Current Topics in Media Computing and HCI

Seven Research Contribution Types (continued)

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https://hci.rwth-aachen.de/cthci

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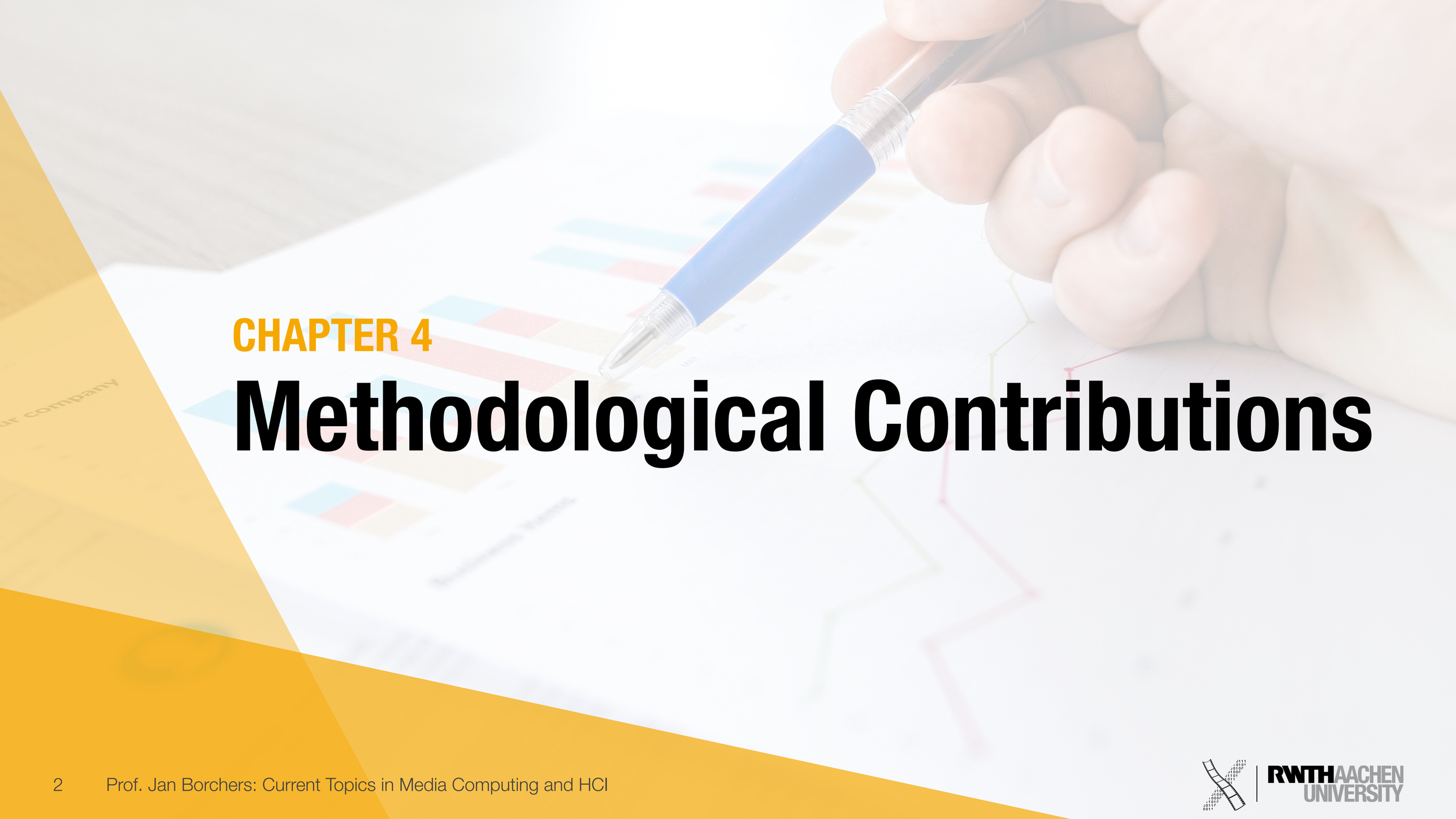


