symbolic meaning otherwise

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The current issue and full text archive of this journal is available at www.emeraldinsight.com/0736-3761.htm



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indistinguishable products become differentiated in the eyes of the consumer. Similarly Salzer-Möring and Strannegård (2004) recently stated:

With the abundance of products in the western world, the managerial challenge, it seems, is to become that of differentiating similar products (p. 224).

Due to its increasing relevance, many articles have investigated the symbolic meaning of products. The range of topics studied is very broad, varying from the cultural meaning of products (e.g. Kleine *et al.*, 1993; McCracken, 1986), semiotics of consumption (e.g. Holman, 1981; Mick, 1986), products as tools for self-expression (e.g. Belk, 1988; Prentice, 1987), and impression formation based on possessions (e.g. Belk, 1978; Dittmar and Pepper, 1994; Gosling *et al.*, 2002).

Part of this literature is more specifically concerned with the use of personality related concepts, such as brand personality (Aaker, 1997; Biel, 1993) and product-user image (Sirgy, 1982; Sirgy *et al.*, 1997; Sirgy *et al.*, 2000). Parts of the symbolic meaning of products are captured by these concepts. However, some of the symbolic meaning has not been accounted for. Brand personality refers to “the set of human personality characteristics associated with a brand” (Aaker, 1997) and the product-user image reflects the stereotypical image of users of a product class or brand (Sirgy *et al.*, 1997). Yet, the physical product itself also carries symbolic meaning. That part of the symbolic meaning that refers to the physical product itself, and is described with human personality characteristics, is called product personality.

Seems good, but they did not use the SCM!

Login

PDF

Help

Supporting Claims...

- Me: **“Can you find scientific evidence for the claim that the SCM model suggests that people have different expectations and emotions towards each of group stereotype, which may impact their attitudes and behaviors towards products associated with them?”**

Supporting Claims...

- Me: “Can you find scientific evidence for the claim that the SCM model suggests that people have different expectations and emotions towards each of group stereotype, which may impact their attitudes and behaviors towards products associated with them?”

- ChatGPT: „[...]

Sure, here are a few references that support the claim that the SCM model suggests that people have different expectations and emotions towards each group stereotype, which may impact their attitudes and behaviors towards products associated with them:

*Fiske, S. T., Cuddy, A. J., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of personality and social psychology*, 82(6), 878–902.*

<https://doi.org/10.1037//0022-3514.82.6.878>

*Cuddy, A. J., Fiske, S. T., & Glick, P. (2008). Warmth and competence as universal dimensions of social perception: The stereotype content model and the BIAS map. *Advances in experimental social psychology*, 40, 61–149. [https://doi.org/10.1016/s0065-2601\(07\)00002-0](https://doi.org/10.1016/s0065-2601(07)00002-0)*

*Eskine, K. J., Kacinik, N. A., & Prinz, J. J. (2011). A bad taste in the mouth: Gustatory disgust influences moral judgment. *Psychological science*, 22(3), 295–299. <https://doi.org/10.1177/0956797611398497>*

*Lee, S. Y., Chung, S. Y., & Chen, G. (2015). Consumers’ responses to different service recovery actions: The moderating roles of warmth and competence stereotypes. *Journal of Services Marketing*, 29(2), 150–163. <https://doi.org/10.1108/jsm-06-2013-0199>*

WTF

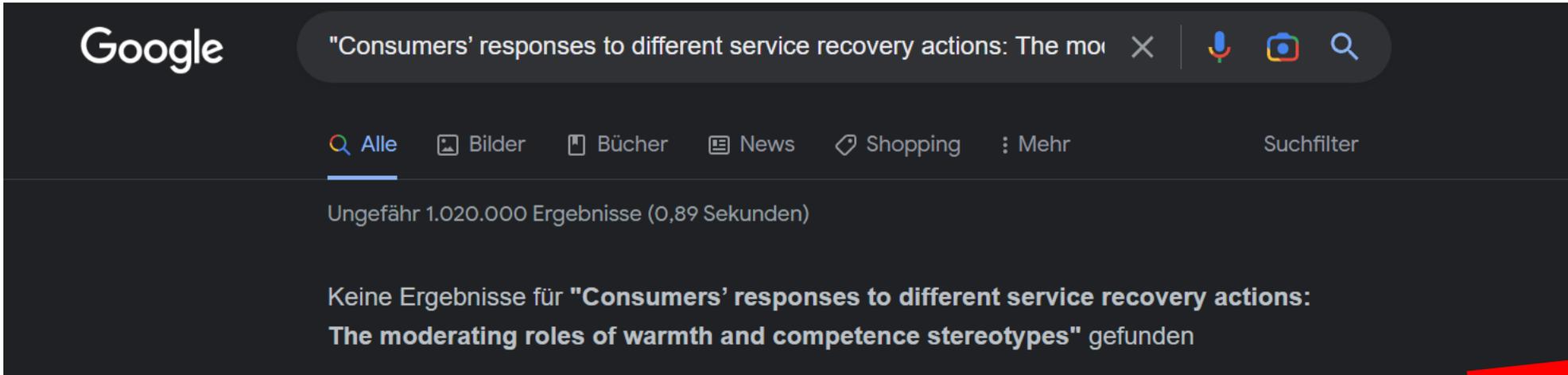
Okay, let's check the last one

DOI NOT FOUND

10.1108/jism-06-2013-0199

This DOI cannot be found in the DOI System. Possible reasons are:

- The DOI is incorrect in your source. Search for the item by name, title, or other metadata using a search engine.
- The DOI was copied incorrectly. Check to see that the string includes all the characters before and after the slash and no sentence punctuation marks.
- The DOI has not been activated yet. Please try again later, and report the problem if the error continues.

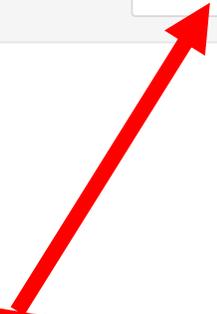


The thing doesn't exist

products warmth and competence



Good old Google



Beliebige Zeit

Seit 2023

Seit 2022

Seit 2019

Zeitraum wählen...

Nach Relevanz sortieren

Nach Datum sortieren

Beliebige Sprache

Seiten auf Deutsch

Alle Typen

Übersichtsarbeiten

Social perception of brands: **Warmth** and **competence** define images of both brands and social groups

[N Kervyn](#), [ST Fiske](#), C Malone - Consumer Psychology Review, 2022 - Wiley Online Library

... **product** features influence brand **warmth** and **competence** ... , **product** features influence brand **warmth** and **competence** ... way around: brand **warmth** and **competence** can influence the ...

☆ Speichern Zitieren Zitiert von: 21 Ähnliche Artikel Alle 5 Versionen

[PDF] wiley.com

Unintended consequences of **warmth** appeals: An extension of the compensation effect between **warmth** and **competence** to advertising

[T Kim](#), [JG Ball](#) - Journal of Advertising, 2021 - Taylor & Francis

... brand **competence** and **product** quality ... **warmth** advertising appeal reduced perceived **comp** ... **warmth** appeal when the brand belongs to a **product** ...

☆ S Ähnliche Artikel Alle 2 Versionen

Let's take this...

Here we are

When do **warmth** and **competence** sell best? The "golden quadrant" shifts as a function of congruity with the **product** type, targets' individual differences, and ...

[M Zawisza](#), C Pittard - Basic and Applied Social Psychology, 2015 - Taylor & Francis

[PDF] anglia.ac.uk

- Beliebige Zeit
 - Seit 2023
 - Seit 2022
 - Seit 2019
 - Zeitraum wählen...
- Nach Relevanz sortieren
- Nach Datum sortieren
- Beliebige Sprache
 - Seiten auf Deutsch
- Alle Typen
 - Übersichtsarbeiten

Zitieren

MLA Kervyn, Nicolas, Susan T. Fiske, and Chris Malone. "Social perception of brands: Warmth and competence define images of both brands and social groups." *Consumer Psychology Review* 5.1 (2022): 51-68.

APA Kervyn, N., Fiske, S. T., & Malone, C. (2022). Social perception of brands: Warmth and competence define images of both brands and social groups. *Consumer Psychology Review*, 5(1), 51-68.

Yep!

BibTeX EndNote RefMan RefWorks

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 - Seit 2023
 - Seit 2022
 - Seit 2019
 - Zeitraum wählen...
- Nach Relevanz sortieren
 - Nach Datum sortieren
- Beliebige Sprache
 - Seiten auf Deutsch
- Alle Typen
 - Übersichtsarbeiten

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MLA	Kervyn, Nicolas, Susan T. Fiske, and Chris Malone. "Social perception of brands: Warmth and competence define images of both brands and social groups." <i>Consumer Psychology Review</i> 5.1 (2022): 51-68.
APA	Kervyn, N., Fiske, S. T., & Malone, C. (2022). Social perception of brands: Warmth and competence define images of both brands and social groups. <i>Consumer Psychology Review</i> , 5(1), 51-68.
ISO 690	KERVYN, Nicolas; FISKE, Susan T.; MALONE, Chris. Social perception of brands: Warmth and competence define images of both brands and social groups. <i>Consumer Psychology Review</i> , 2022, 5. Jg., Nr. 1, S. 51-68.

[BibTeX](#) [EndNote](#) [RefMan](#) [RefWorks](#)

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```
@article{kervyn2022social,  
  title={Social perception of brands: Warmth and competence define  
images of both brands and social groups},  
  author={Kervyn, Nicolas and Fiske, Susan T and Malone, Chris},  
  journal={Consumer Psychology Review},  
  volume={5},  
  number={1},  
  pages={51--68},  
  year={2022},  
  publisher={Wiley Online Library}  
}
```

Bäm! ...okay not perfect, but a good basis...

The field of Human-Computer Interaction (HCI) is concerned with the design, development, and evaluation of interactive systems that aim to support and enhance human activities. One key aspect of this field is to understand how users perceive and interact with technology, which can be assessed through various user-centered design and evaluation methods. Two popular paradigms in HCI research are the AttrakDIFF questionnaire \cite{Hassenzahl2003} and the Stereotype Content Model (SCM) \cite{Fiske2007}.

The AttrakDIFF questionnaire is a user-centered design and evaluation method that assesses users' subjective experiences and perceptions of interactive products. It focuses on evaluating the attractiveness and hedonic qualities of the product, as well as its usability and pragmatic qualities. The questionnaire consists of several dimensions, including attractiveness, hedonic quality, stimulation, novelty, and usability.

On the other hand, the SCM provides a lens for understanding how social stereotypes may influence users' attitudes and behaviors towards interactive products. The SCM is a theoretical framework that categorizes social groups into four types based on their perceived warmth and competence: high-warmth/high-competence groups (admired), high-warmth/low-competence groups (pitied), low-warmth/high-competence groups (envied), and low-warmth/low-competence groups (disliked). **The model suggests that people have different expectations and emotions towards each of these groups, which may impact their attitudes and behaviors towards products associated with them.**

While the AttrakDIFF questionnaire and the SCM have different theoretical underpinnings, both have been used in HCI research to understand users' perceptions and attitudes towards interactive products. However, to our knowledge, no study has directly compared the two paradigms in terms of their ability to predict users' attitudes and behaviors towards products.

Therefore, the aim of our study is to compare the AttrakDIFF questionnaire and the SCM in terms of their ability to predict users' attitudes and behaviors towards interactive products. We hypothesize that the two paradigms will show comparable results, suggesting that they could be used interchangeably in HCI research.

To test our hypothesis, we will recruit a sample of participants and ask them to interact with a set of interactive products while completing both the AttrakDIFF questionnaire and the SCM. We will then compare the results of the two paradigms and examine their predictive power in terms of users' attitudes and behaviors towards the products.

In conclusion, the comparison of the AttrakDIFF questionnaire and the SCM has the potential to provide insights into the relative strengths and weaknesses of these two paradigms in understanding users' perceptions and attitudes towards interactive products. Our study can inform the choice of research methods in HCI research and contribute to a better understanding of how social stereotypes and user-centered design factors influence users' interactions with technology.

```
@article{Hassenzahl2003, author={Hassenzahl, Marc and Tractinsky, Noam}, title={User experience - a research agenda}, journal={Behaviour & Information Technology}, volume={22}, number={2}, pages={91-97}, year={2003}, publisher={Taylor & Francis}, doi={10.1080/0144929031000073554} }
```

```
@article{Fiske2007, author={Fiske, Susan T. and Cuddy, Amy J.C. and Glick, Peter and Xu, Jun}, title={A Model of (Often Mixed) Stereotype Content: Competence and Warmth Respectively Follow From Perceived Status and Competition}, journal={Journal of Personality and Social Psychology}, volume={82}, number={6}, pages={878-902}, year={2007}, publisher={American Psychological Association}, doi={10.1037/0022-3514.82.6.878} }
```

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While the AttrakDIFF questionnaire and the SCM have different theoretical underpinnings, both have been used in HCI research to understand users' perceptions and attitudes towards interactive products. However, to our knowledge, no study has directly compared the two paradigms in terms of their ability to predict users' attitudes and behaviors towards products.

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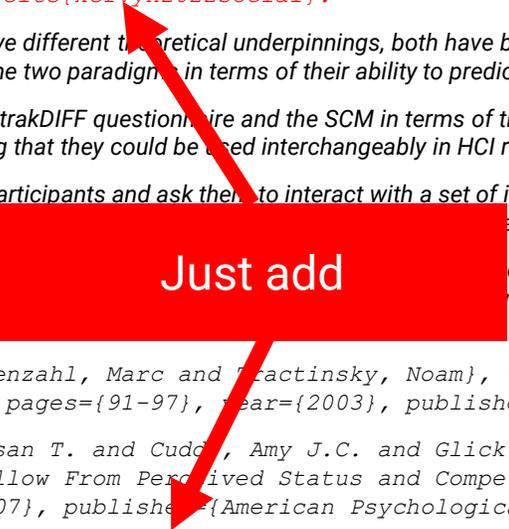
To test our hypothesis, we will recruit a sample of participants and ask them to interact with a set of interactive products while completing both the AttrakDIFF questionnaire and the SCM. We will then compare the results of the two paradigms and examine their predictive validity towards the products.

In conclusion, the comparison of the AttrakDIFF questionnaire and the SCM will provide insights into the relative strengths and weaknesses of these two paradigms in understanding users' perceptions and attitudes towards interactive products. This study will contribute to the development of better user-centered design methods in HCI research and contribute to a better understanding of how social stereotypes and user-centered design factors influence users' interactions with technology.

```
@article{Hassenzahl2003, author={Hassenzahl, Marc and Tractinsky, Noam}, title={User experience - a research agenda}, journal={Behaviour & Information Technology}, volume={22}, number={2}, pages={91-97}, year={2003}, publisher={Taylor & Francis}, doi={10.1080/0144929031000073554} }
```

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@article{Fiske2007, author={Fiske, Susan T. and Cudd, Amy J.C. and Glick, Peter and Xu, Jun}, title={A Model of (Often Mixed) Stereotype Content: Competence and Warmth Respectively Follow From Perceived Status and Competition}, journal={Journal of Personality and Social Psychology}, volume={82}, number={6}, pages={878-902}, year={2007}, publisher={American Psychological Association}, doi={10.1037/0022-3514.82.6.878} }
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@article{kervyn2022social, title={Social perception of brands: Warmth and competence define images of both brands and social groups}, author={Kervyn, Nicolas and Fiske, Susan T and Malone, Chris}, journal={Consumer Psychology Review}, volume={5}, number={1}, pages={51--68}, year={2022}, publisher={Wiley Online Library} }
```



Just add

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While the AttrakDIFF questionnaire and the SCM have different theoretical underpinnings, they both aim to understand users' perceptions and attitudes towards interactive products. However, to our knowledge, no study has directly compared the two paradigms in terms of their predictive power towards products.

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To test our hypothesis, we will recruit a sample of participants and ask them to interact with a set of interactive products while completing both the AttrakDIFF questionnaire and the SCM. We will then compare the results of the two paradigms and examine their predictive power in terms of users' attitudes and behaviors towards the products.

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```

Sounds generic. Let's check

AI Detectors

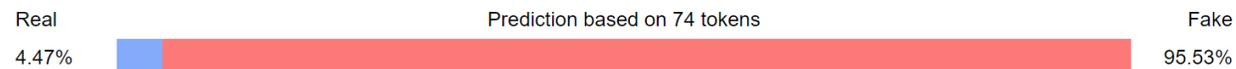
- <https://openai-openai-detector.hf.space/>

GPT-2 Output Detector Demo

This is an online demo of the GPT-2 output detector model, based on the 🤖/Transformers implementation of RoBERTa. Enter some text in the text box; the predicted probabilities will be displayed below. The results start to get reliable after around 50 tokens.

The AttrakDIFF questionnaire is a user-centered design and evaluation method that assesses users' subjective experiences and perceptions of interactive products. It focuses on evaluating the attractiveness and hedonic qualities of the product, as well as its usability and pragmatic qualities. The questionnaire consists of several dimensions, including attractiveness, hedonic quality, stimulation, novelty, and usability.

Fake!!!!



Let's paraphrase it...

- <https://quillbot.com/>

Modes: **Standard** Fluency Formal Simple Creative Expand Shorten Synonyms:

The AttrakDIFF questionnaire is a user-centered design and evaluation method that assesses users' subjective experiences and perceptions of interactive products. It focuses on evaluating the attractiveness and hedonic qualities of the product, as well as its usability and pragmatic qualities. The questionnaire consists of several sections, including ones for usability, stimulation, novelty, and hedonic quality, stimulation, novelty, and hedonic quality.

A user-centered design and evaluation technique called AttrakDIFF evaluates users' subjective experiences with and perceptions of interactive products. It concentrates on assessing the product's usability, pragmatism, and hedonic qualities in addition to its aesthetics. The evaluation has several sections, including ones for usability, stimulation, novelty, and hedonic quality.

GPT-2 Output Detector Demo

This is an online demo of the GPT-2 output detector model, based on the [https://github.com/Transformerlabs/transformers](#) implementation of RoBERTa. Enter some text in the text box; the predicted probabilities will be displayed below. The results start to get reliable after around 50 tokens.

A user-centered design and evaluation technique called AttrakDIFF evaluates users' subjective experiences with and perceptions of interactive products. It concentrates on assessing the product's usability, pragmatism, and hedonic qualities in addition to its aesthetics. The evaluation has several sections, including ones for usability, stimulation, novelty, and hedonic quality.

Real: 99.21% Prediction based on 71 tokens Fake: 0.79%

Yay 99.21% real. But wrong. AttrakDIFF evaluates Attractiveness (not aesthetics)

You need a reference?

- https://www.caktus.ai/caktus_student → Citation Creator (costs money)
 - › „While the AttrakDIFF questionnaire focuses on user-centered design and evaluation, the SCM provides a lens for understanding how social stereotypes may influence users' attitudes and behaviors towards interactive products.”

Citation Creator

Enter your idea or paragraph and get a list of relevant sources

While the AttrakDIFF questionnaire focuses on user-centered design and evaluation, the SCM provides a lens for understanding how social stereotypes may influence users' attitudes and behaviors towards interactive products.

Get Citations

D Petrelli, A De Angeli, G Convertino. "A user-centered approach to user modeling." https://link.springer.com/chapter/10.1007/978-3-7091-2490-1_25

"User-centered design through learner-centered instruction." <https://www.tandfonline.com/doi/abs/10.1080/13562517.2013.827646>

"A web-based program for informal caregivers of persons with Alzheimer's disease: an iterative user-centered design." <https://www.researchprotocols.org/2014/3/e46>

AI Serban. "Smart home sensing and monitoring in households with dementia: User-centered design approach." <https://aging.jmir.org/2021/3/e27047>

C Putnam, E Rose. "Adapting user-centered design methods to design for diverse populations." <https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authType=crawler&jml=15447529&asa=Y&AN=484614878h=XUVVsnIYYAMb8WQUkbEchyhOsp36%2FVKTPwXyo30L9SyK02vSmLjkd%2Bz10aPw8VPGh%2FercXymQV0eOKGf3hh2a%3D%3D&crfc>

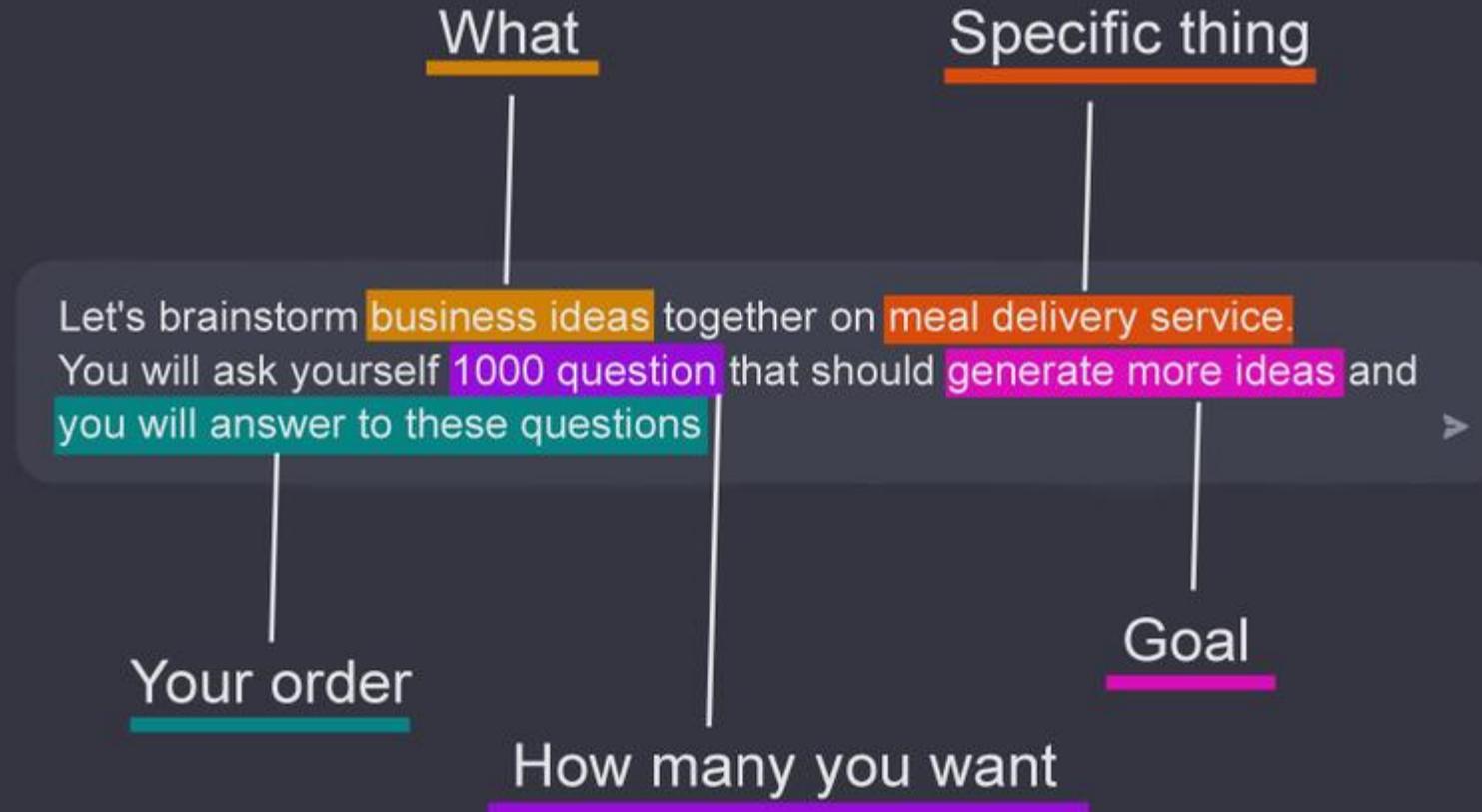
"Exploring design guidelines of using user-centered design in gamification development: A Delphi study." <https://www.tandfonline.com/doi/abs/10.1080/10447318.2018.1514823>

N Reich-Stiebert. "Exploring university students' preferences for educational robot design by means of a user-centered design approach." <https://link.springer.com/article/10.1007/s12369-019-00554-7>

S Santini, V Stara, A Merizzi. "... agent for coaching older adults to choose active and healthy ageing behaviors during the transition to retirement: A cross-national user centered design study." <https://www.mdpi.com/1660-4601/18/18/9681>

Brings you sources!