CHAPTER 4

Methodological Contributions

Methodological Contributions

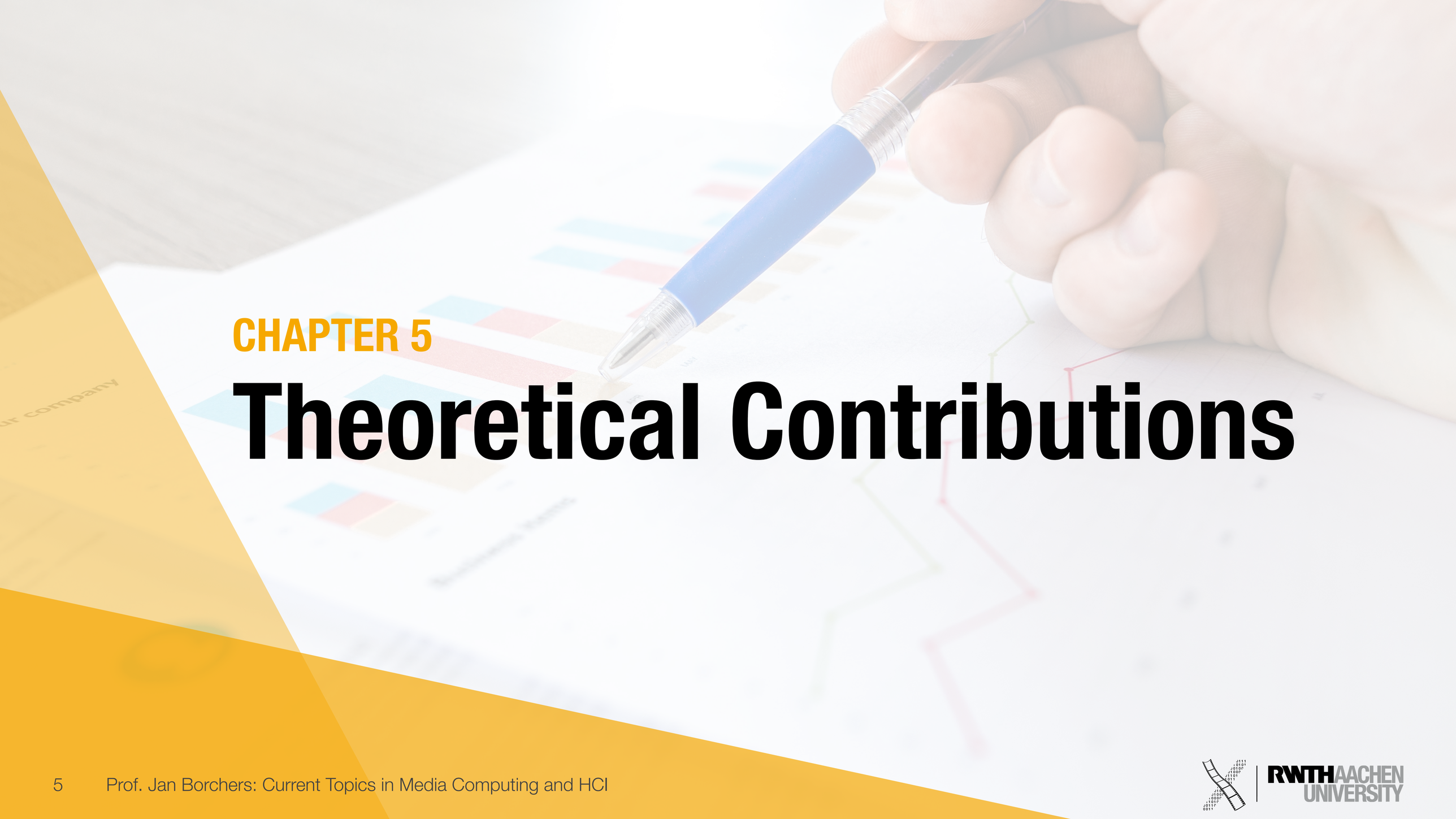
- Knowledge to **improve** how we do, discover, measure, analyze or build in research and practice

- Evaluated based on:
  - Utility
  - Reproducibility
  - Reliability
  - Enhancing Abilities

- Requires **repeated validations**

Example: Metrics for Text Entry Research

- Soukoreff and MacKenzie, CHI ’03
- Developed a new set of statistics to evaluate input errors in keyboard-based text entry
  - TOTAL ERROR RATE combines errors committed but corrected and errors left in the transcribed text
- Method: **Empirical experiment**
  - Evaluating text entry error rate when manipulating the persistence or absence of text
  - Results analysed with new and old statistics: **Similar numerical performance**



CHAPTER 5

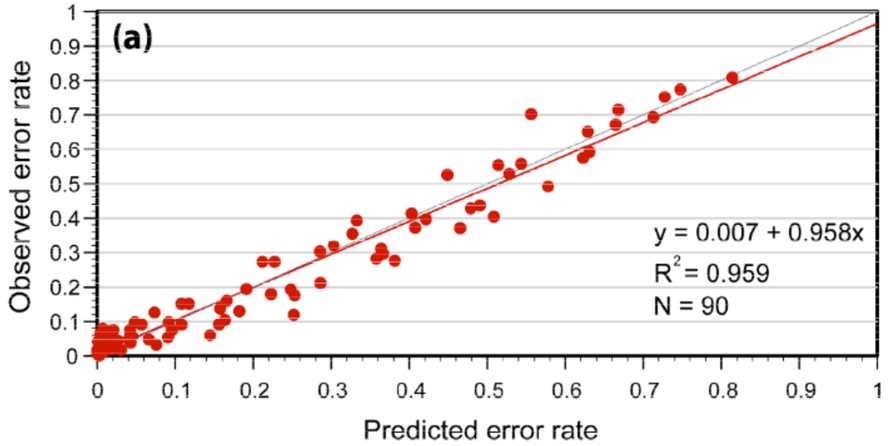
Theoretical Contributions

Theoretical Contributions

- Knowledge on what and why we do things, and our expectations
- Have descriptive and/or predictive power
  - Describe what would happen and explain why it occurs
- New **concepts**, **definitions**, **principles**, **models**, or **frameworks**
- Must be **testable** and **falsifiable**
- **Evaluated using empirical methods** based on novelty, soundness, power to describe, predict or explain, and ability to generalise