More Ideas



<https://twitter.com/heyBarsee/status/1612351396283654148>

More Ideas

Make things
simple



Explain [complex topic] like I'm 5 years old. >

Mix and
creates new
things



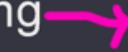
Mix every storytelling frameworks and craft one best framework from them. >

Writes your
personal story



Write a Newsletter post on sharing my personal story of hitting \$100,000 this year >

Lists anything
you ask



List 10 movies about entrepreneurs >

<https://twitter.com/heyBarsee/status/1612351396283654148>



Sure! Here are 20 prompts that people can use to increase their productivity with GPT-4, presented in chart form:



Number	How	Prompt
1	Generate Ideas	"List 10 potential solutions to the problem at hand."
2	Summarize Information	"Summarize the key points from this article in one paragraph."
3	Brainstorm Names	"Generate 5 possible names for this new product."
4	Proofread	"Proofread this document for errors and suggest corrections."
5	Generate Headlines	"Come up with 3 catchy headlines for this blog post."
6	Paraphrase	"Rewrite this paragraph in your own words."
7	Write Descriptions	"Write a short description of this product for the website."
8	Create Outlines	"Create an outline for this research paper."
9	Translate	"Translate this document from English to Spanish."
10	Generate Questions	"List 5 questions that you would ask in an interview with this candidate."
11	Generate Social Media Posts	"Create 3 social media posts to promote this event."
12	Generate Product Descriptions	"Write a product description for each of these 5 items."
13	Generate Taglines	"Create 2 taglines for this advertising campaign."
14	Generate Email Templates	"Create an email template to respond to customer inquiries."
15	Generate Blog Posts	"Write a 500-word blog post on this topic."
16	Generate Product Reviews	"Write a review of this product for the website."
17	Generate Ad Copy	"Write a short ad for this product."
18	Generate Job Descriptions	"Write a job description for this position."
19	Generate Website Copy	"Write the copy for the homepage of this website."
20	Generate News Articles	"Write a news article on this current event."

🔄 Regenerate response

Using Latex

Academic Writing Using Latex

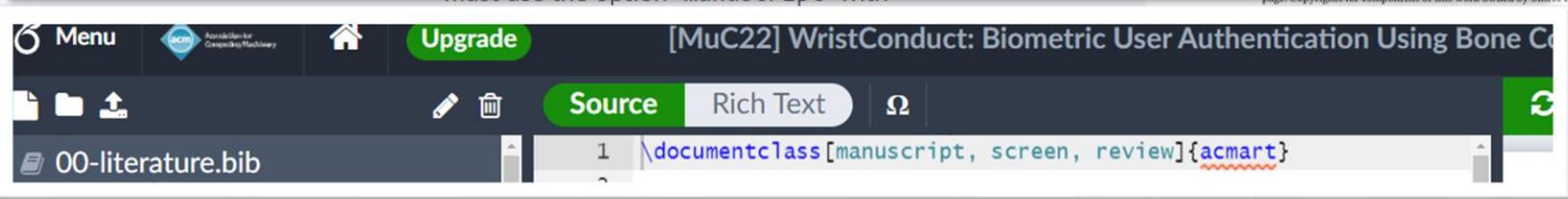
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```



will be provided the opportunity to review and approve the formatted output before the article is published to the ACM Digital Library.

The Name of the Title is Hope

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LARS THÖRVÄLD, The Thörvöld Group, Iceland
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APARNA PATEL, Rajiv Gandhi University, India
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CCS Concepts: • Computer systems organization → Embedded systems; Redundancy; Robotics; • Networks → Network reliability.

Additional Key Words and Phrases: datasets, neural networks, gaze detection, text tagging

ACM Reference Format:

Ben Trovato, G.K.M. Tobin, Lars Thörväld, Valerie Béanger, Aparna Patel, Huifen Chan, Charles Palmer, John Smith, and Julius P. Kumquat. 2018. The Name of the Title is Hope. *Proc. ACM Meas. Anal. Comput. Syst.* 3, 4, Article 111 (August 2018), 10 pages. <https://doi.org/XXXXXXXXXXXX>

1 INTRODUCTION

ACM's consolidated article template, introduced in 2017, provides a consistent \LaTeX style for use across ACM publications, and incorporates accessibility and metadata-extraction functionality necessary for future Digital Library endeavors. Numerous ACM and SIG-specific \LaTeX templates have been examined, and their unique features incorporated into this single new template.

*Both authors contributed equally to this research.

Authors' addresses: Ben Trovato, trovato@corporation.com; G.K.M. Tobin, Documentation, P.O. Box 1212, Dublin, Ohio, USA, 43017-6221; Lars Thörväld, larst@affiliation.org; Valerie Béanger, Inria Paris, Rocquencourt, France; Aparna Patel, Rajiv Gandhi University, India; Huifen Chan, Tsinghua University, Beijing, China; Charles Palmer, Palmer Research Laboratories, 8600 Datapoint Drive, San Antonio, Texas, USA; John Smith, The Thörvöld Group, Iceland; Julius P. Kumquat, The Kumquat Consortium, New York, USA.

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Comput. Syst., Vol. 37, No. 4, Article 111. Publication date: August 2018.

The official version

Use this in the first line

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	Content (DINA4)	Readers/Year	Latex Code
Title	1/2 sentence	1000	<code>\title{...}</code>
Abstract	4-6 sentences	200	<code>\begin{abstract}</code> <code>\end{abstract}</code>
Introduction	1 page	100	<code>\input{01-introduction}</code>
Related Work	1 page	10	<code>\input{02-relatedwork}</code>
Method	2-3 pages	3	<code>\input{03-method}</code>
Results	2-3 pages	4	<code>\input{04-results}</code>
Discussion	1 page	10	<code>\input{05-discussion}</code>

Basic Structure of the Latex Template

```
\documentclass[manuscript, screen, review]{acmart} % use this
\begin{document}
\title{WristConduct: Biometric User Authentication Using Bone Conduction at the Wrist}
% authors (see next pages)
\begin{abstract}
% todo
\end{abstract}
\begin{CCSXML}
% we talk about that later
\end{CCSXML}
\keywords{authentication, biometrics, bone conduction, machine learning, wrist} % 5 keywords comma separated
\maketitle
\input{01-introduction} % <- this is a text file in the same directory: "01-introduction.tex"
\input{02-relatedwork} % <- this is a text file in the same directory: "02-relatedwork.tex"
\input{03-method} % <- this is a text file in the same directory: "03-method.tex"
\input{04-results} % <- this is a text file in the same directory: "04-results.tex"
\input{05-discussion} % <- this is a text file in the same directory: "05-discussion.tex"
\bibliographystyle{ACM-Reference-Format} % <- the citation format
\bibliography{literature} % <- a Bibtex file in the same directory
\end{document}
\endinput % <- no idea why this is here, but i'm superstitious and i'll leave it here
```

The Title

- **Use Initial Caps for the Title & Sub-titles,**
 - › <https://capitalizemytitle.com> ← goto to make it correctly
- **Should be informative and interesting**
- **Can be catchy**
- Think about...
 - › **the independent and dependent variables**, the population and setting, the study design, the timing, and even the main result in your title, etc.
 - › **the keywords** you select should complement those in your title to maximize the likelihood that a researcher will find your paper through a database search, etc.
- **Avoid using abbreviations**
- **What is a good paper title?**

Good Paper Titles

- The Superhero Pose: Enhancing Physical Performance in Exergames by Embodying Celebrity Avatars in Virtual Reality [1]
- Step on it: Asymmetric Gain Functions Improve Starting and Stopping in Virtual Reality Walking [2]
- User Identification Utilizing Minimal Eye-Gaze Features in Virtual Reality Applications [3]
- Anticipated User Stereotypes Systematically Affect the Social Acceptability of Mobile Devices [4]

[1] Nouran Sadek, Passant Elagroudy, Ali Khalil, and Slim Abdennadher. 2022. The Superhero Pose: Enhancing Physical Performance in Exergames by Embodying Celebrity Avatars in Virtual Reality. In Nordic Human-Computer Interaction Conference (NordiCHI '22). Association for Computing Machinery, New York, NY, USA, Article 1, 1–11.
<https://doi.org/10.1145/3546155.3546707>

[2] van Gemert, T., Hornbæk, K., & Bergström, J. (2022). Step on it: asymmetric gain functions improve starting and stopping in virtual reality walking. *Virtual Reality*, 1-19.

[3] Asish, S.M.; Kulshreshth, A.K.; Borst, C.W. User Identification Utilizing Minimal Eye-Gaze Features in Virtual Reality Applications. *Virtual Worlds 2022*, 1, 42-61.
<https://doi.org/10.3390/virtualworlds1010004>

[4] Valentin Schwind and Niels Henze. 2020. Anticipated User Stereotypes Systematically Affect the Social Acceptability of Mobile Devices. In Proceedings of the 11th Nordic Conference on Human-Computer Interaction: Shaping Experiences, Shaping Society (NordiCHI '20). Association for Computing Machinery, New York, NY, USA, Article 13, 1–12.
<https://doi.org/10.1145/3419249.3420113>

Bad and Funny Paper Titles (published anyway)

- Avatar customization orientation and undergraduate-course Outcomes: Actual-self avatars are better than ideal-self and future-self avatars [1]
- Facilitating learning in immersive virtual reality: Segmentation, summarizing, both or none? [2]
- Fantastic yeasts and where to find them: the hidden diversity of dimorphic fungal pathogens [3]
- miR miR on the wall, who's the most malignant medulloblastoma miR of them all? [4]

[1] Rabindra Ratan Matthew, S. Klein, Chimobi R. Ucha, Leticia L. Cherchiglia, Avatar customization orientation and undergraduate-course Outcomes:Actual-self avatars are better than ideal-self and future-self avatars, Computers & Education, 2022, 104643, ISSN 0360-1315, <https://doi.org/10.1016/j.compedu.2022.104643>.

[2] Klingenberg, S., Fischer, R., Zettler, I., & Makransky, G. (2022). Facilitating learning in immersive virtual reality: Segmentation, summarizing, both or none?. Journal of Computer Assisted Learning.

[3] Van Dyke, M. C. C., Teixeira, M. M., & Barker, B. M. (2019). Fantastic yeasts and where to find them: the hidden diversity of dimorphic fungal pathogens. Current opinion in microbiology, 52, 55-63.

[4] Wang, X., Holgado, B. L., Ramaswamy, V., Mack, S., Zayne, K., Remke, M., ... & Taylor, M. D. (2018). miR miR on the wall, who's the most malignant medulloblastoma miR of them all?. Neuro-oncology, 20(3), 313-323.

The Authors

- Only the authors should be on the paper
 - › **You**
 - › Not me
 - › No Hiwis
 - › No staff members
 - › Only you
 - › **Your affiliation**
 - › Your mail address (not visible in the ACM draft template)
 - › Orcid (if the paper is going to be published)

FENG YI LU, Frankfurt University of Applied Sciences, Germany
LEONARD HUSSKE, Frankfurt University of Applied Sciences, Germany
ANTON ROESLER, Frankfurt University of Applied Sciences, Germany

Title and Authors: The Latex Code

```
\title{WristConduct: Biometric User Authentication Using Bone Conduction at the Wrist}  
  
\author{Feng Yi Lu}  
\orcid{0000-0002-3498-1164}  
\affiliation{  
\institution{Frankfurt University of Applied Sciences}  
\city{Frankfurt am Main} \country{Germany}}  
\email{feng.lu@stud.fra-uas.de}  
  
\author{Leonard Husske}  
\orcid{0000-0001-8526-263X}  
\affiliation{  
\institution{Frankfurt University of Applied Sciences}  
\city{Frankfurt am Main} \country{Germany}}  
\email{leonard.husske@stud.fra-uas.de}  
  
\author{Anton Roesler}  
\orcid{0000-0002-2566-8950}  
\affiliation{%  
\institution{Frankfurt University of Applied Sciences}  
\city{Frankfurt am Main} \country{Germany}}  
\email{anton.roesler@stud.fra-uas.de}
```

They even had
an Orcid (you need for
publishing later...)

Be Explicit

- **Many papers** contain good ideas, but **do not distil the core information**
- **Make certain** that the reader is in no doubt **what the idea is**
- **Be 100% explicit:**
 - › “The main idea of this paper is...”
 - › “In this section, we present ...”
 - › “To investigate ... we conducted an online survey...”
 - › “We found that...”
 - › “The implications are...”
 - › “This paper contributes...”

Adapted from Simon Peyton Jones, Microsoft Research Cambridge

Before we start writing... some basics

Active Grammar

- We use we
 - › “In this paper, we present a study”
 - › “We show that...”
- Unlike in German
 - › „In diesem Artikel wird von einer Studie berichtet...”
 - › „Es wurde gezeigt...”
- The word we
 - › implies that you are a team (remember: blind peer review)
 - › counter-checked each other
 - › is more readable

Tenses (1/3)

- **Abstract** (composed as the paper)
- **Introduction**
 - › Typically, **present tense** (now)
 - › “Virtual reality (VR) **is** an experience ...”
 - › Exception: **past tense** to report **other’s studies**
 - › “Slater et al. [3] **conducted** a study to ...”
- **Related Work**
 - › Typically, **present** (now) if you write about **definitions, statements, constructs**
 - › “According to Slater et al. [1] presence **is** defined as...”
 - › **Past (passive) tense** if you describe **things that happened**
 - › “Another approach to measuring presence **was developed** by Slater et al. [35,39]”

Tenses (2/3)

- **Method Section** (active and passive grammar)
 - › Typically, **past tense**
 - › “**We conducted** a study with the independent variables...”
 - › “**We measured** presence using three different questionnaires...”
 - › **Past passive tense** (seldom but okay)
 - › “Particularly the concepts of social or co-presence **were investigated** using...”
 - › **Passive tense** for internal references
 - › “Means and standard deviations **are shown** in Table 2”

Tenses (3/3)

■ Results

- › Always **past tense** for results that were obtained
 - › “**We obtained** the presence scores ...”
 - › “A two-way ANOVA **revealed** a significant effect of ...”

■ Discussion

- › **Combination of tenses** (depending of things that happened or are ongoing)
 - › “**We found** a systematic increase of the questionnaires’ variance”
 - › “**There are** previous discussions about which questionnaire is the most appropriate measurement tool.”

About Numbers

- Use text if the number is **small** and numbers if the number is **huge**:
 - > „In our **second** study, **77** participants (38 female, 39 male) were recruited ...”
- Use **textual numbers** at the beginning of a sentence
 - > “**Seventy-seven** participants (38 female, 39 male) were recruited ...”
- Use **commas** to make large numbers more readable
 - > „1,000,000“
 - > not „1000000“
 - > not „1.000.000“
- Use a **point** to indicate decimals
 - > 0.001
- Always **round** decimals **three digits after the decimal point!**

My threshold is 12.
Whatever your
threshold is:
Be consistent!

one
two
three
...
eleven
twelve
13
14
15
...

Additional Hints

- Declare **abbreviations** once in your paper (separate in your abstract)

- › Use ACRONYM packages for consistency with abbreviations!

- › *“They also developed the immersive tendency questionnaire (ITQ)... ITQ results showed that”*

```
\usepackage{acronym}
```

```
\newacro{AR}[AR]{augmented reality}
```

```
\newacro{VR}[VR]{virtual reality}
```

```
\ac{VR} enables to go beyond the physical constraints of the real world. In \ac{VR}, users can...
```

→ Virtual Reality (VR) enables to go beyond the physical constraints of the real world. In VR, users can...

```
\iac{HMD} % uses the correct article
```

→ an HMD

How to cite (1/3)

- A **direct** and **indirect citation** is always indicated by a reference (in your **slides and paper!**).
- Add a **reference** at the **end of a sentence**
 - › “For example, Namwongsa et al. investigated how the usage of mobile phones increases the user's postural ergonomic risk particularly due to bad neck postures [23].”
- Add a **reference** after mentioning **one author**
 - › “In 1980, Minsky [19] introduced the concept of telepresence ...”
- Add a **reference** after mentioning **two (or three) authors**
 - › “Wittmer and Singer [42] developed ...”
- Add a **reference** after **more than three authors**
 - › “A study by Usoh et al. [39] revealed ...”
- **Directly**
 - › “He concluded that “presence researchers must move away from questionnaires in order to make any progress in this area” [34].”

How to cite (2/3)

- You can add **reference** in a **list of items**
 - › “In addition to knowledge-based schemes such as passwords, **gestures** [10], and personal identification numbers (PINs), some devices use biometric data such as **fingerprints** [14], **bodily** [6] or **facial characteristics** [5] to authorize access for users.”
- You can add **multiple citations** at **once** (mostly at the add of a sentence)
 - › “However, wrist-worn devices with limited displays for user input, while poorly suited for knowledge-based input, can be worn continuously and passively collect functional biometric data [2,13,25].”
- Refer using **cf.**, if you have something interesting
 - › “... is currently the most cited presence questionnaire on Google scholar (**cf.** [2]).”

How to cite (3/3)

- In Latex, use `~\cite{...}`
- `\cite{...}` refers to a Bibtex key of your bibliography (the .bib-File)
 - › e.g., `\cite{khorshid-2020}`
- `~` ensures that the **reference** will **not break** with the next line
 - › For example, Khorshid et al. show that a high authentication accuracy can be achieved by sending signals from electrodes on the arm through intrabody communication `channels~\cite{khorshid-2020}`.
 - › For example, Khorshid et al. show that a high authentication accuracy can be achieved by sending signals from electrodes on the arm through intrabody communication `channels [7]`.

How **not** to cite

- **Never** use your **reference as subject**

- › “For example, [23] investigated how the usage of mobile phones increases the user's postural ergonomic risk particularly due to bad neck postures.”

- **No pages** behind your **reference**

- › “For example, Khorshid et al. [23] investigated **on page 2** how the usage of mobile phones increases the user's postural ergonomic risk particularly due to bad neck postures.”

- **Never** put the **reference outside of the sentence** (behind der period)

- › “For example, Khorshid et al. investigated how the usage of mobile phones increases the user's postural ergonomic risk particularly due to bad neck postures. [23]”

- **Separated Citations**

- › [...] continuously and passively collect functional biometric data [2] [13] [25].

- › `\cite{...,...,...}` **not** `\cite{...}\cite{...}\cite{...}`

What **not** to cite

- **Articles in conference proceedings**
- **Articles in journals**
- Books
- Thesis (Bachelor, Master, PhD)
- On the internet (e.g., blogs, Wikipedia)
- Talks and lectures
- Personal communication
- Patents
- Word-to-mouth
- ...

Peer review vs no peer review

How to argue...

- The basic structure:

Thesis (also known as claim)

Analysis (the explanation)

Conclusion (the meaning and an example)

Optional: **Relevance, Problem, Anticipations** (moreover...)

Arguments: Thesis, Analysis, Conclusion

Assessing physiological signals of the human body is important for a widespread range of disciplines. Particularly assessing the muscle activity using electromyography (EMG) is indispensable for a wide range of medical, assistive, and interactive applications [2, 7, 65, 105, 120]. For interactions with computing systems, electrodes of an EMG device can register the physiological activity of muscles at different locations on the human body allowing continuous as well as a discrete input [58]. Thus, EMG can be used to recognize limb movements [92], gestures [123], and trigger events for e.g., hands-free interaction [79].

Jessica Sehart, Tim Wißmann, Jan Breitenbach, and Valentin Schwind. 2023. The Effects of Body Location and Biosignal Feedback Modality on Performance and Workload Using Electromyography in Virtual Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 84, 1–16. <https://doi.org/10.1145/3544548.3580738>

Arguments: **Thesis**, Analysis, Conclusion

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Jessica Sehart, Tim Wißmann, Jan Breitenbach, and Valentin Schwind. 2023. The Effects of Body Location and Biosignal Feedback Modality on Performance and Workload Using Electromyography in Virtual Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 84, 1–16. <https://doi.org/10.1145/3544548.3580738>

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Arguments: Thesis, Analysis, Conclusion, Problem

Assessing physiological signals of the human body is important for a widespread range of disciplines. Particularly assessing the muscle activity using electromyography (EMG) is indispensable for a wide range of medical, assistive, and interactive applications [2, 7, 65, 105, 120]. For interactions with computing systems, electrodes of an EMG device can register the physiological activity of muscles at different locations on the human body allowing continuous as well as a discrete input [58]. Thus, EMG can be used to recognize limb movements [92], gestures [123], and trigger events for e.g., hands-free interaction [79]. However, as muscles can have varying functions in the human body their corresponding location while using EMG cannot only affect the signal [69] but also the interaction performance [90] or comfort during interaction [74].

2001

Jessica Sehart, Tim Wißmann, Jan Breitenbach, and Valentin Schwind. 2023. The Effects of Body Location and Biosignal Feedback Modality on Performance and Workload Using Electromyography in Virtual Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 84, 1–16. <https://doi.org/10.1145/3544548.3580738>

Arguments: Thesis, Analysis, Conclusion, Relevance

For understanding and improving muscle control as interaction technique it is important to consider the physiological difference between muscle tension caused by moving a limb due to a shortening or lengthening of the muscle (isotonic contraction) and applying muscle force without changing its length (isometric contraction) [76]. While movement-based muscle contractions are easy and quick for the user to perform (clicking a button, for instance, is basically the result of an isotonic movement), isometric muscle contractions must be consciously activated without any movements. Thus, they allow a new layer of motionless, subtle [14] and unobtrusive (social) interactions [71]. They are relevant in rehabilitation and sports as they can be applied within pain-free joint angles resulting in analgesic effects [78].

2001

Jessica Sehart, Tim Wißmann, Jan Breitenbach, and Valentin Schwind. 2023. The Effects of Body Location and Biosignal Feedback Modality on Performance and Workload Using Electromyography in Virtual Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 84, 1–16. <https://doi.org/10.1145/3544548.3580738>

Arguments: Thesis, Analysis, Conclusion

Previous work uses EMG for the registration of muscle activity as an input method for VR. However, it is still unclear which body areas are well-suited for interaction with such systems. As humans do not activate and use their muscles in the same way, we hypothesize that there are differences in the users' input performance between different areas of the human body. Therefore, we conducted a VR user study using a within-subject design with the independent variable Body Location. Based on a standardized Fitts' law target selection task using EMG and an HMD as the pointing device (cf. ISO 9241-411 [43, 66]) as well as subjective assessments, we measured performance and workload.

Jessica Sehart, Tim Wißmann, Jan Breitenbach, and Valentin Schwind. 2023. The Effects of Body Location and Biosignal Feedback Modality on Performance and Workload Using Electromyography in Virtual Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 84, 1–16. <https://doi.org/10.1145/3544548.3580738>

One Sentence Arguments: How to **justify**

- The mean of all EMG values within one received package was calculated **to provide a reasonable level of signal smoothing.**
- **For determining the throughput performance,** we recorded target selection time, the corresponding IDs, target position, and actual hit point coordinates.
- **For perceived workload,** participants filled out the Raw NASA Taskload Index (RTLX) as widely used tool in HCI for workload assessments [33] with a digital questionnaire in VR.
- **To ensure correct sensor placement,** the experimenters were provided with a scheme of human anatomical landmarks.

Jessica Sehart, Tim Wißmann, Jan Breitenbach, and Valentin Schwind. 2023. The Effects of Body Location and Biosignal Feedback Modality on Performance and Workload Using Electromyography in Virtual Reality. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 84, 1–16. <https://doi.org/10.1145/3544548.3580738>

Non-Citing References: Footnotes and Confer

- `\footnote{\url{...}}`
- When you refer to external stuff (e.g., when you downloaded something from there)
- When you refer to your stuff (e.g., data sets, external material, project files)

input vectors to reduce the classification error (cf. [9, 20]). To allow other researchers to replicate and extend our findings, we published our software and the full dataset at Github¹

¹<https://github.com/antonroesler/Wrist-Conduct>

cf. = confer = vgl.
≠ citation

Footnote ≠ citation

Never use...

- **„believe“**: you do not believe, **you only infer**
- **„decide“**: you never decide, **you only deduce**
- **„want“**: you never want something, **you do it or not**
- **„try“**: Do or do not. **There is no try.**
- **„very“**: Stop using it. **No very.**
- **„%“**: Don't use percent (or explain the full context)
- **„significant“**: Only **use statistically significant** ($p < 0.05$)
- **„we proved“**: You cannot prove a theory. **You can only find evidence.**
- **„but“**: no but. **Use however.**
- **„in order to“**: no order. **Just to.**



How to not write a paper (Bad example from this course)

Even though undo and redo are common functions of every Personal Computer (PC) nowadays, the leading companies which are producing mobile devices, like Samsung or Apple, haven't implemented consistent feature yet. With our following study we want to discuss if there is a need for such a function. Since people are used to have an undo and redo function on their PCs, we want to discuss if there is only a need for one of those two or if people prefer to have both functions implemented onto their Smartphones.

In this study, we want to find out which gesture people would most naturally use to undo and redo actions on the smartphone. In doing so, we do not limit ourselves to one operating system, but combine the conventional ones in order to avoid consumption. In designing the study, we follow the approach of an elicitation study. Each participant was given two scenarios including two tasks each. We were able to show in our study that one class of gestures was most often used intuitively. For further studies it would be interesting to see if the gestures differ for different groups of people. Especially with age and gender, our participants were not very diverse.

Helpful Tools

- ChatGPT
- A **spell checker** (Grammarly)
- A **translator** (Google Translate, DeepL)
- Checker for **plagiarism** (Google, plagscan)
- Your literature **bibliography tool** (Mendeley, Zotero, Citavi,...)
- A **text editor** (Notepad++, TeXnicCenter,...)
- Something to **collaborate** (Overleaf)
- Something to **backup** (Dropbox, Google Drive)

Feedback

- You are not in school anymore
- Thus, treat every feedback or review like **gold dust**
- Be (truly) grateful for criticism
 - › This is **really, really, really** hard
 - › But it's **really, really, really** important
- **Read every review** as a positive suggestion (paper submission)
 - › DO NOT respond: “you stupid person, I clearly meant X”
 - › INSTEAD: fix the paper so that X is apparent even to the stupidest reader.
 - › Thank them warmly. They have given up their time for you.

Adapted from Simon Peyton Jones, Microsoft Research Cambridge

Now we can start...

Writing a paper

Abstract

- You can only complete your abstract when the findings are clear.
- Write just one sentence about:
 - › **Introduction**. What's the topic? State the problem you tackle and why
 - › **Related work**. What is known and what is unanswered?
 - › **Method**. Explain how you tackled the research question.
 - › **Results**. What came out?
 - › **Discussion**: What's the key impact of your research?
- Look into: “How to write a scientific abstract”
<https://www.easterbrook.ca/steve/2010/01/how-to-write-a-scientific-abstract-in-six-easy-steps/>

Example: Abstract

```
\begin{abstract}
```

```
Biometric user authentication is an important factor to ensure security and privacy for personal devices. While many devices such as smartphones or laptops can be unlocked based on biometric data, smartwatches or other wrist-worn mobile devices still rely on knowledge-based schemes such as PINs or passwords. In a proof-of-concept study with 24 participants, we show that it is possible to identify individuals using sound waves passing through the wrist bones using a bone conduction speaker and a laryngophone (microphone). We tested support vector machines (SVMs) and artificial neural networks (ANNs) for binary classification. Using ANNs our method shows an authentication accuracy of 98.7%. We discuss the implications of integrating our approach into future devices and contribute with our findings in doing the first step for continuous passive user authentication at the wrist.
```

```
\end{abstract}
```

Example: Abstract

```
\begin{abstract}
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Biometric user authentication is an important factor to ensure security and privacy for personal devices. While many devices such as smartphones or laptops can be unlocked based on biometric data, smartwatches or other wrist-worn mobile devices still rely on knowledge-based schemes such as PINs or passwords. In a proof-of-concept study with 24 participants, we show that it is possible to identify individuals using sound waves passing through the wrist bones using a bone conduction speaker and a laryngophone (microphone). We tested support vector machines (SVMs) and artificial neural networks (ANNs) for binary classification. Using ANNs our method shows an authentication accuracy of 98.7%. We discuss the implications of integrating our approach into future devices and contribute with our findings in doing the first step for continuous passive user authentication at the wrist.

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Example: Abstract

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```

```
\end{abstract}
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Introduction

Related Work

Example: Abstract

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```

```
\end{abstract}
```

Introduction

Related Work

Method

Example: Abstract

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\begin{abstract}
```

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```
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```

Introduction

Related Work

Method

Results

Example: Abstract

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\begin{abstract}
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Biometric user authentication is an important factor to ensure security and privacy for personal devices. While many devices such as smartphones or laptops can be unlocked based on biometric data, smartwatches or other wrist-worn mobile devices still rely on knowledge-based schemes such as PINs or passwords. In a proof-of-concept study with 24 participants, we show that it is possible to identify individuals using sound waves passing through the wrist bones using a bone conduction speaker and a laryngophone (microphone). We tested support vector machines (SVMs) and artificial neural networks (ANNs) for binary classification. Using ANNs our method shows an authentication accuracy of 98.7%. We discuss the implications of integrating our approach into future devices and contribute with our findings in doing the first step for continuous passive user authentication at the wrist.