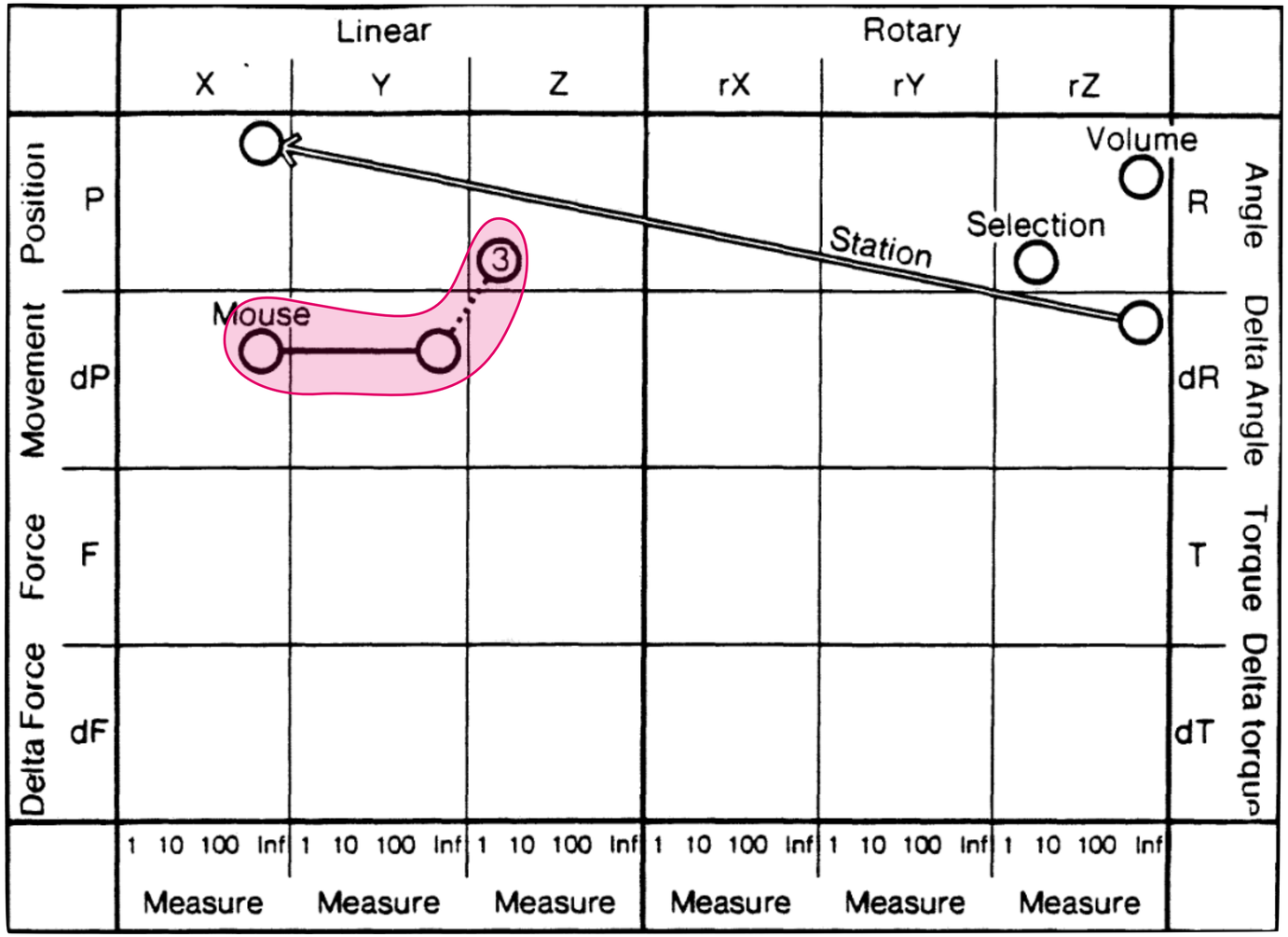
Example: Error model based on Fitts' Law

- Wobbrock et al., CHI '08
- Derived a predictive error rate model mathematically from Fitts' law
- Goal: Evaluate the validity of the model



- Method: User experiment manipulating Fitts' law parameters
  - Confirmed that results compare to previous research, and that Fitts' law assumptions hold for error rates too
  - Compared the results of applying the new prediction model to the observed data
- Predicted and observed error rates showed **strong correlations** in all conditions

Theoretical Contr.: Input Devices Design Space

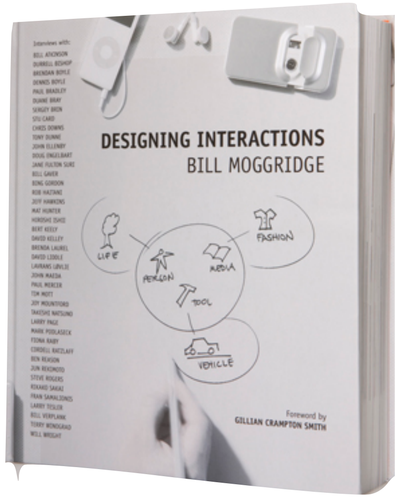


Card et al., CHI ’90

Design Meets Science

"This was my ideal model of how the supporting science could work. It required good designers to actually do design, but what we could do was help structure the design space so that the movement through that design space was much more rapid. The science didn't design the mouse, but it provided the constraints to do it."