```
\end{abstract}
```

Introduction

Related Work

Method

Results

Discussion

A Good Introduction

- **Establishes a territory**

- › bring out the importance of the subject and/or make general statements about the subject and/or present an overview on current research on the subject

- **Establishes a niche**

- › oppose an existing assumption or reveal a research gap or formulate a research question or problem or continue a tradition.

- **Occupies the niche**

- › sketch the intent of the own work and/or outline important characteristics of the own work; outline important results; and give a brief outlook on the structure of the paper

Introduction: Starting a Good Introduction

`\section{Introduction \& Background} % summarizing Intro + RW, 0.5-0.75 pages`

User authentication for pervasive computing devices is important to secure personal data and access. In addition to knowledge-based schemes such as passwords, gestures~\cite{Lewis-2016}, and personal identification numbers (PINs), some devices use biometric data such as fingerprints~\cite{Park2004}, bodily~\cite{Holz2015} or facial characteristics~\cite{Hammoud2007} to authorize access for users. Most of current handheld devices allow access per user session using biometric data with an active input as one-time authentication. Repeatedly or continuous checking the user for device access can massively restrict the device interaction when frequently asking to manually enter the PIN, to perform a gesture, or to constantly keep the face upright to the front camera. However, wrist-worn devices with limited displays for user input, while poorly suited for knowledge-based input, can be worn continuously and passively collect functional biometric data~\cite{mantyjarvi2005identifying, Bo2013,Watanabe2021}.

Relevance

Establishes a territory

Establishes a niche

Occupies the nice

Related Work Section

- **Can be part of the Introduction:** „Introduction and Background“
- Summarize what is relevant (present state of knowledge)
- **Findings** that have been reached until today
 - › Do all writers agree with each other?
 - › Are the experiments comparable?
 - › What is the quality of the studies?
- **Main issue and controversies** around the problem
 - › The main problem
- **Definitions**

Related Work: Example

Previous work successfully demonstrates the utilization of bone conduction with wearable mobile devices on different body parts~\cite{Nirupam-Roy-2016,schneegass-2016,Laput-2016,zhong-2007}. For example, ViBand~\cite{Laput-2016} and OsteoConduct~\cite{zhong-2007} are two systems that use bone conduction for communication between devices. While OsteoConduct measures the reflected frequency on the elbow joint, ViBand measures sound directly on the wrist for passive object and activity recognition. Based on these paradigms, Roy and Choudhury, for example, implemented a system that allows users of smartphones to communicate with a ring or a watch by using bone conduction~\cite{Nirupam-Roy-2016}. More related to our research, Schneegass et al. developed "SkullConduct" that authenticates users based on the biometric properties of their skull~\cite{schneegass-2016}. The device uses the integrated bone conduction speaker of a Google glass device near the ear that sends white noise in a specific frequency that gets recorded by a microphone in the front of the eyewear. Velasco et al. took up the idea and suggest a general machine-learning based user authentication algorithm for sound classification of bone conduction without committing to a specific device~\cite{velasco-2019-user}. However, it is currently unknown if bone conduction directly at the wrist (between ulna and radius, see Figure~\ref{fig:experiment}) is able to authenticate or identify individual persons.

Claim

Example

Follow up work

Now we are addressing the most related stuff

Follow up work

The research gap

The Method Section

- **The part that I attach particular importance to**
- Mostly includes the following subsections
 - › Study Design*
 - › Measures*
 - › Stimuli/Conditions/Prototypes/... *
 - › Apparatus (not required with e.g., online surveys)
 - › Procedure*
 - › (sometimes) Scenarios, Tasks, Sessions, ...
 - › Participants*
 - › Data Analysis (when you e.g., filtered your data or in a qualitative study*)
- ***mandatory**

Quantitative Study Design: Subsection

- **What is your hypothesis?** (Repeat it, even if you already mentioned it) and **how to you want to answer it?**
 - › “To understand the potential to enhance the effectiveness of agility ladder training in VR environments, we conducted an experimental user study investigating the effects of different visualization forms for correct foot positioning.”
- **What is within, what is between-subject variable?** Use CAPITALIZED LETTERS with `\textsc{...}` for your independent variables. Use *italic* font with `\textit{...}` to highlight different levels
 - › “The only independent within-subject variable VISUALIZATION comprises the levels *footsteps, arrows, numbers, and empty fields*”

Stefan Resch, Mustafa Rafati, Angela Altomare, Oumaima Raddi, Arso Tahmas, Valentin Schwind, and Diana Völz. 2023. Correct Foot Positioning in Virtual Reality through Visual Agility Ladder Training. In Proceedings of Mensch und Computer 2023 (MuC '23). Association for Computing Machinery, New York, NY, USA, 524–528. <https://doi.org/10.1145/3603555.3608558>

Qualitative Study Design: Subsection

- **What is your research question?** (Repeat it, even if you already mentioned it) and **how to you want to answer it?**
 - › The success of the healthcare intervention and using a mobile application tracking one's own physiological state depends on the usability, acceptance, and effectiveness of healthcare professionals as well as patients. **This leads to the research question asking for the requirements, needs, and preferences of patients and experts regarding a mobile application for people with foot deformities and wearing smart insoles.** Therefore, we conducted an exploratory, qualitative user study with healthcare professionals and potential users of smart in-soles.

Resch, S., Zoufal, K., Akhouaji, I., Abbou, M.-A., Schwind, V., & Völz, D. (2023). Augmented Smart Insoles – Prototyping a Mobile Application: Usage Preferences of Healthcare Professionals and People with Foot Deformities. *Current Directions in Biomedical Engineering*, 9(1), 698–701. doi: 10.1515/cdbme-2023-1175

Quantitative Study Design: The study in one sentence...

- **Be concise:**

- › “To investigate **the effects of wearing an HMD while being at a non-seated virtual workplace**, we conducted **an experimental user study** with the **ENVIRONMENT** as the independent within-subject variable comprising the levels *real workplace* and *virtual workplace*.”

- **Now we know everything** (important) about the study!

- › **Research question**

- › **Experimental method**

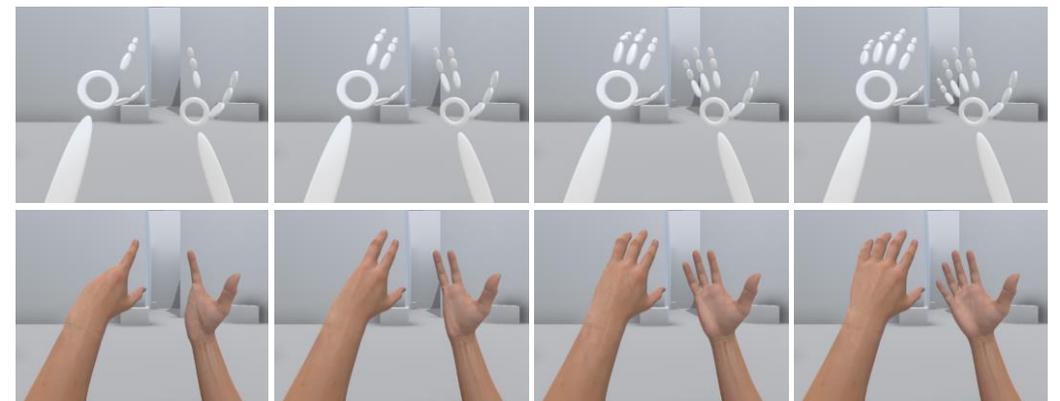
- › **Independent variable** (within = all subject did everything)

- › **Individual levels**

Sehrt, J., Neumann, H. P., Wenzel, J. N., Kindermann, L., & Schwind, V. (2022). The Negative Effect on Postural Ergonomics of Non-Sedentary Workplace Desks in Virtual Reality. MuC '22: Proceedings of Mensch und Computer 2022. Association for Computing Machinery. doi: 10.1145/3543758.3547541

Stimuli/Conditions Subsection

- Refer to **individual levels/conditions** in your study design (e.g., through images)
- Typical questions in this section:
 - › What did you use to create the stimuli and why?
 - › How were they selected?
 - › Where can I find it, if I want to repeat the study?
 - › How many stimuli?
 - › How did the participants see them?



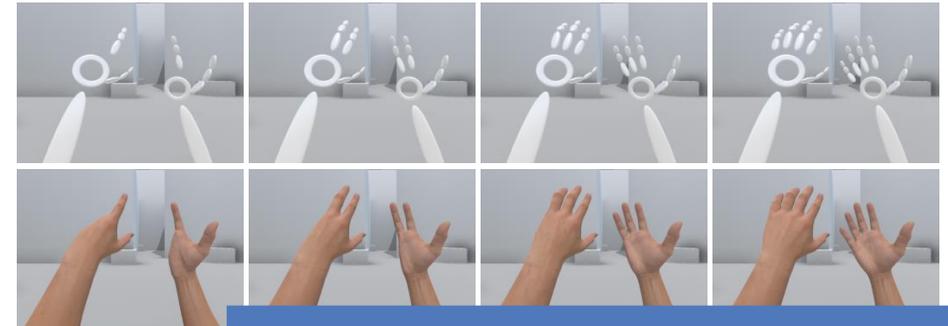
Apparatus and Procedure Subsections

- **Tasks** explains what participants did (tasks are time-limited activities)
 - › What did the participants do?
 - › Why/how did you select the tasks?
 - › Is the task representative?
- **Procedure** explains what the participants experienced
 - › Always start like:
 - › „After providing informed consent, participants were introduced with ...”
 - › Describes then **what happened** then **to every participant**
 - › “All participants were surveyed for their demographics and if they had any experiences with desk adjustable desks, VR, and if they suffer from any issues caused by bad body posture.”
 - › **What was different?** e.g., How were stimuli ordered in your procedure
 - › „The **order of the conditions was randomized** for each participant **using a balanced Latin square design.**”

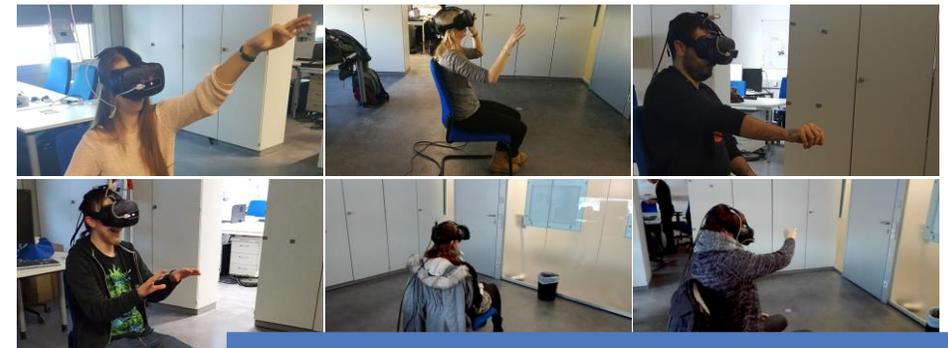
Apparatus Subsection

■ Apparatus

- › **Show** your apparatus in your paper!
- › Do **images** with your mobile phone (with participant gave consent!)
 - › What did the experimenter see?
 - › What did the participant see? (Screenshots)
- › **Describe in what you build** - highlight your skills ;)
- › How did participants use it?
- › **Condense information:** „To prevent motion sickness, we used an HTC Vive Pro 2 with 90 FPS.“
 - › *No UML Charts, No Flowchart, No bla bla...*



What the participants saw



What the experimenter saw

Measures Subsection

- Say **what** you measured and **why** and **how**
 - › “To assess the perceived workload using VR and the real-world questionnaires, we used the NASA TLX with 6 items.”
 - › “Presence scores of the three questionnaires were obtained using a total of 52 items (6 SUS, 14 IPQ, 32 WS) on 7-point scales. All items were presented as described in the original work.”
- **Ensure that you used the state-of-the-art approach**, if not, justify why
 - › “To measure HR, subjects held smartphones in their right hands, putting the tip of their right hand's index finger on the camera on the back side of the smartphone, and held it in place with limited movement for 1 minute.”

Participant Subsection

- Always name their gender (m,f,o) and age (Mean, SD, Min, Max)
- Describe the **recruitment process** and **demographics** in this way:
 - › “We recruited 20 participants (4 female, 16 male) from multiple computer science courses at our institution for the study. All student participants attended voluntarily and received credit points for the lecture unit. Participants’ age ranged from 21 to 42 years (M = 25.15, SD = 5.02).”
- Any How were they **compensated**?
 - › “Participants were compensated with credit points for their lecture.”
- Did you **exclude** anyone? If not, say it.
 - › “Three students already participated in the first study and were not excluded from the analysis.”
 - › “All participants were included in the evaluation”

More on Participants

- **Any special/not special** about them?
 - › “All of them had a technical background in computer science or engineering.”
 - › “A number of 13 participants wore glasses, 20 had previous VR experience.”
 - › “At the end of the study, two participants reported mild complaints of cybersickness, which did not necessitate pausing or terminating the study”
- The participant's section is (in HCI) typically the section where you talk about ethics and data protection. **Use this sentence:**
 - › “The study received ethics clearance according to the ethics and privacy regulations of our institution.”
- We don't have an ethical committee yet. **I am responsible for you.**

For Data-Driven/Machine Learning Studies

- How were **training data** collected?
 - Report the study
- How did you **construct input vector**
- **Network architecture**
 - > Layers
 - > Cost function
 - > ...
- **Model Validation**
 - > Leave-one-out cross validation!
 - > Comparison

Example: Model Creation Subsection

Main objective is a model that can authenticate a single specific person and reject all extraneous persons. To obtain representative results, we created a separate data set for each of the 24 test persons by applying a positive label to the respective person and a negative label to all other persons. The resulting 24 data sets were unbalanced, with 10 positive to 230 negative elements each.

In order to balance the datasets slightly more and at the same time not make them too small, we turned each dataset into five datasets, each with the identical 10 positive elements, however with a random selection of 92 of the negative elements inserted. We divided each of the 120 data sets stratified into training (65%, N=78) and test (35%, N=42) data, each of which were used to train and evaluate a dedicated model. The Mel Frequency Cepstral Coefficient was used to extract features from the recordings and create a numerical data set.

In a first step, we tested two common types of binary classifiers provided by the Keras API by Google's TensorFlow with different levels of complexity: (1) low classification complexity: A support vector machine (SVM) with stochastic gradient descent (SGD) using weighted classes with and with a higher complexity (2) an artificial neural network (ANN) with six dense layers, binary cross entropy loss, and adam optimizer (200 epochs).

Data Analysis Subsection

- Sometimes required when you did an **exhaustive analysis** (e.g., qualitative feedback)
- **Answers the following questions**
 - › How did you analyze?
 - › Did you filter and why?
 - › Which data did you use?
- Example: **Qualitative Analyzes**
 - › “Oral feedback was analyzed using axial coding to find related concepts that provide further insights into the visuo-haptic integration of the avatar hands. Two researchers went through all transcribed notes to check each other’s coding and to establish consistency in the assignment of codes to the same phenomena. Discrepancies between the two sets of annotations were resolved through discussion. Data of participants who took part in the pilot studies was not considered in the final evaluation.”

Example: Method Section

3 STUDY 1: DEVICES AND STEREOTYPES

The SCM is based on the assumption that a cognitive process assesses other people's intent (warmth) and the capability to pursue it (competence). The hypothesis of our first study is that the perceived warmth and competence of a member of a known stereotypical group changes when the hypothetical person uses different mobile devices. We used an online survey to investigate different mobile devices and known stereotypes from social sciences.

Study Design

A two-factorial within-subject design was carried out with the independent variables STEREOTYPE and DEVICE. Multiple stereotypes were repeatedly used in studies by previous work. Based on their locations in the SCM, we selected eight stereotypical groups in the first study: homeless people and welfare recipients (contemptuous), senior citizens (paternalistic), physicians (admiration), career women/men and rich people (envious). Singles and environmentalists were selected due to discussions about their indistinct stereotypes and atypical roles [8, 16].

Stimuli

We used illustrations of externally visible mobile devices. Brief descriptions indicated their functionality as intended by the manufacturer. Through discussion and online research we selected eight devices: two medical devices from the following categories for hypothesis testing: two medical devices for monitoring physiological data (*blood pressure monitor* and *blood glucose sensor*), two head-worn devices



Figure 1: Illustrations of devices used in Study 1 & 2: (a) Blood pressure monitors, (b) Blood glucose sensors, (c) EEG headsets, (d) VR headsets, (e) Quadcopters, (f) LED glasses, (g) Tablets, and (h) Narrative clips.

(*EEG* and *VR*), two devices used for leisure/fun (*quadcopter* with remote control and *LED glasses*), one known device (*tablet*) and a camera device for life-logging purposes which could be critically assessed due to privacy concerns (*narrative clips*). Device stimuli are shown in Figure 1. A ninth condition was added to understand how stereotypes were perceived without device. Exemplary photos of male and female persons that are in line with the stereotypes were obtained from shutterstock.com (see Figure 2b-i). They were selected using keyword search and through discussion. The design of the first study included the combination of eight stereotypes and nine stimuli, resulting in a total of 72 conditions.

Survey Procedure

After giving informed consent, participants read the following: "As viewed by society, how ... are [stereotype] with [device]?". Question and stimulus were visible at the same time on each survey page. We used images of the human stereotypes to prevent biases at the expense of the presented device (e.g., that participants oversaw or overread the name of a human stereotype while reading a question). The nine items of the SCM questionnaire by Fiske et al. [10] were presented (*compassionate, tolerant, confident, warm, independent, good-natured, competitive, sincere, and intelligent*). The items were presented on a 5-point scale ranging from *not at all* (1) to *extremely* (5). Images of a device and a group stereotype were presented and captioned with a short description (e.g., *Blood pressure monitor: Measures blood pressure at the wrist*, or *welfare recipients: Someone receiving Financial support given to those who are unemployed or otherwise in need*) as shown in Figure 2a. The order of the conditions was randomized for each participant.

Participants

We recruited 71 computer science students (15 female, 56 male) as participants for the study. We conducted the study in our institution. Participants were compensated with credit points. Participants' age ranged from 19 to 36 years ($M = 23.81, SD = 5.16$). Responses and demographic information were collected anonymously.

What else can you report?

- Measures
- Scenarios
- Figures of the Apparatus!
- Data Analysis



Again: What is the problem and how can we solve it?

Study Design

Stimuli/Conditions

Procedure/Tasks

Participants

Stimuli/Conditions

Results Section

- Only **objective findings** of your research (not the interpretation!)
- Patterns from your method (e.g. measures) must be found
- Structured by e.g.,
 - › Quantitative and Qualitative Findings
 - › Objective and Subjective Measures
 - › Concepts
 - › Research Questions, Hypotheses

Reporting Results

- **Results are the core of your paper!** Report them properly
- **Order of results according to hypotheses or metrics**
- **Report all measures** you mentioned in your method
- Rule:
 - › **First descriptive statistics** (means, standard deviations,..),
 - › **Then inferential statistics** (ANOVA, t-test,...)
- Typical Structure:
 - › Statement or sentence + technical details (numbers for the test in brackets)
- Use past tense

Example: Results Section

Session 9: VR and Other Novel IO Technology

CHI PLAY 2017, October 15–18, 2017, Amsterdam, NL

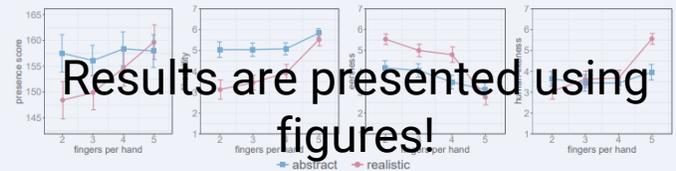


Figure 3. Average presence scores, perceived likeability, eeriness, and human-likeness of abstract and realistic virtual hands with number of fingers per hand. All error bars show standard error of the mean (SE).

Participants

We recruited 24 participants (11 males, 13 females) from our campus via mailing lists and social networks. All participants had light skin tones matching the visual appearance of the realistic virtual hand. None of the volunteers was excluded from participation in the study. The average age of the participants was 21.8 years ($SD = 6.4$). Only four participants mentioned having previous VR experience, 20 of our participants stated that they had no VR experience at all.

RESULTS

On average the study lasted for 75 minutes per participant ($SD = 8.34$). The average task completion time was 3.0 minutes ($SD = 1.8$). Two participants took a 5-minute break.

Quantitative Results

We analyzed the effects of the within-subject factors REALISM and FINGERS PER HAND on our five dependent variables with analyses of variance (ANOVA) using linear mixed-effects models. All effects were taken as random at the participant level. Since we had non-parametric data, we used “rank transformations” by Wobbrock et al. [21]. All statistical tests were run at $\alpha = .05$. The results of presence, likeability, eeriness, and human-likeness are depicted in Figure 3. All means (M) and standard deviations (SD) are listed in Table 1.

Presence

A two-way ANOVA showed significant effects of REALISM, $F(1, 168.00) = 13.990, p < .001$, and FINGERS PER HAND, $F(3, 168.01) = 8.890, p < .001$, on perceived presence. We also found a significant interaction effect between both factors, $F(3, 168.01) = 5.890, p < .001$. Pairwise post-hoc comparisons using Tukey’s method for p-value adjustment within the levels of the main factors revealed no significant differences of the presence scores between the levels of FINGERS PER HAND using the abstract hands (all with $p > .05$). However, the analysis of the realistic hands showed significant differences between the levels of FINGERS PER HAND (all with $p < .03$), except between the two- and three-fingered ($p = .866$) as well as the three- and four-fingered hand ($p = 0.066$). Bonferroni-corrected pairwise cross-factor comparisons of REALISM and FINGERS PER HAND revealed significant differences between

² <http://depts.washington.edu/madlab/proj/art/>

Results are presented using tables!

Session 9: VR and Other Novel IO Technology

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Hand Type	Fingers	M	SD	M	SD	M	SD	M	SD	N	N	
Abstract	2	157.480	17.702	5.040	1.843	1.160	1.713	3.640	1.741	4.200	1.876	2
	3	156.080	14.475	1.843	1.160	1.920	4.520	1.676	2	1		
	4	158.360	16.930	4.200	1.741	4.151	4.440	1.675	2	1		
	5	157.920	15.620	1.876	1.160	1.822	5.480	1.473	13	1		
	Realistic	2	148.417	17.384	3.640	2.225	5.542	1.225	3.042	1.815	2.625	1.998
3	149.885	16.714	1.741	1.758	5.000	1.518	3.615	2.000	2.962	1.763	2	
4	154.640	17.065	4.160	2.016	4.600	1.811	3.660	1.627	3.090	1.853	3	
5	159.640	16.473	1.713	1.473	2.760	1.595	5.560	1.267	5.200	1.697	7	1

Table 1. Means (M) and standard deviations (SD) of the quantitative measures (presence score, likeability, eeriness, human-likeness, attractiveness) as well as the number of participants (N) who stated at the end of the experiment to prefer or not prefer an avatar hand.

Eeriness

For eeriness we found significant effects of REALISM, $F(1, 168.00) = 11.020, p < .001$, FINGERS PER HAND, $F(3, 168.14) = 17.088, p < .001$, and an interaction effect of REALISM \times FINGERS PER HAND [$F(3, 168.14) = 4.923, p < .001$]. Pairwise comparisons showed significant differences between the abstract hands with two- and five-fingered hands, three- and five-fingered hands, as well as between four- and five-fingered hands (all with $p < .05$). We found significant differences between all realistic hands (with $p < .001$) except for the two- and three-fingered, two- and four-fingered, as well as the three- and four-fingered hand. Pairwise cross-factor comparisons showed significant differences between the two- and five-fingered hand ($p = .004$) and the four- and five-fingered hand ($p = .007$).

Attractiveness

We found significant effects of REALISM, $F(1, 168.00) = 29.535, p < .001$, and FINGER PER HAND, $F(3, 168.11) = 19.263, p < .001$, on the perceived attractiveness. There was no significant interaction effect between both factors, $F(3, 168.11) = 19.206, p = .09$. Pairwise comparisons showed significant differences between the abstract hands with two- and five-fingered hands, as well as between three- and five-fingered hands (both with $p < .05$). Differences were significant between all realistic hands (with $p < .05$) except for the two- and three-fingered, two- and four-fingered, three- and four-fingered hand. Due to the missing interaction effect, pairwise cross-factor comparisons showed no significant differences (all with $p > .05$).

Final Assessments