— Stu Card. In Bill Moggridge, **Designing Interactions** (2007)



CHAPTER 6

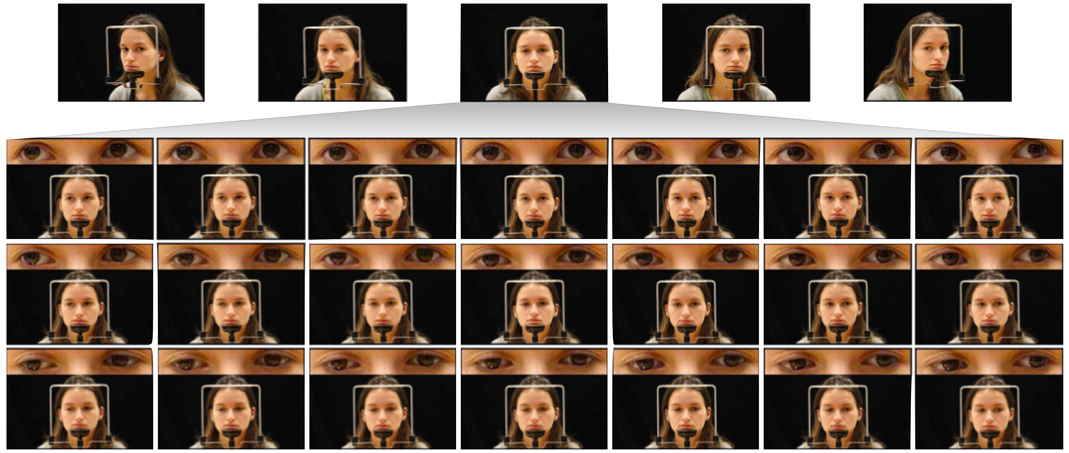
Dataset, Survey and Opinion Contributions

Dataset Contributions

- Corpus of **raw data points** including an **analysis of its characteristics**
- Enable comparing new and standardised
  - Algorithms
  - Systems
  - Methods
- Evaluation:
  - How representative and useful is the data to the research community?
- Usually **accompanied by tools** to view and apply the data

Example: Gaze Locking

- Smith et al., UIST ‘13



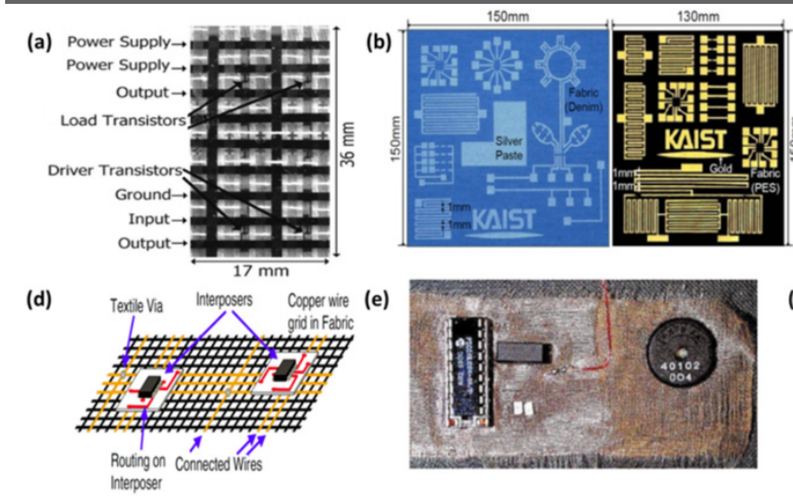
- Gaze data set:
  - 5,880 images, 56 people, 5 head poses
  - 21 gaze directions per head pose
  - Subjects were ethnically diverse, 21 wore glasses
  - Public link provided to access the dataset
- **Described** and **evaluated a method** to analyze the data
- Example applications demonstrate the use of gaze locking in HCI