After having left the VR, a final questionnaire on a sheet of paper were handed out to the participants in which they were asked, which virtual hand they most prefer and not prefer: 13 participants (52%) prefer the abstract hand with five fingers, 7 participants (28%) the realistic hand with five fingers, 2 participants (8%) the abstract hand with two fingers and 2 participants (8%) the abstract hand with three fingers. 16 participants (64%) would definitely not use the realistic hand with two fingers again, 3 participants (12%) the realistic hand with four fingers, 2 participants (8%) the realistic hand with four fingers, and 1 participant (4%) in each case the realistic hand with five fingers, the abstract hand with three, and the abstract hand with four fingers. The numbers of participants which prefer or not prefer the eight avatar hand pairs are summarized in Table 1.

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(2) **Habituation:** For most of the participants the study was the first VR experience. Entering VR and the impression of being in another body was first exciting and overwhelming for them: “Oh my god, this is so cool.” (P4, A4). The enthusiasm was in another body outweighed a potentially strange feeling at the beginning: “Only four fingers? Oh no! But I am so impressed. I could just look at my hands all day. That’s so cool.” (P12, A4). We further observed that participants accustomed to all virtual hands as well as to a reduced number of fingers: “You get used to dealing with every hand very quickly.” (P22, R4).

(3) **Aesthetics:** Participants were influenced by several aesthetic preferences, e.g., design aspects, in particular, while using abstract hands: “Nicely designed.” (P16, A4). We assume that design preferences are potentially connected to personal experiences and familiarity: “To see the fingers in such a design is somehow unfamiliar. You should have put a little more effort into it.” (P7, A3) We also found that aesthetic aspects depend on the perceived style of the virtual environment: “Everything looks so sterile. You get used to it, however, the robot [abstract] hand fit very well into it.” (P4, A5). Aesthetic aspects were also mentioned when using realistic hands: “The place where the finger is missing looks disgusting.” (P14, R4).

(4) **Sensitivity to display/tracking errors:** Hands of all participants were tracked in the same way. However, some participants responded more sensitively to potential errors of hand tracking, underlining certain hands. Then, they expressed their dissatisfaction: “It’s unpleasant because you can’t see the hand anymore unless you turn the hand around quickly.” (P12, A4). Not only tracking errors, but the overall loss of control of one’s own body evoked negative feelings: “I feel to have no control over my middle finger anymore. This is weird.” (P12, R3). Some participants had problems with hand tracking that only allowed inputs when visible in the field of view of the HMD.

(5) **Task performance:** We observed that participants became involved into VR when they tried to solve a task, especially the typing task. Completing a task satisfactorily sometimes lead to positive feedback related to the used hands: “I think two fingers are even better to type or paint.” (P4, A2). To complete a task successfully may be influenced by the association (see beforehand) that participants consider hands with fewer fingers as useful tools: “With those, I can type better since I’m not distracted by the other fingers.” (P15, A2). Individual performances may be (reversely) related to other behavioral changes which are considered in the following section about individual effects.

Additional Effects

Furthermore, we identified emotional reactions and changes of hand interaction as main categories of additional or individual effects, which have not been explicitly quantified through concepts in our questionnaire. We define emotional reactions as initial and prominent short-term responses. Changes of hand interaction are defined as medium-term tendencies of acting and solving problems with hands differently.

(1) **Emotional Reactions:** We observed strong verbal and physical emotional reactions when participants were confronted with realistic virtual hands and less than five fingers. They felt “disgusting”, “strange”, “creepy”, “unfamiliar”, or “uncomfortable”. Partly the participants were incensed. “What the hell is that?” (P6, R3). This was not the case with fewer fingers on the abstract hands: “It doesn’t disturb me that I only have three fingers because the hand is not realistic anyway.” (P3, A3). However, we recognized satisfaction of participants getting back virtual hands with five fingers after having a hand with a reduced number of fingers. “I have my pinky again!” (P7, A5). Some participants did not initially notice that there was a missing finger in the four-fingered hand condition. They were scared when they finally realized that they are having a four-fingered hand.

(2) **Hand interaction:** We observed that participants changed their way of hand interaction when using a reduced number of fingers. Participants only used the fingers they saw. “It is so crazy, I don’t move it [the little finger] automatically.” (P4, R4). Some participants recognized by themselves changes of their hand interaction which potentially lead to a reverse effect on their feelings and behavior: “It is a totally strange feeling to grab something. You don’t expect to be able to hold things.” (P12, R4). They also reflect their behavioral changes after getting a five-fingered hand: “Now, I move all the fingers instead of just a few, and that is more natural and immersive.” (P12, A5). Participants also tried to use haptic feedback of their real fingers to confirm that they are still there: “Yes, I have five fingers. I see four, however, I can still feel my little finger.” (P2, R4).

Discussing Potential Cognitive Mechanisms

In a second feedback analysis, two of the authors repeated the analysis of the protocols provided by think-aloud and video. In this iteration, we used axial coding based on the identified factors and effects (see beforehand) to understand why an individual factor has an effect on the user experience. In the following, we establish five potential cognitive mechanisms, which may influence an individual’s concept of having an avatar with a reduced number of fingers in VR. The themes were discussed and established when they were supported by the feedback from the participants.

(1) **Visually induced phantom pain** caused by the fear of amputation and limb loss lead to strong emotional and behavioral reactions. We observed participants who painted replacements for their fingers at the stumps of their hands during the draw task. “As if you had phantom pain. You feel it, but don’t see it.” (P5, R4). We also observed that the level of associated phantom pain increased with the number of missing fingers: “So, I can get over one finger. But not two.” (P4, A3).

(2) **Familiarity** emerges through individual prior experiences caused by associations. Associations influence personal preferences through knowledge e.g. about threats. Such preferences can then either be positive or negative: “What! Please! No! Reminds me somehow of claws of an animal.” (P5, R2). Familiarity influences the individual long-term habituation of using hands with fewer fingers. “I have often seen people with

Example: Results Section

Quantitative Results

We analyzed the effects of the within-subject factors REALISM and FINGERS PER HAND on our five dependent variables with analyses of variance (ANOVA) and linear mixed-effects models. All effects were taken as random at the participant level. Since we had non-parametric data, we used aligned rank transformations² by Wobbrock et al. [27]. All significance levels are at $\alpha = .05$. The results of presence, likeability, eeriness, and human-likeness are depicted in Figure 3. All means (M) and standard deviations (SD) are listed in Table 1.

Presence

A two-way ANOVA showed significant effects of REALISM, $F(1, 168.00) = 13.990, p < .001$, and FINGERS PER HAND, $F(3, 168.01) = 8.890, p < .001$, on perceived presence. We also found a significant interaction effect between both factors, $F(3, 168.01) = 5.890, p < .001$. Pairwise post-hoc comparisons using Tukey's method for p-value adjustment within the levels of the main factors revealed no significant differences of the presence scores between the levels of FINGERS PER HAND using the *abstract hands* (all with $p > .05$). However, the analysis of the *realistic hands* showed significant differences between the levels of FINGERS PER HAND (all with $p < .03$), except between the *two-* and *three-fingered* ($p = .866$) as well as the *three-* and *four-fingered* hand ($p = 0.066$). Bonferroni-corrected pairwise cross-factor comparisons of REALISM and FINGERS PER HAND revealed significant differences between

²<http://depts.washington.edu/madlab/proj/art/>

WTF

WTF

WTF

WTF

WTF

WTF

WTF

This stuff is called **inferential statistics**. Currently, you have no idea what's going on here (even when you had statistics).

But three things are important for you:

- There is a **precisely defined procedure** for obtaining each of the results
- **You will need statistical tests**, but only to **know the tests for the measures you have** (and how to report it) to analyze your results (we will find your test in the exercises)
- Most of that stuff is repetitive

Descriptive and Inferential Statistics

- Use **descriptive statistics** (means, standard deviations,..)
- ...and **inferential statistics** (ANOVA, t-test,...)
- Name the exact evaluation method (e.g. a one-way ANOVA)
 - › Unusual methods need a source
- Its common to add a **textual summary** of these findings
 - › To investigate if virtual questionnaires cause higher workloads than questionnaires in the real-world, we performed a one-way ANOVA on the NASA-Task Load Index (TLX) scores, which were 33.16 (SD = 20.96) in VR and 37.77 (SD = 19.26) outside the VR. **There were no significant effects, neither on the overall workload, $F(1, 34) = .472, p = .497$, nor on its sub-scales (mental, physical, temporal, performance, effort, and frustration, all with $p > .111$).** The results indicate that perceived workload while completing the virtual questionnaires in VR had a negligible effect on the participants' perceived workload. [...] However, the workload between the questionnaires itself was not determined and could be subject of future work.

How to Report Statistics

- Report **what had an effect on what**

- › “We found a main effect of VIRTUAL REALISM, $F(1,34) = 11.518$, $p = .002$; however, not of ENVIRONMENT, $F(1,34) = .002$, $p = .958$, and no interaction effect of VIRTUAL REALISM \times ENVIRONMENT, $F(1,34) = .007$, $p = .933$ on the scores of the SUS.”

- **What else** did you analyze? And why? Make it short

- › “To determine potential effects of gender and previous VR experience, all analyses were repeated considering both factors as between-subject variables. None of the tests revealed statistically significant effects.”

- **Use Tables**

- **Use Figures**

Tables and Figures

- The **narrative section** of the results are used to **present the general findings** via descriptive and inferential statistics
- When **tables**?
 - › Present details
 - › Multiple data at once
 - › Numeric, textual, avoid images in tables (!)
- When **figures**?
 - › When the narrative section of the results
 - › Use subfigures, when necessary
- Tables and figures **must be referenced in the text**
 - › otherwise remove them

Results Section: Plots

- Plots sell your paper: use bar charts, line plots, box plots, ...
- Main results are always plotted

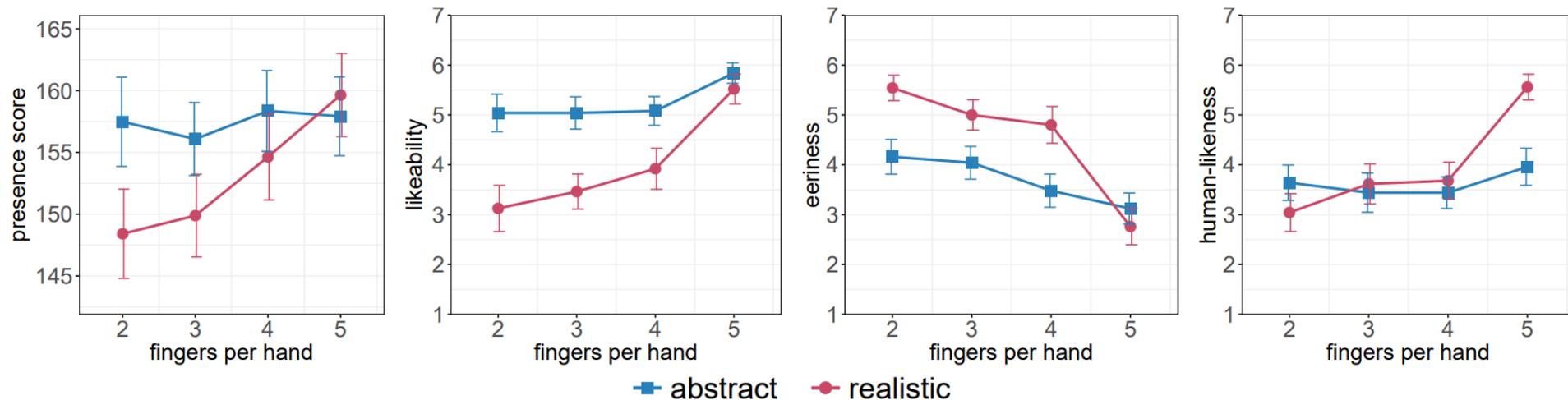


Figure 3. Average presence scores, perceived likeability, eeriness, and human-likeness of abstract and realistic virtual hands with number of fingers per hand. All error bars show standard error of the mean (SE).

Reporting Results

- **Round values to three digits** (no one wants to read millions of numbers):
 - › $p = 0.345678 \rightarrow p = 0.346$
 - › $p = 0.123456 \rightarrow p = 0.123$
 - › $p = 0.000001 \rightarrow p < 0.001$
- You can **aggregate multiple results** if they don't reach significance level $\alpha < 0.05$
 - › „For other comparisons no significant differences were found (all with $p > .05$)“
- **Always report means and standard deviation** in text, you can use means and CI95/SE/SD as error bars in figures
 - › CI95 can indicate if the null-hypothesis can be rejected

Estimate of Mean A	Estimate of Mean B	
-----	-----	convincing evidence of a difference
-----	-----	strong evidence of a difference
-----	-----	no evidence of a difference

Reporting Post-hoc Tests

- **Post-hoc tests are pairwise comparisons** (t-tests, Wilcoxon-signed rank tests) between all conditions
 - can be problem with more than two factors
 - › **If you have more than two IVs and your hypothesis includes interaction effects**, report **cross-factor comparisons**
 - › use phia-package in R
- Provide post-hoc tests if one IV has more than two levels
- Only provide post-hoc tests if your ANOVA was significant!

Report Statistics of Individual Items

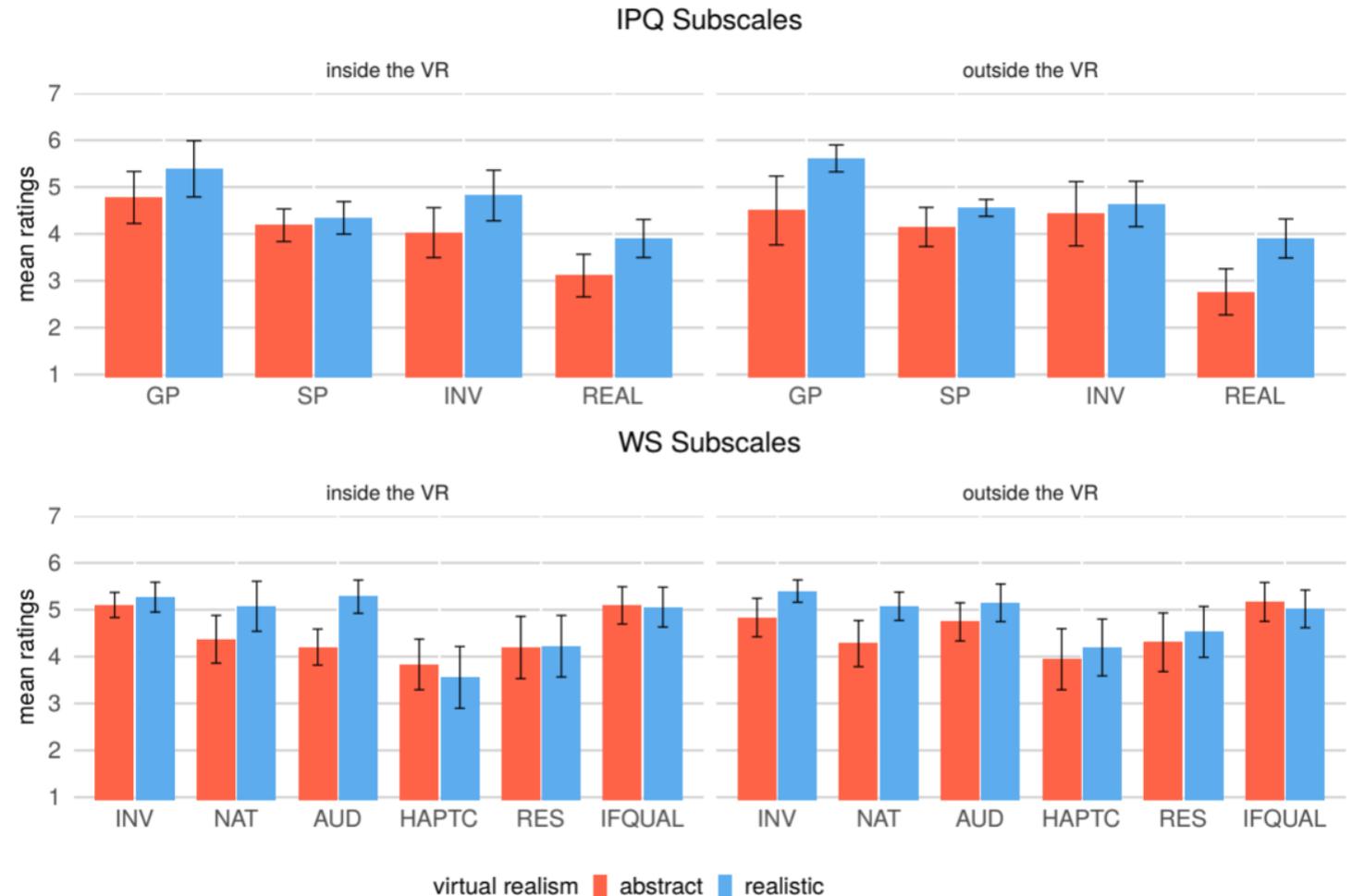
Table 1: Questionnaire results. Items in bold belong to statements designed to test if the hand illusion has occurred. They are either direct ownership questions, or implications or signs of ownership. Friedman tests were used to detect significant differences. Pairwise results are based on Wilcoxon-signed rank tests (H=Human, R=Robot, A=Abstract, C=Cartoon, I=Invisible).

ID	Questionnaire Item	Concept	X ²	H	R	A	C	I	Results
VHI1	I had the sensation that the touch I felt on my hands was on the same location where the virtual hands were in contact with the object.	Location-based similarity	9.0	5.7±1.7	5.9±1.1	5.6±1.3	5.7±1.4	4.6±2.1	
VHI2	I had the sensation that the touch I felt on my hands was caused by the contact of the object with the virtual hands.	Intersensory Interactions	2.4	6.1±1.2	6.3±1.1	6.4±0.9	6.4±0.9	6.2±1.2	
VHI3	The movements of the virtual hands were caused by myself.	Agency	14.3	5.4±1.4	5.5±1.8	5.2±1.8	4.9±1.8	3.9±2.3	R>C>I
VHI4	It seemed my own hands were located in the virtual world.	Location-based similarity	82.7	4.6±1.7	1.7±1.2	1.8±1.3	1.6±1.3	1.3±1.0	H,A>R>C,I
VHI5	The virtual hands began to resemble my own hands, in terms of shape, skin tone, freckles, or some other usual feature.	Visual Similarity	4.7	5.6±1.3	5.4±1.3	5.4±1.3	5.3±1.6	4.8±1.7	
VHI6	It seemed as if what I was feeling was caused by the objects that I was seeing in the virtual world.	Intersensory Interactions	15.5	4.9±1.5	4.8±1.9	4.8±1.8	4.3±2.0	3.4±2.2	H,R>C>I
VHI7	I felt as if the hands in the virtual world were my own hands.	Ownership	15.5	4.5±1.7	4.4±2.0	4.4±1.8	3.7±2.0	3.1±2.2	H,R>C>I
VHI8	I felt as if my real hands were becoming virtual.	Filler / Control	8.7	5.8±1.5	5.6±0.5	5.9±1.2	5.5±1.6	4.9±1.9	
VHI9	It seemed as if I had more than one pair of hands.	Filler / Control	2.4	2.7±1.8	2.3±1.7	2.3±1.7	2.5±1.9	2.2±1.7	
Q1	I had the sensation that the touch I felt on my hands matched the touch I saw using my virtual hands.	Touch Location	9.1	5.9±1.3	5.6±1.3	5.7±1.4	5.5±1.3	4.7±2.1	
Q2	It seemed as if touching with the virtual hands resembled touching with my own hands.	Touch realism	19.3	5.8±1.4	5.7±1.3	5.5±1.6	5.2±1.7	4.1±2.1	H,R>C>I
Q3	Sometimes I had the feeling I was actually touching the bump/indent that I was virtually viewing.	Filler / Control	7.4	6.0±1.5	5.7±1.5	6.0±1.1	5.7±1.4	5.0±1.9	
Q4	I felt confident in my own measurement judgments of the bumps/indents.	Judgment confidence	4.4	5.8±1.2	5.6±1.0	5.5±1.2	5.5±1.4	5.1±1.7	
Q5	I was able to interact with the environment the way I wanted to.	Agency	7.2	5.7±1.5	5.8±1.3	5.7±1.3	5.7±1.3	4.8±2.0	

Order individual items based on significant differences

Multiple Descriptive Values

- If you have many means (and many SDs) do not report them all and put them into figures and refer to that figure.



Results Section: Tables

- No vertical lines. Make it easy to read.

Session 9: VR and Other Novel IO Technology

CHI PLAY 2017, October 15–18, 2017, Amsterdam, NL

Realism	Fingers	PQ score		Likeability		Eeriness		Human-like		Attractiveness		Prefer	Not Prefer
		M	SD	M	SD	M	SD	M	SD	M	SD	N	N
Abstract	2	157.480	17.702	5.040	1.843	4.160	1.713	3.640	1.741	4.200	1.876	2	
	3	156.080	14.475	1.843	1.587	4.040	1.612	3.440	1.920	4.520	1.676	2	1
	4	158.360	16.030	4.200	1.412	3.480	1.628	3.440	1.551	4.440	1.675		1
	5	157.920	15.620	1.876	1.007	3.120	1.532	3.960	1.822	5.480	1.473	13	
Realistic	2	148.417	17.364	3.640	2.225	5.542	1.225	3.042	1.815	2.625	1.998		16
	3	149.885	16.714	1.741	1.758	5.000	1.518	3.615	2.000	2.962	1.763		2
	4	154.640	17.085	4.160	2.018	4.800	1.811	3.680	1.827	3.080	1.853		3
	5	159.640	16.473	1.713	1.473	2.760	1.795	5.560	1.267	5.200	1.697	7	1

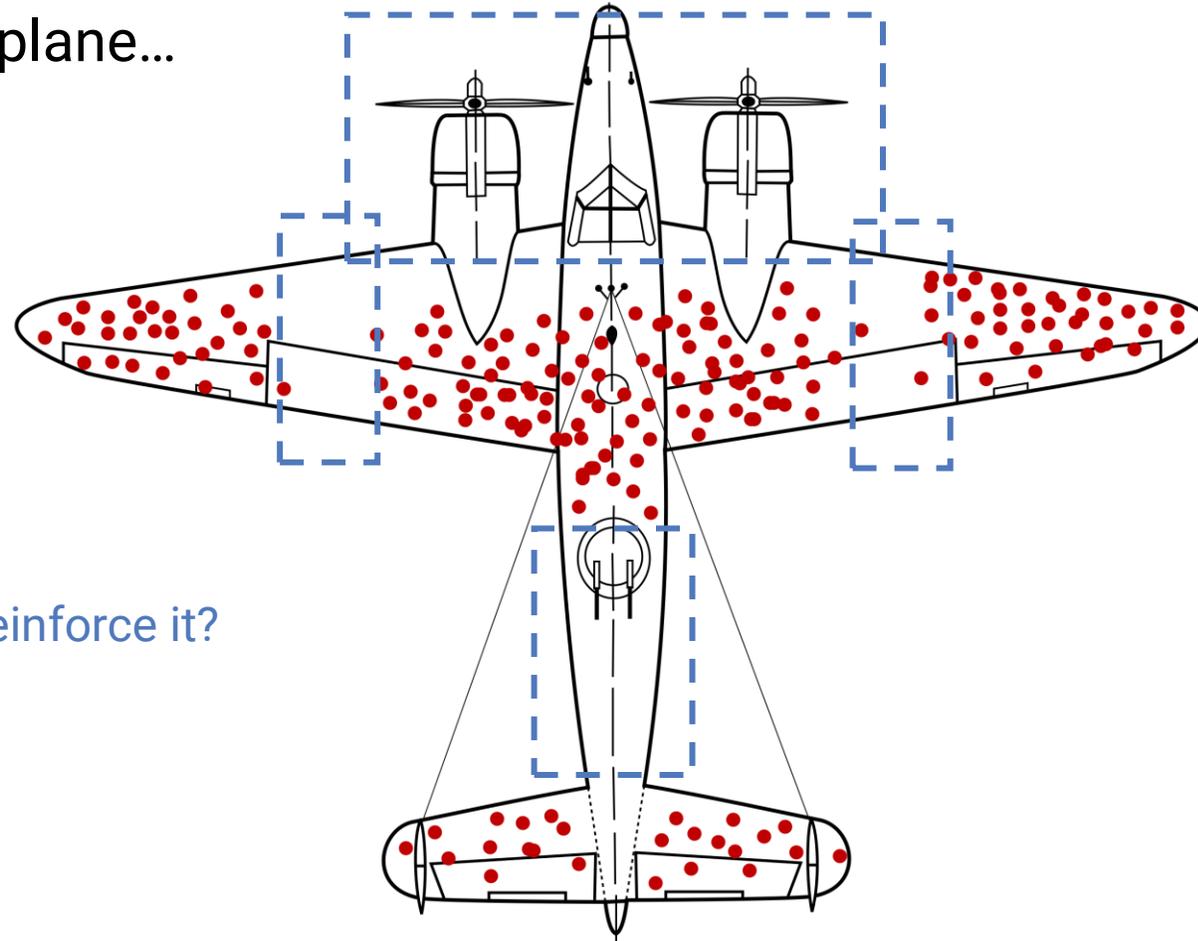
Table 1. Means (M) and standard deviations (SD) of the quantitative measures (presence score, likeability, eeriness, human-likeness, attractiveness) as well as the number of participants (N) who stated at the end of the experiment to prefer or not prefer an avatar hand.

Checking the Results

- Repeat the whole evaluation process to **check for failures**
- Prepare the results to **answer your research questions**
- **Derive implications** from your results
- **Record your the whole process** and analysis of the data
 - › Editing, Coding, Classification, Tabulation
- **Focus on your** statistical **measures**
 - › Central Tendency: Means, Median, Mode
 - › Error/Variance: Standard Deviation
 - › Relationships: Correlation, Regression, t-text, ANOVA, ...

How to draw conclusions...

- Hits on a WW2 plane...



Where to reinforce it?

Results Interpretation and Finding Evidence

- Interpretation is the application of scientific knowledge and professional judgement to **make inferences** about your conditions
 - › **Plot your results** before you think about them and look into the qualitative stuff → do they support each other?
 - › **Be careful** with absolute scores (e.g. SUS, AttrakDiff, NASA TLX)
 - › Scientific research only compares between conditions in one study. Absolute scores are rarely comparable
 - › **Consider the criteria** of your tests (e.g. alpha level, effect sizes, correlations strength, etc.)
 - › **Effect sizes can be very interesting** for the interpretation
 - › We will talk about effect size in „Statistics“, but huge effects are more interesting than small effects (particularly in two-factorial designs)

Discussion Section

- **Starts with brief summary** of the study, whereas the **focus lies on discussing** and not recapitulating **the results**.
- **Bring your results into context with the background** information as well as recapitulation of the research aims of the study
- **Conclusions or hypotheses drawn from the results**, with summary of evidence for each conclusion
 - › **Do qualitative and quantitative findings support each other?**
- **Proposed follow-up research** questions and outlook on further work
- **Weaknesses? Non-significant results? Unexpected data?**
- If you are a non-scientist, **what are the implications?**

Discussion Section

- **Explain** your results **for normal humans**
- Explain **the meaning of the information** in **easily** understood terms
- How were **reliability** and **validity** were maintained?
- **Stating the cause** for your results
- **Compare** the results with
 - › Theoretical expectations (e.g. based on models)
 - › Findings in previous work
- **Discuss weaknesses** and explain non-significant results
- **Explain** if significant but opposite to those predicted (and why)
- **Point on inconsistent** or **mixed results**

Discussion: Starting a Good Introduction

`\section{Discussion}`

In a proof-of-concept study with 24 subjects, we tested the general feasibility of using bone conduction at the wrist to authenticate users with our WristConduct system prototype. We tested SVMs and ANNs as binary classifiers and found the best accuracy using ANNs (98.9 %), which achieved a specificity of 99.3 %. With a false positive rate of less than one percent (0.7 %), our approach shows one of the highest classification performance rates compared to solutions from the literature. For example, the scores indicate a better classification performance compared to the related work with an ANN (97.0 % accuracy and 3 % false positives) [18] or VibID (91 % accuracy and 9 % false positives) [27]. Thus, the evaluation shows that even with simple and cheap hardware as well as common software classification, bone conduction at the wrist can be a promising method of user classification and authentication.

Again, what we did

What we found

Findings compared with related work

The finding and evidence

Discussion: A Good Discussion

Our data collection took place in a controlled and calm environment with low background noise and a static apparatus. Using a bone conduction speaker with 25 W, the hardware was likely to be more powerful than it might have been necessary for classifying the audio data. Our research indicates that there is a potential for miniaturization and optimization to integrate the hardware into a portable device. Testing bone conduction with high ecological validity in a more realistic setting requires to build a wearable bone conduction authentication band with a smaller bone conduction speaker and receiver microphone. Such bone conduction speakers are already in use for communication systems, language development approaches, mitigation of stuttering, acoustic investigations and medical applications [16]. We are sure that there are possibilities to further miniaturize the speakers and microphone while improving their efficiency [28].

Internal validity

Critical reflection

Important to investigate this further

Supporting that claim using more references

Discussion: A Good Discussion

In our study, we only implemented a stationary device due to lacking hardware alternatives during the fast prototyping process. Further, our approach has only been evaluated in a single experimental session, however, future studies in repeated sessions (e.g., at different days) are required to test and further improve the robustness of the approach and the validity of the classification accuracy. For testing the ecological validity of the approach, we also recommend to test the approach in a smaller device and different in settings with acoustic backgrounds or environmental noise. More factors that can influence the quality of the authentication are the exact location of the speaker and the microphone on the wrist, the audio volume, and pattern frequency.

Limitation

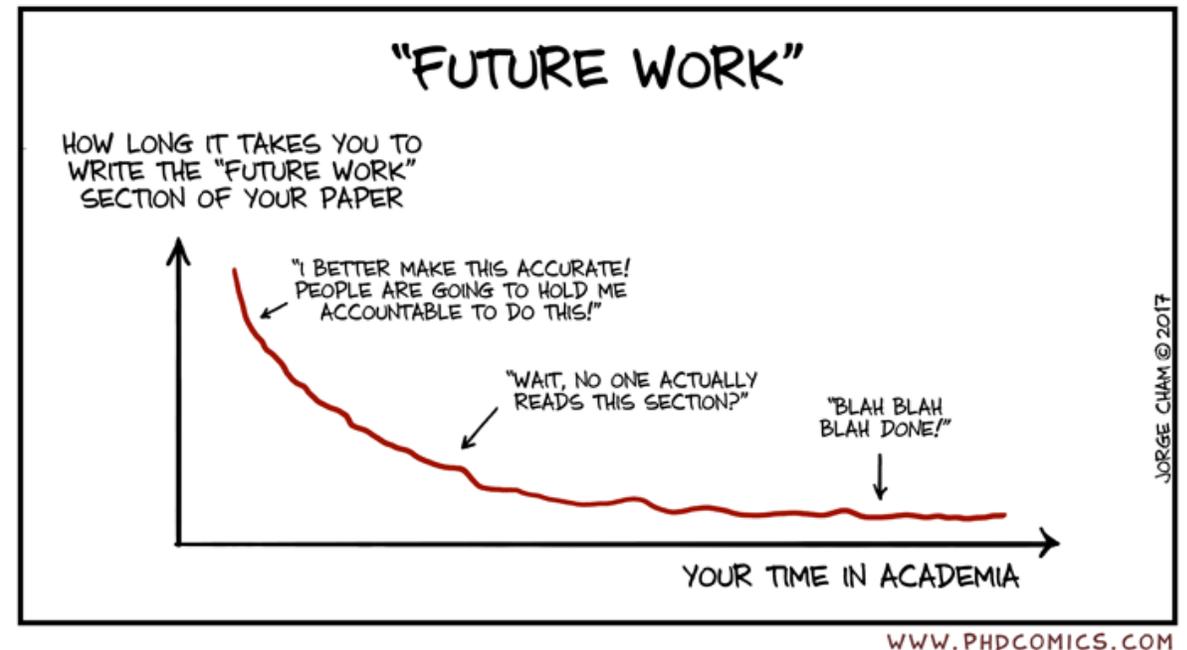
Future Work

Important to investigate this further

Speculations for future work

Future Work (often an own section)

- What are the recommendations now?
 - › Logical extension of the study: What comes next?
 - › Replication of the study: Different setting?
 - › Correction of limitations: Sample, apparatus, variable control, method
- You can learn a lot for your own study hear
 - › If someone recommends to do your study, it is a great template



Conclusion (often an own section)

- **Summarizes** again
- The researcher attempts to **show what knowledge has been gained** through the study and tries to **generalize that knowledge** by considering the population and characteristics of the sample
 - › Was the problem answered?
 - › Was the research purpose met?
 - › Was the research hypothesis supported?
 - › Was the theoretical model/framework/predictions supported?
- **Provide implications.** Give others the opportunity to be creative. Implications give meaning for theory and practice
- **Provide suggestions** for making changes, further studies, etc.

Conclusion Section

- **Provide recommendations**

- › Logical extension of your study: What comes next?
- › Replication of the study: Different setting?
- › Correction of limitations: Sample, apparatus, variable control, method, ...

- **Utilize your findings**

- › What can we do with that?

Discussion: A Good Conclusion

```
\section{Conclusion}
```

In a proof-of-concept study with 24 participants, we show the feasibility to identify human users using propagating soundwaves passing through bone tissue of the wrist using simple bone conduction speaker and a laryngophone (the receiver microphone) with high accuracy. We tested support vector machines (SVMs) and artificial neural networks (ANNs) as common means for binary classification. Using ANNs our method shows an authentication accuracy of 98.7\% and a false positive rate of 0.7~\%. We direct future work to further explore the possibilities of wrist-based bone conduction for passive and continuous user authentication for mobile and wearable devices.

Again, what we did

What we found

Recommendations and how to utilize those findings

Example: Discussion

Discussion

In the first study, we found that the warmth and competence of human stereotypes is significantly affected by the anticipated use of mobile devices. Moreover, the plots show a systematic attraction of the warmth and competence vectors which potentially suggests that the presented devices have their own location in the SCM. For example, using narrative clips or LED glasses moves almost all stereotypical groups to the center of the SCM (low warmth and low competence). Medical devices (blood pressure monitor, blood glucose sensor) increase sympathy. According to the SCM, the emotional effects could be evoked by feelings of pity, but also sympathy as wearing these devices signifies that people compete less for the same pool of resources due to their physical limitations. EEG and VR headsets make people more competitive, however, with medium status and the approach-related affect of contempt. Tablet users are perceived to be more competent and competitive.

A systematic attraction of competence and warmth of people using mobile devices would mean that a mobile device is a social object and perceived stereotypically by itself. Furthermore, such a systematic attraction would move any stereotype into the direction of the presumed center of the pointing vectors. This means that devices can systematically elicit emotions when people use them. Thus, the SCM can potentially explain previous work's findings that social acceptance of highly competitive devices such as smart glasses depends on the stereotype of the person wearing the device [30].

Not every stereotype moves warmth and competence to the location of a device in the same way. Senior citizens using tablets, VR headsets or quadcopters show a higher influence of the device on competence than on warmth. This is not the case for the other stereotypes, which means that there is potentially an additional factor affecting warmth and competence of a group. This could be the motivation reasons for this deviation are not considered by the SCM and further addressed in our general discussion. Additionally, the effect of the device on warmth and competence for each stereotype differs. Thus, the vectors have different lengths and attraction forces. While LED glasses, narrative clips, blood glucose sensors, and blood pressure monitors strongly attract the stereotypes to their position, VR or EEG headsets, and Tablets have a weaker attraction.

Summary of findings

Implications

Critical Reflection/Limitations

Typically, paper end here, if your paper has a 2nd study: proceed...

If you have more than one study provide a **General Discussion** summarizing the findings from all studies

5 GENERAL DISCUSSION

In this paper, we use the SCM to understand the role of mobile devices as social objects and their interdependence with bystanders' stereotypical perceptions. In two studies, we investigated if mobile devices significantly change the social perception of stereotypes and if devices are perceived stereotypically by themselves. Known human stereotypes were used to determine how perceived competence and warmth are affected when individuals of these groups use different

mobile devices. We not only found that using these devices significantly change social perception but also that mobile devices are social objects and perceived stereotypically. We designed and validated a linear model allowing to predict the social perception of human stereotypes when individuals of each groups interact with mobile devices. We conclude that the SCM is a plausible and reliable framework to explain social perception of mobile devices.