Survey Contributions

- Also known as “Review Articles”
- A meta-analysis or synthesis of existing research, in order to detect trends and gaps
- Evaluated based on completeness, depth, maturity, and organisation, and the opportunities they reveal for further research
  - Not a mere list of related work
- Excellent starting point to learn about the state of the art in a current field, e.g., for a thesis

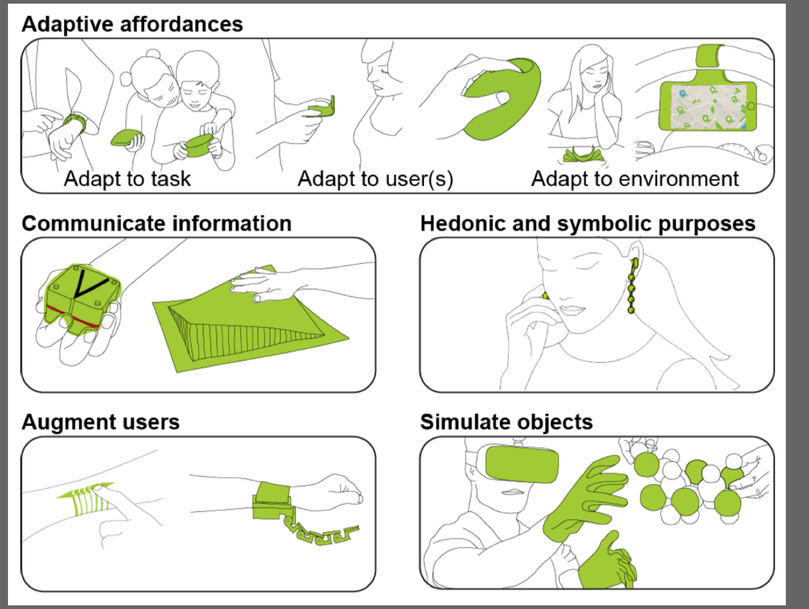
Example: Smart Fabrics & E-textiles

- Castano et al., SMS ’14
  - Defines **different types of smart textiles**
  - Identifies
    - The main research questions in this domain
    - Interesting findings and gaps
  - Compares
    - Conductive threads, fabrication techniques, insulating techniques, etc.
  - Suggests a future direction to the field



Example: Shape-Changing Interfaces

- Alexander et al., CHI ’18
  - Identifies 12 **grand challenges** for **shape-change research** across different fields, like engineering, robotics, etc.
  - Highlights the importance and opportunities of these challenges



Opinion Contributions

- **Change** the opinion of reader through persuasion
- Goal is to **encourage reflection, discussion, and debate**
- Build upon the other contribution types to make their case
- Evaluated based on:
  - Strength of the arguments
  - Supporting evidence
  - Consideration of opposing perspectives
- Often by established researchers and for a broader audience

Example: Usability Evaluation Considered Harmful

- Greenberg et al., CHI ’08
  - **Goal:** Understand the critical process of usability evaluation
  - **Argues** that usability evaluation can be ineffective if done just ‘by rule’ rather than ‘by thought’
  - Agrees that, of course, it is very important in early development stage

    -> See our DIA Cycle
  - **Sensitises** readers that each usability evaluation needs individual consideration

In-class Exercise: Identify Research Contributions

- Empirical Contribution
- Artifact Contribution
- Methodological Contributions
- Theoretical Contribution
- Dataset Contribution
- Survey Contribution
- Opinion Contribution