With respect to the questions how the SCM is related to social acceptance of mobile devices, our results show, that the intention and the ability to pursue a goal depends on the combination of user and device. User-device combinations indicating low status and competing for the same resources are perceived to be contemptuous and, thus, socially less accepted. Conversely, user-device combinations indicating high status and less competition are admirable and accordingly socially accepted. Considering the SCM map, social acceptance of a technical device would, therefore, be a diagonal line from contempt to admiration (see Figure 6).

Using the SCM we are able not only to assess social acceptance but also the dependency of device usage. User-device combinations with low status indicating that the user highly relies on the device results in paternalistic stereotypes eliciting emotions of pity and sympathy. Hearing aids, for example, indicate that a user is constrained and requires technical support in daily life. More independence while using a device indicate control and freedom to pursue a certain goal. However, this increases the probability that a user-device combination is becoming too autonomous, which increases the probability that a user will use the device to compete for resources. This would explain why mobile devices used by enthusiasts (cf. quadcopter and smart glasses) are highly competitive and indicate high status, however, cause emotions of envy and jealousy. Considering the SCM, device dependency is orthogonally related to social acceptance and reaching from autonomous to constrained.

The relationship between humans and devices is potentially bidirectional. Devices transfer their stereotype to humans, while the position for the stereotypical device may also have been characterized by the frequent use by a specific stereotypes. Devices that are used by a certain group, transfer the respective emotions to the device. This would explain why devices and their stereotypical perceptions are weaker and less distinct than the perceived warmth and competence of human stereotypes (see Figure 5).

The SCM does not explain all results. As noted in the discussion of the first study, EEG headsets or quadcopters have a higher influence on the competence of senior citizens than on their warmth, which was not the case for other groups. This could be explained, for example, because of assumed differences in the advantage, which is compensated through a technical device, increases

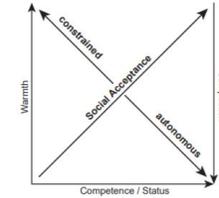


Figure 6: Relations of social acceptance and device dependency in the SCM. Social acceptance increases with competence and warmth while device dependency reaching from autonomous to constrained is a negative function of status and competition.

only the status but not competition if physical possibilities and mental intentions are considered independently. However, the SCM only provides the foundation but not a framework for explaining this phenomenon.

6 LIMITATIONS & FUTURE WORK

In our work, we examined a set of stereotypes and mobile devices, but did not explore any design-specific questions or novel prototypes. Especially the relation and effects between design and functionality of technical devices in social context was not considered. The position of novel devices may be influenced by the perception of known stereotypes, but appearance often do not match with functionality. The relationship and effects of functionality and design in the SCM could be further investigated.

In the herein presented study, we draw our sample from technically affluant participants to ensure that they have a consistent understanding of the presented devices. This potentially provides insight into a specific population and potentially reflects a certain in-group perspective. However, differences between in- and out-group users were not investigated in the studies. It is conceivable that in-group perception (frequent users of a certain device) differs from out-group perception (people without the device). We found that devices do not move all stereotypes in the same way and more research is needed to understand further factors which influence social perception and acceptance.

ACKNOWLEDGMENTS

This work was financially supported by the German Research Foundation (DFG) through projects C04 and C02 of SFB/Transregio 161.

Images

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laboratory.}
  \label{fig:videoimages}
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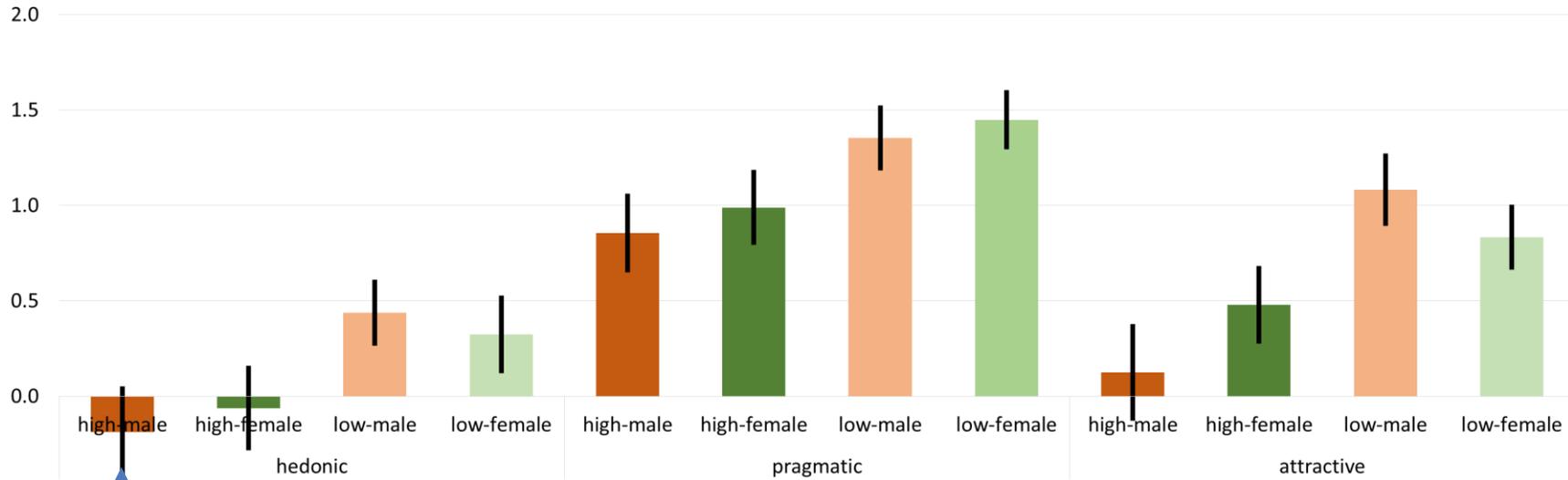
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Image description

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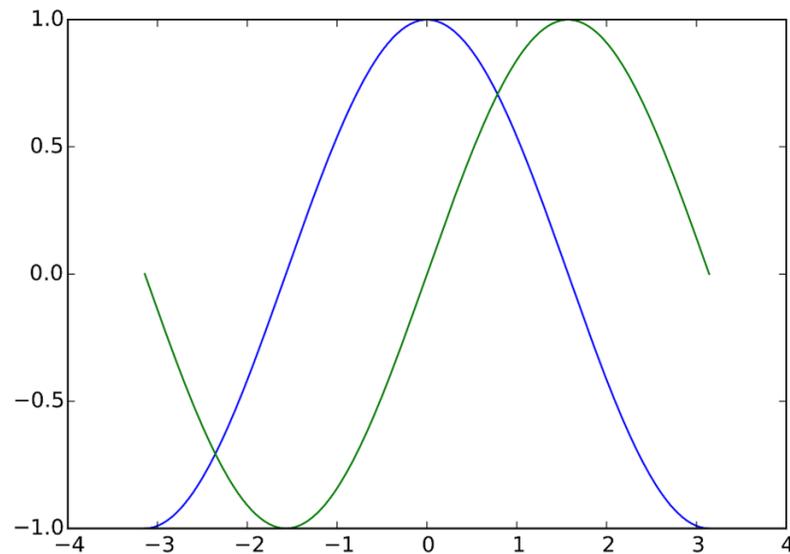
Images of the participants performing our tasks are shown in
Figure~\ref{fig:videoimages}.

Don'ts: Overlaps

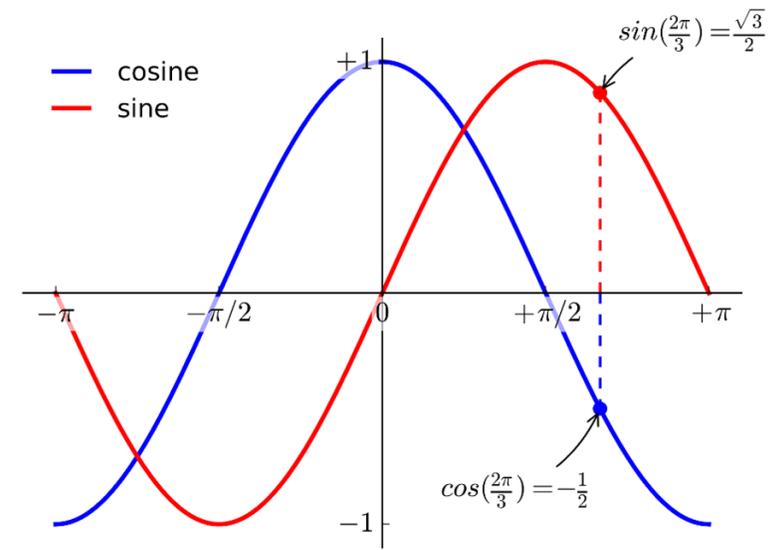


Don't do that

Don'ts: Trusting Default Values

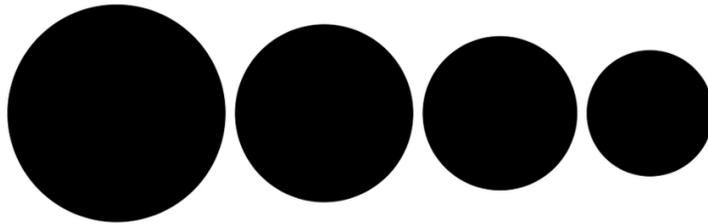


Label correctly



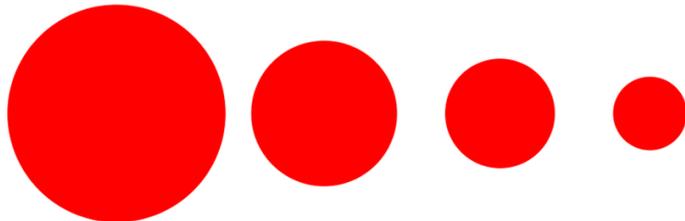
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Don't be misleading



Relative size using disc area

Relative size using disc radius



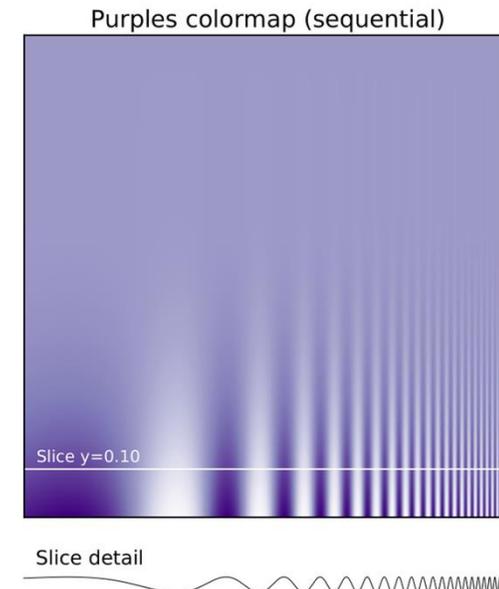
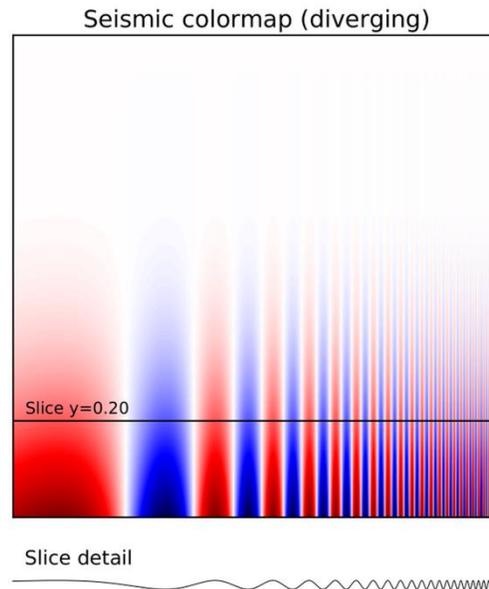
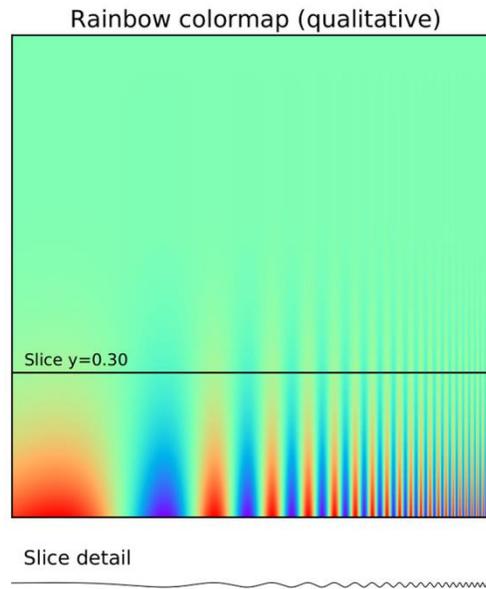
Relative size using full range

Relative size using partial range

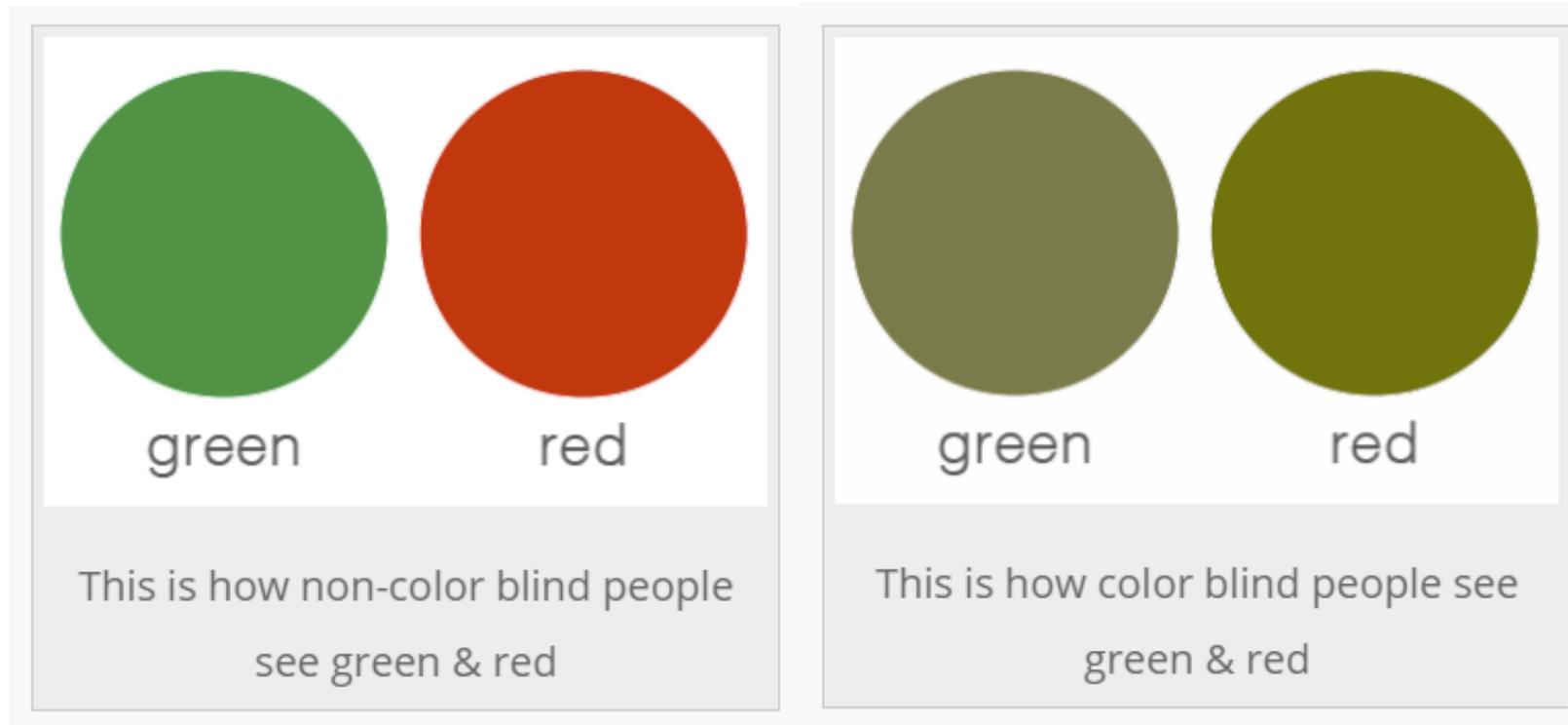


Describe what you do

Use colors effectively

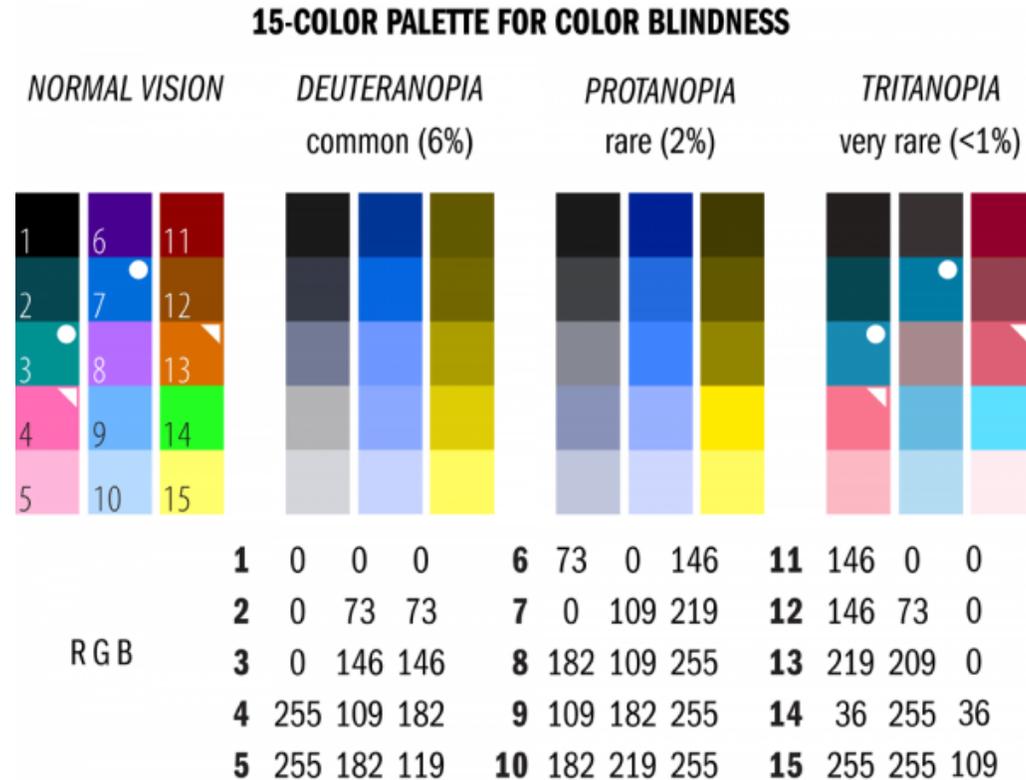


Make it accessible



<https://www.somersault1824.com/tips-for-designing-scientific-figures-for-color-blind-readers/>

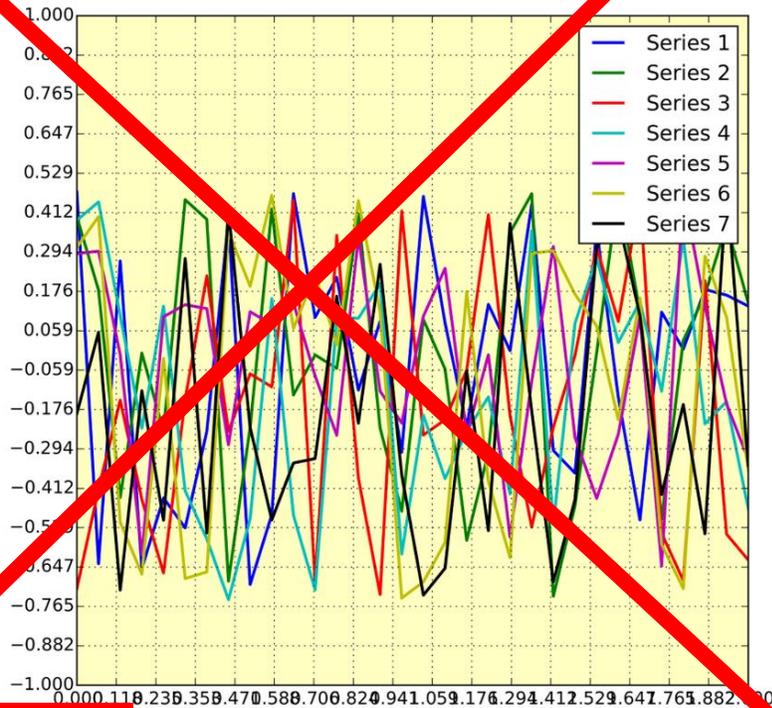
Use pre-defined color schemes



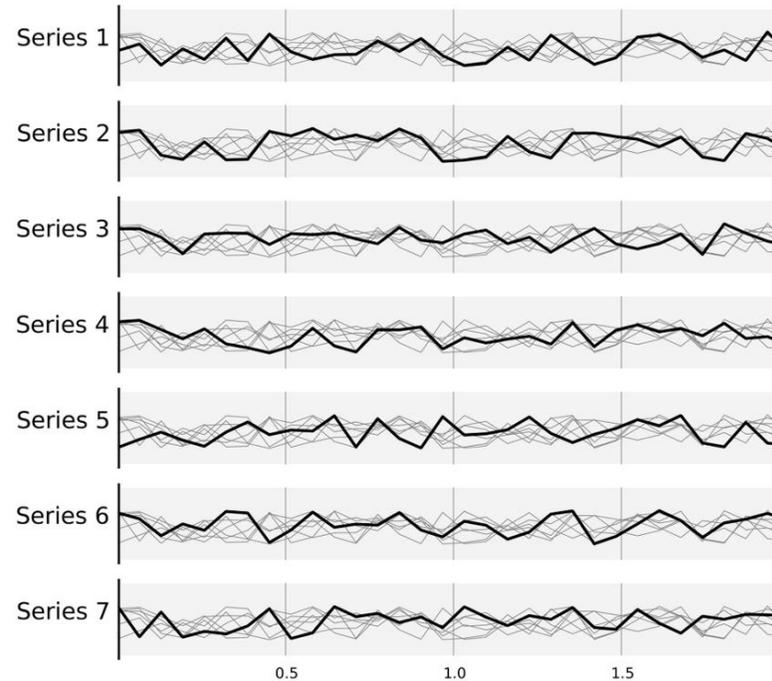
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No Junks

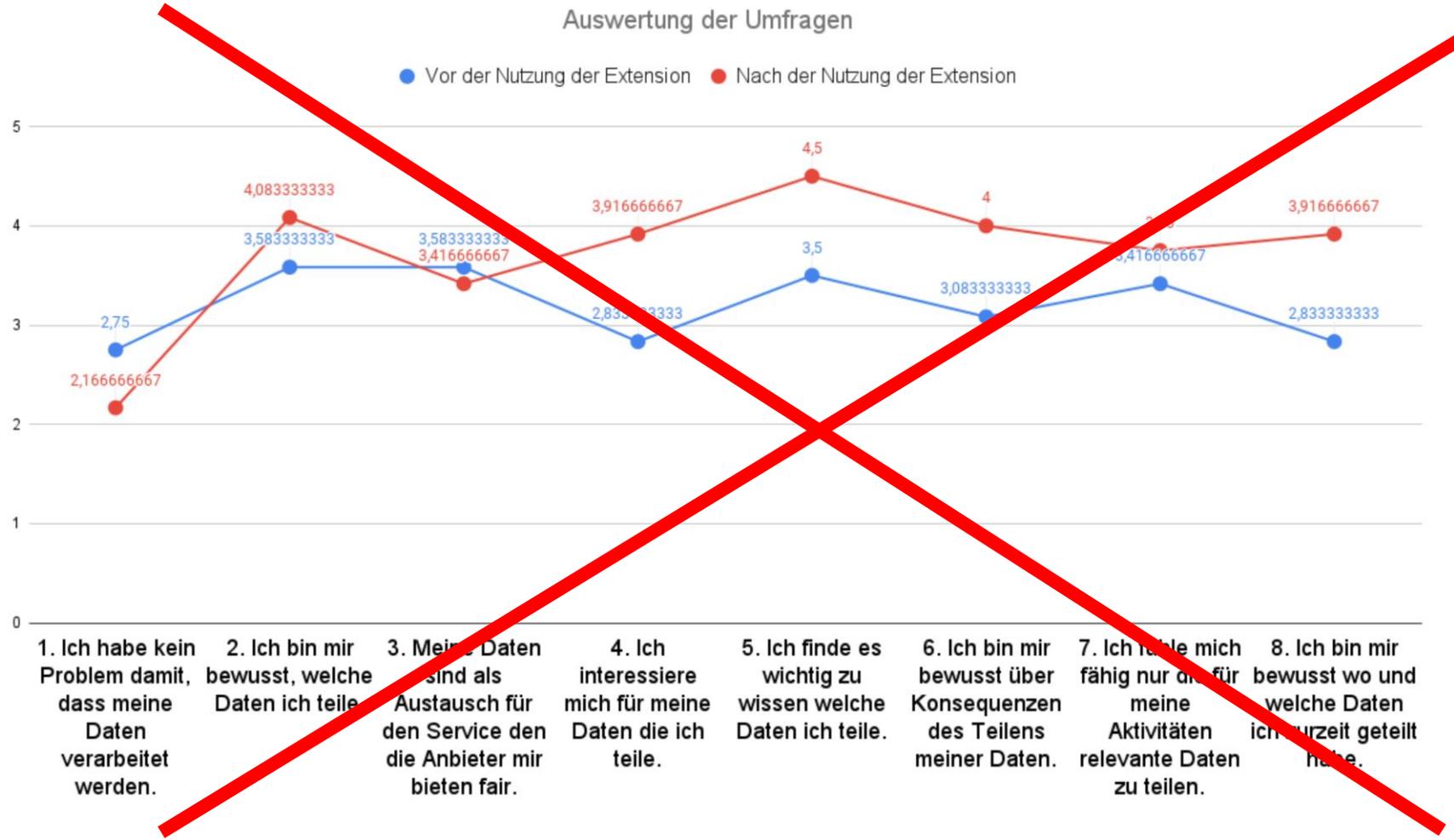


Don't do that

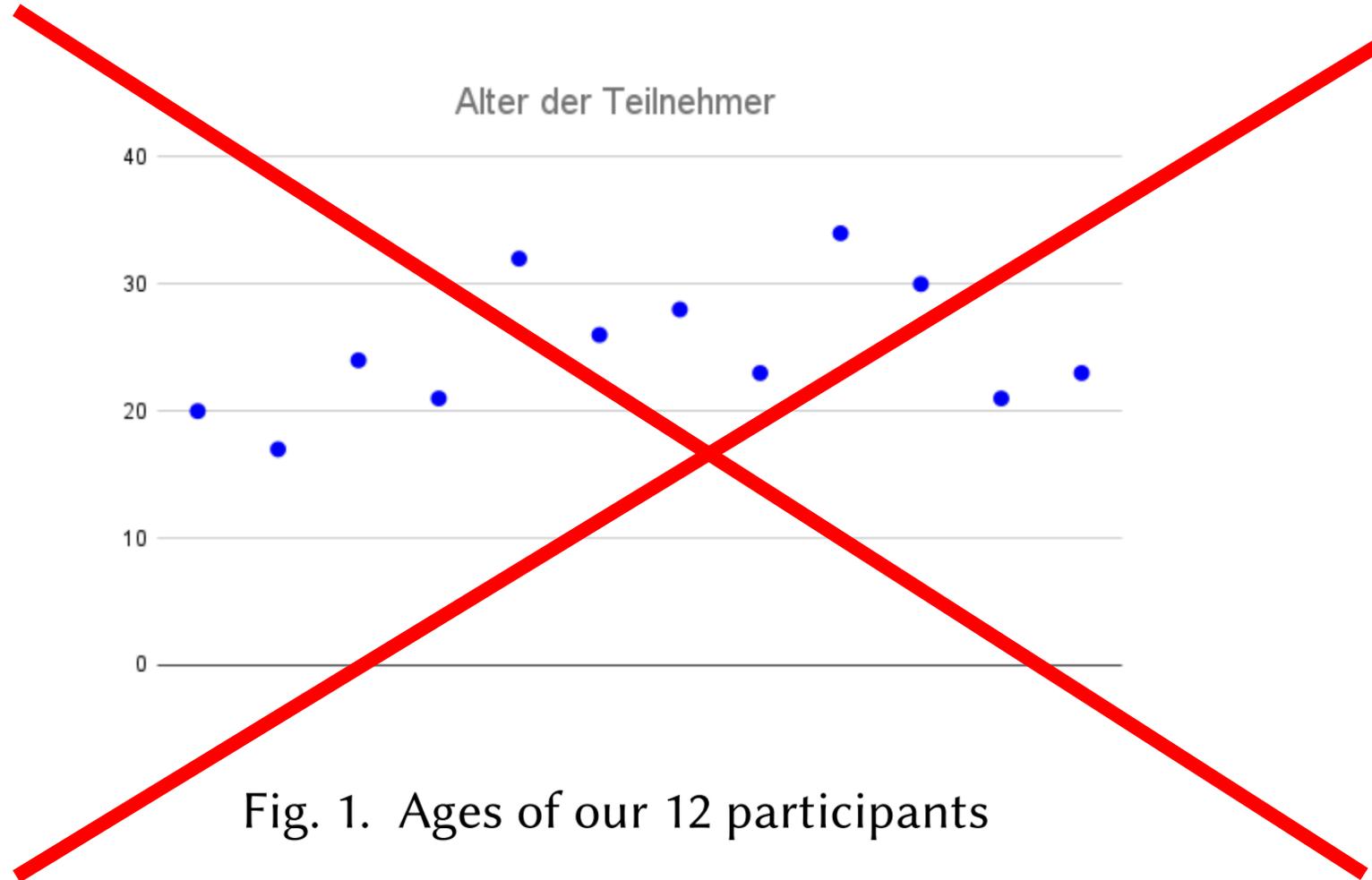


That's okay...

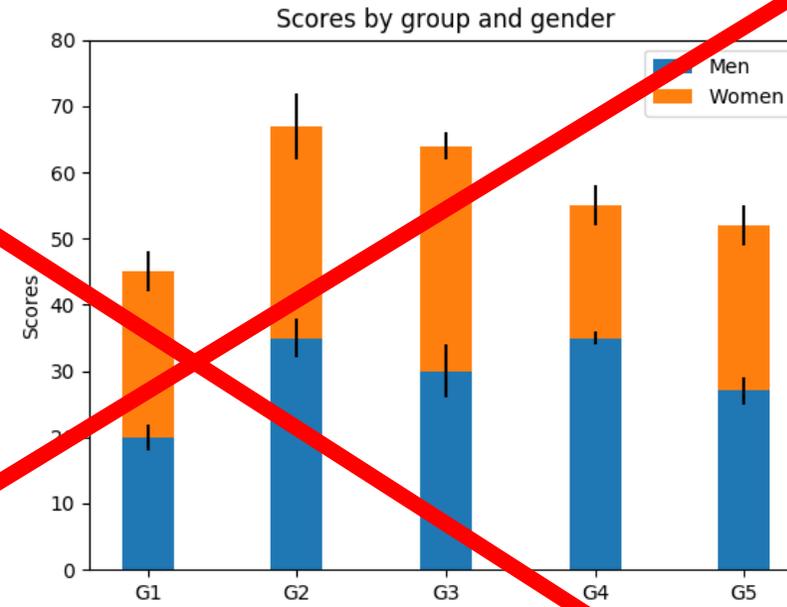
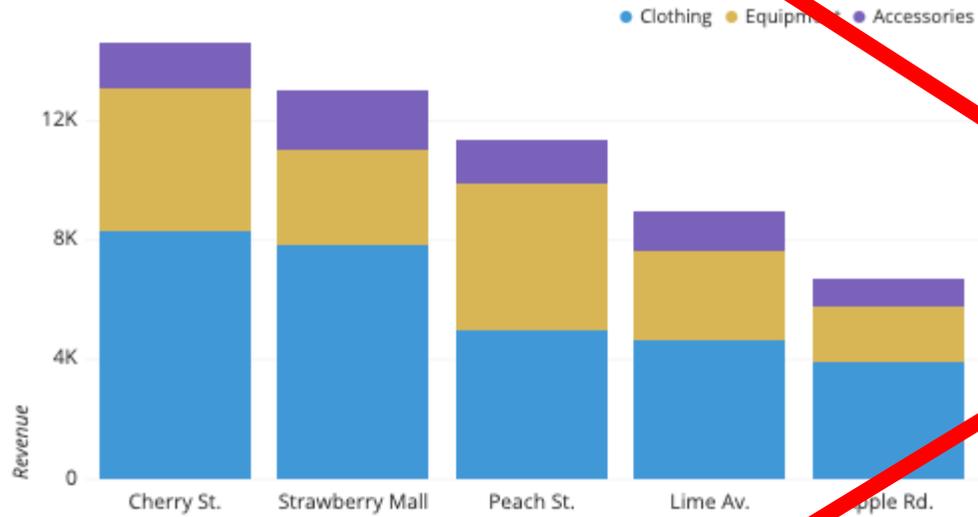
No means without variances



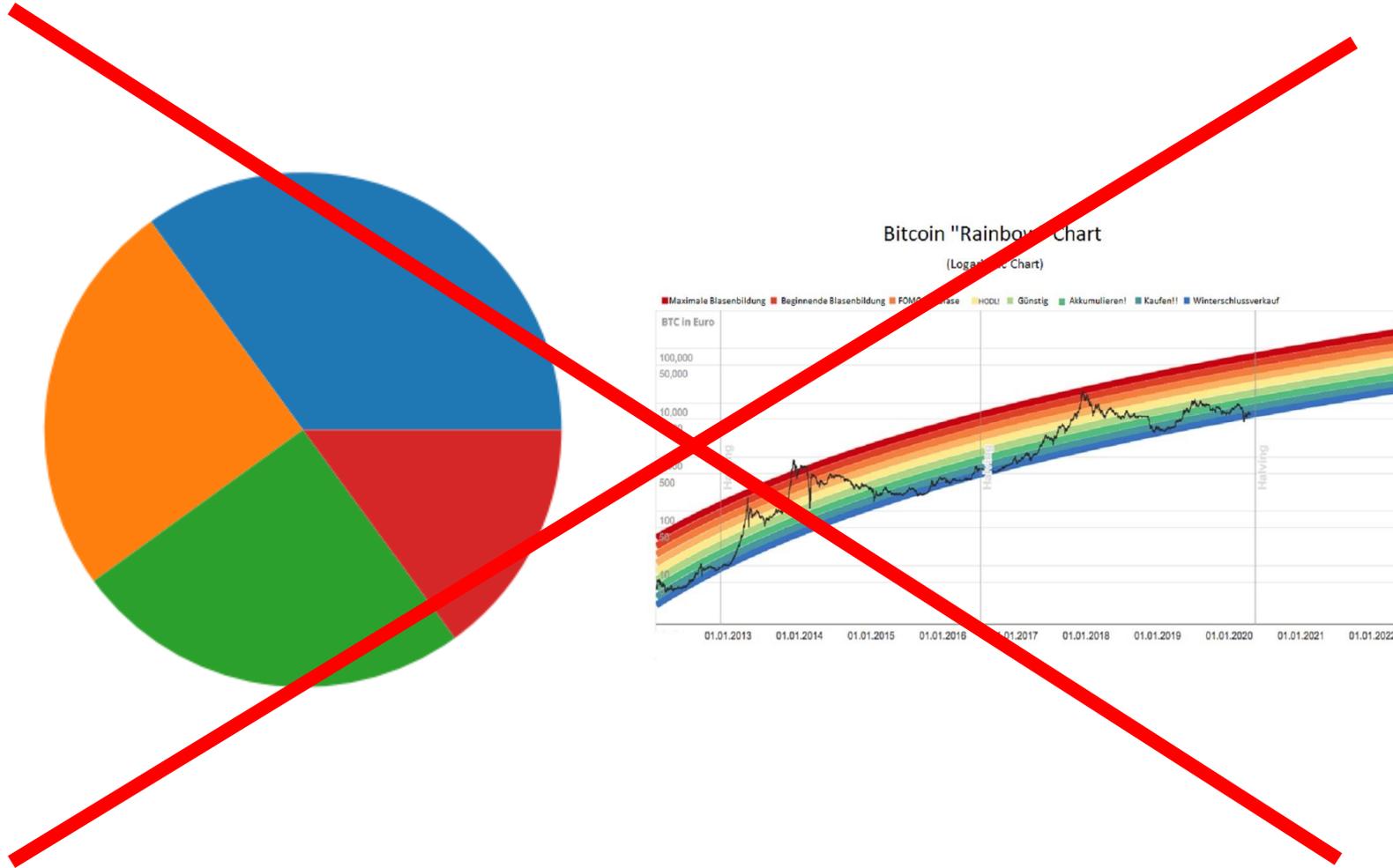
Do we need that?



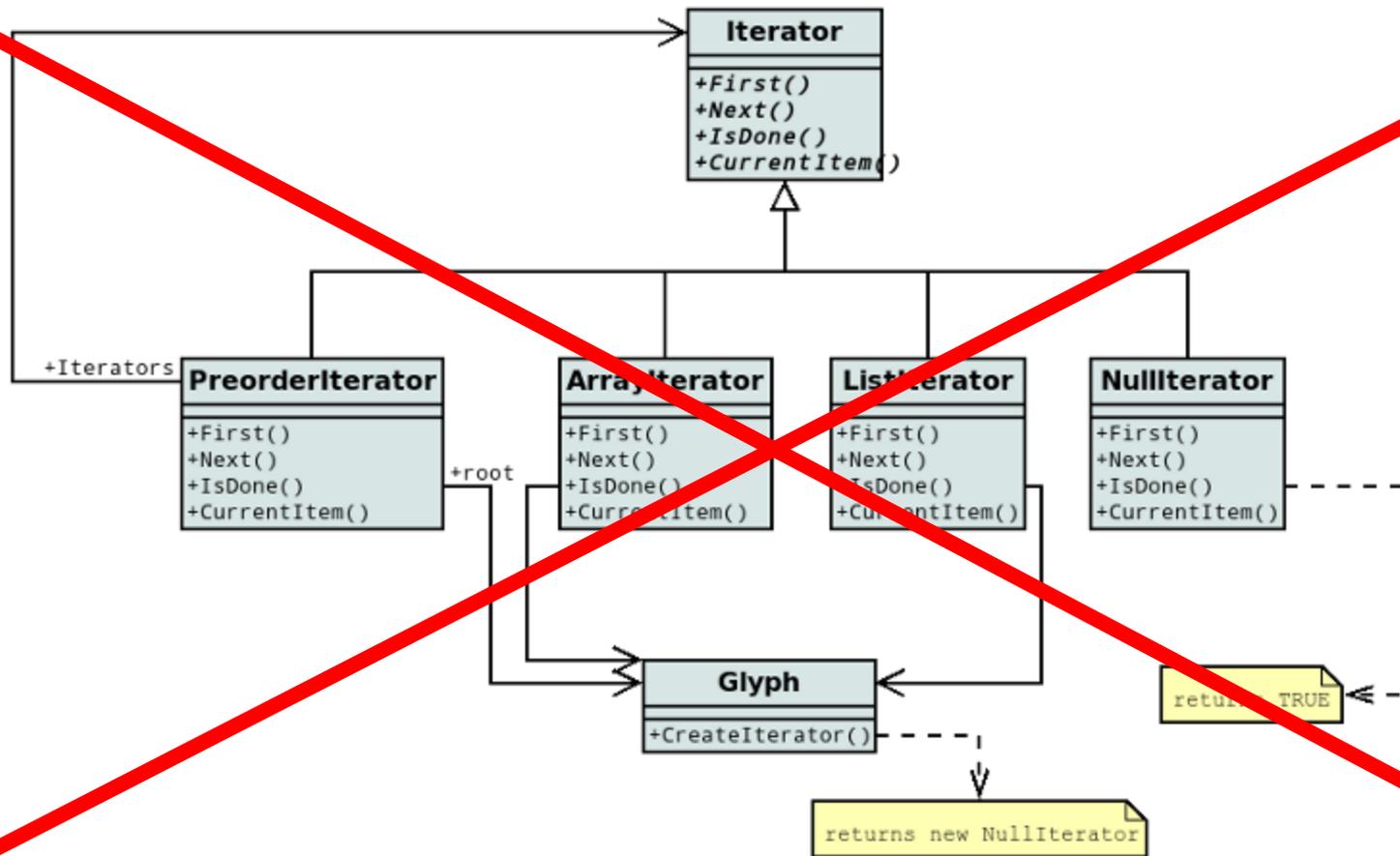
No Stacked Charts



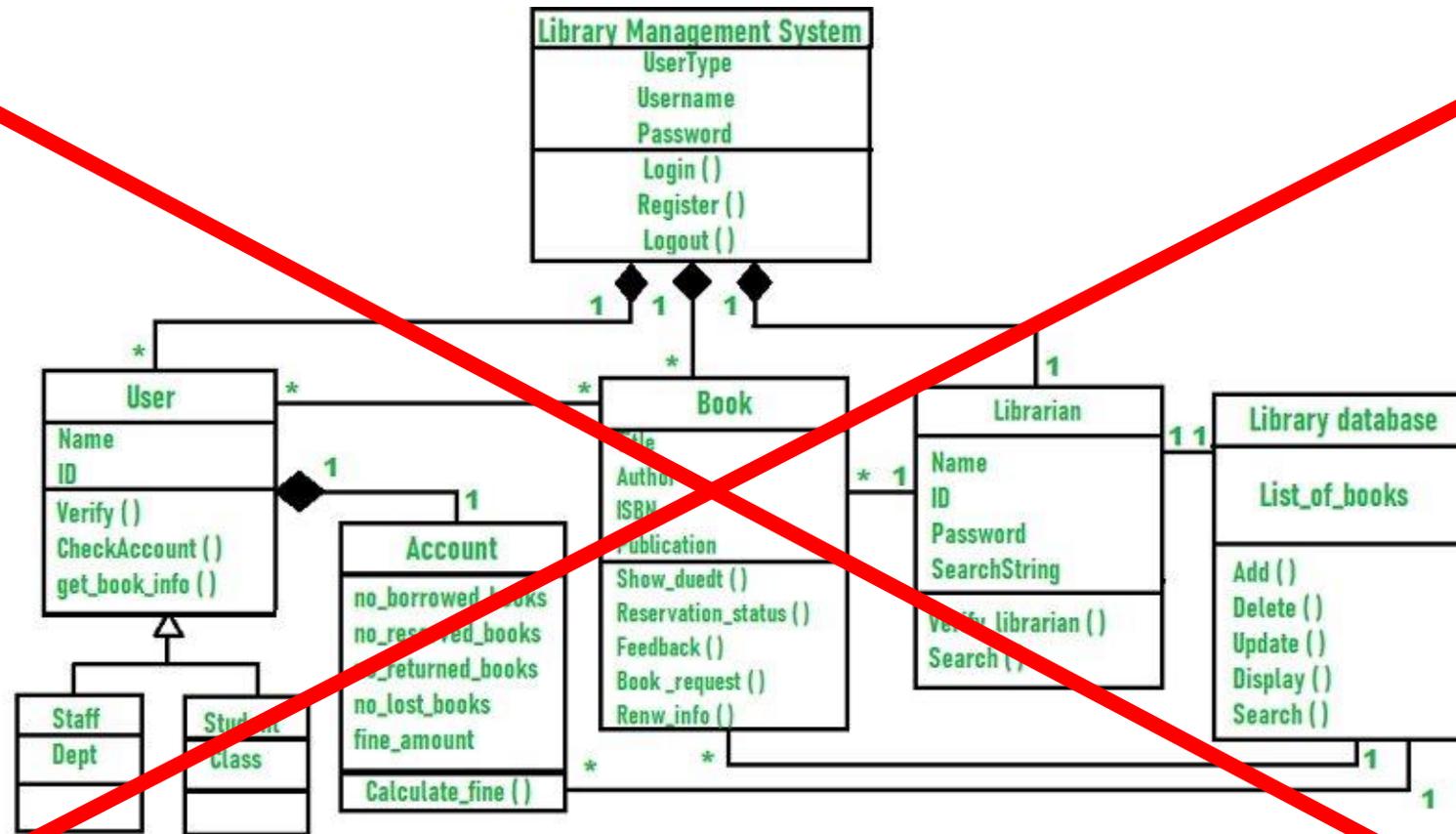
No Pie Charts, No Rainbows



No UML!!!!



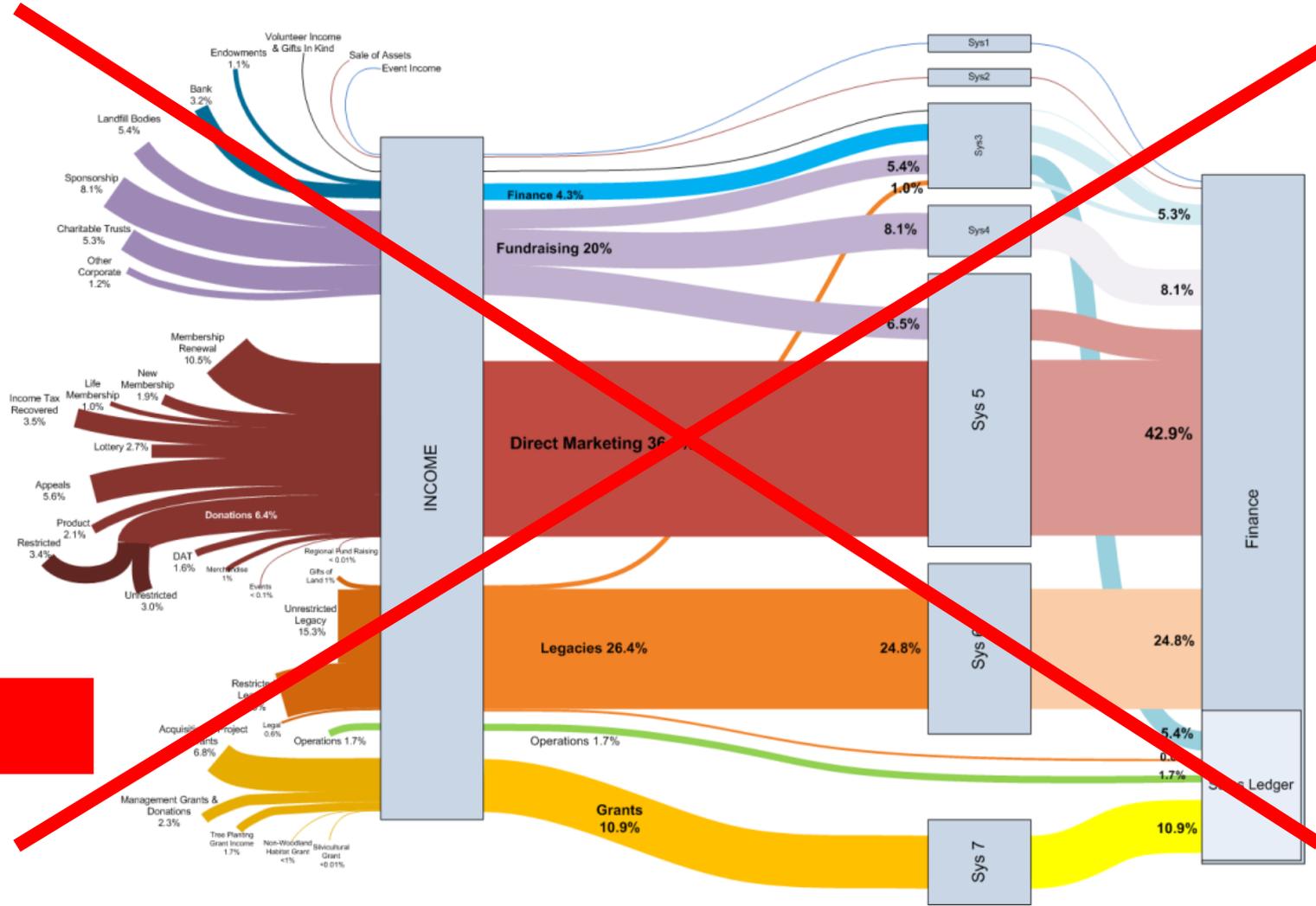
JUST NO!!!!



CLASS DIAGRAM FOR LIBRARY MANAGEMENT SYSTEM

<https://www.edrawsoft.com/de/uml-class-diagram-explained.html>

No Sankey Diagrams



No

JUST NO!!!!!!!

Anatomy of a Winning TED Talk

1%
Sophisticated Visual Aids
We're not sure who coined it in TED—most of the best presentations favor the PowerPoint slide shows (sorry, Brené Brown), the okay-quality drawings (really, Simon Sinek?), or the props at all.

5%
Opening Joke
Remember the one about the shoe salesman who went to Africa in the 1900s? That's how Benjamin Zander opened his talk—which turned out to be about classical music.

5%
Spontaneous Moment
Don't overprepare. Tease the guy in the front row ("You could light up a village with this guy's eyes"). Commend the stagehand who handles the human brain you brought.

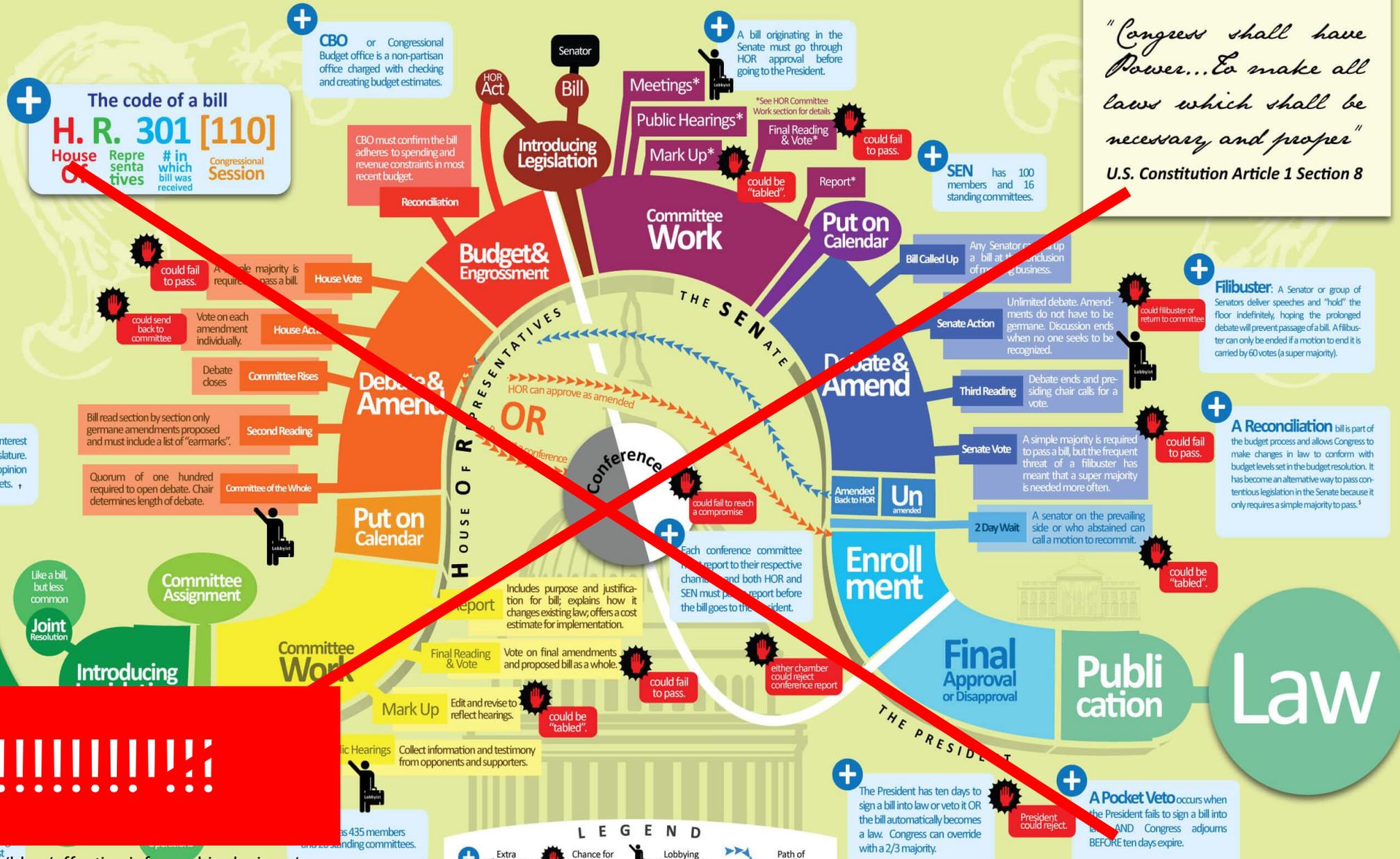
5%
Statement of Utter Certainty
People come for answers—give 'em what they want, as Shawn Achor did: "By training your brain ... we can reverse the formula for happiness and success."

12%
Snappy Refrain
The TED equivalent of "I have a dream." Example: "People don't buy what you do; they buy why you do it." Repeat 7x.



NO!!!!!!!!!!!!!!!

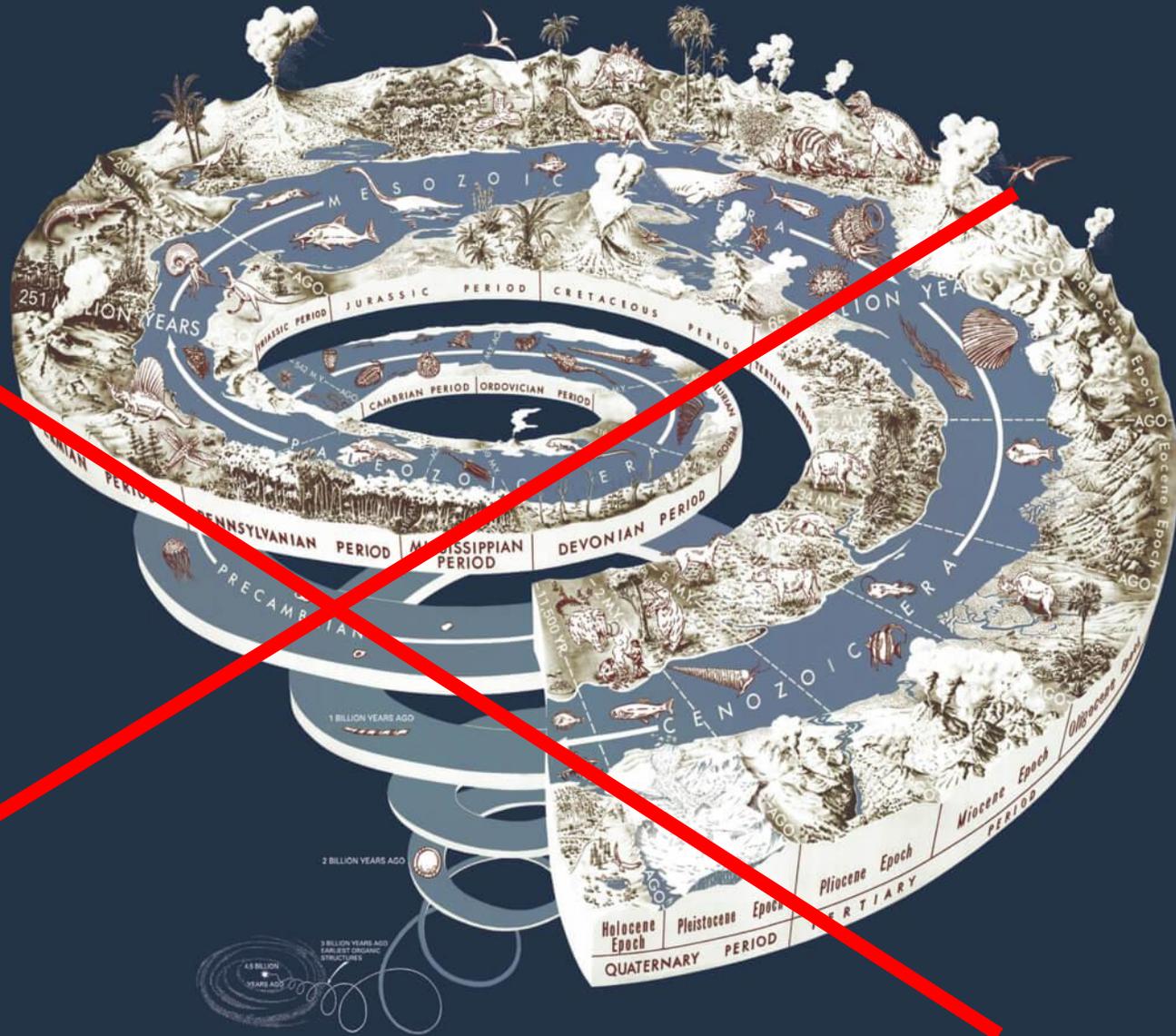
HOW OUR LAWS ARE MADE



NO!!!!!!!!!!!!!!

<https://www.crazyegg.com/blog/effective-infographic-designs/>

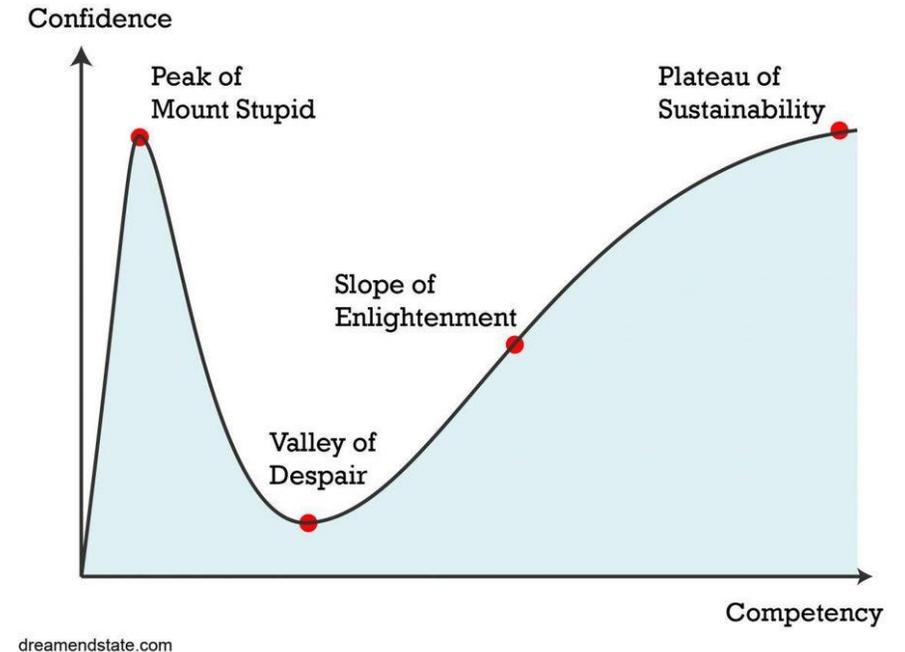
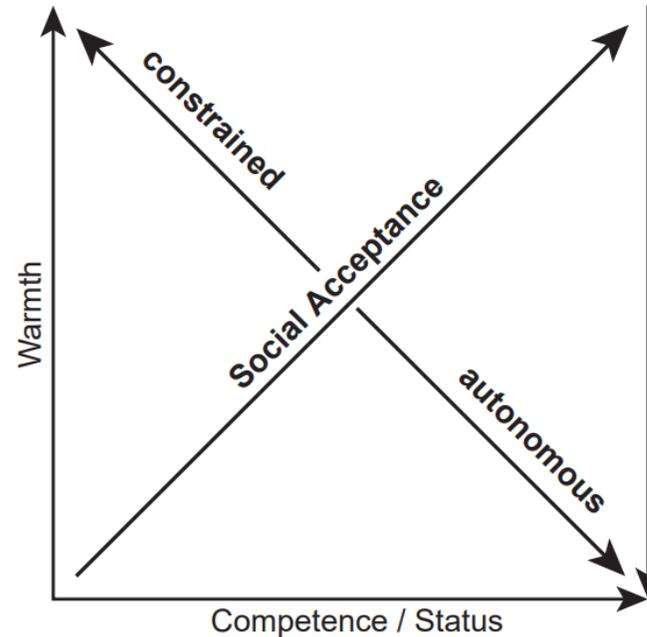
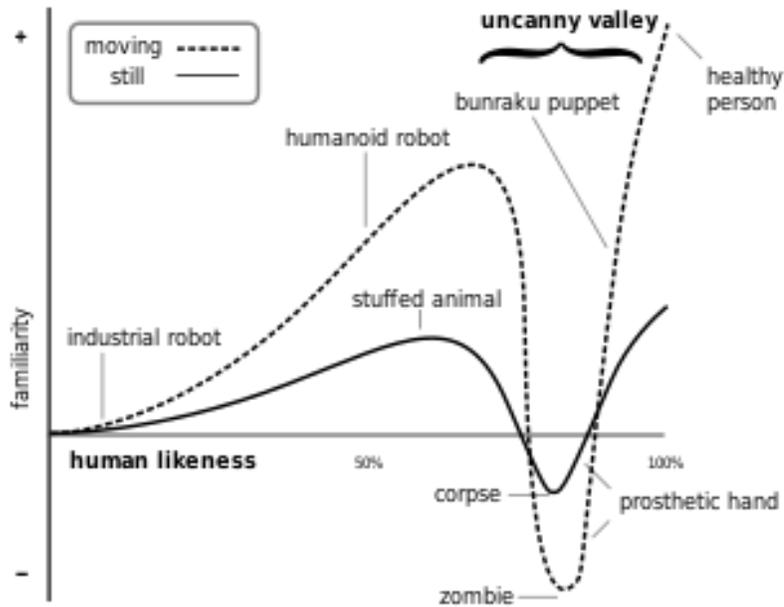
A collaboration of Mike Wirth & Dr. Suzanne Cooper Guasco Ph.D. 2010. Data from "How Laws are Made" by John V. Sullivan. Rev. 6.24.07 thomas.loc.gov. wisegeek.com/what-is-a-lobbyist.htm. brookings.edu/opinions/2010/0125_reconciliation_binder.aspx



Guess...

<http://ceblog.s3.amazonaws.com/wp-content/uploads/2015/10/421.jpg>

Message Trumps Beauty



https://en.wikipedia.org/wiki/Uncanny_valley

We like them!

Next Time: Latex Writing Workshop