Solution

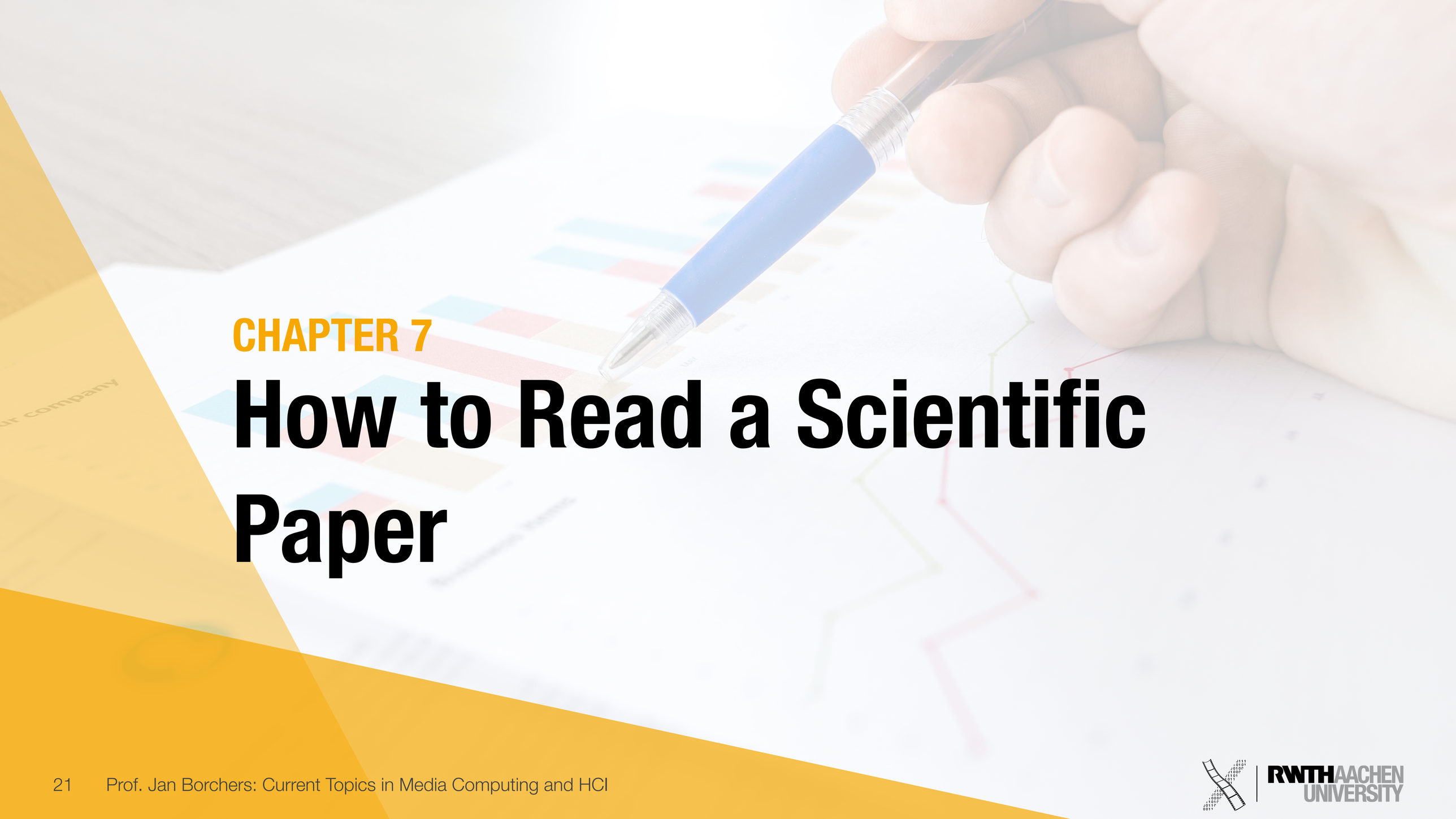
1. **Empirical** - Crowdsourced study. Pandey, A.V., Rall, K., Satterthwaite, M.L., Nov, O., and Bertini, E. How deceptive are deceptive visualizations?: An empirical analysis of common distortion techniques.

2. **Artifact** - Input technique. Grossman, T. and Balakrishnan, R. The Bubble Cursor: Enhancing target acquisition by dynamic resizing of the cursor's activation area.

3. **Empirical** - Interview study. Burke, M., Kraut, R., and Williams, D. Social use of computer- mediated communication by adults on the autism spectrum.

Solution

4. **Methodological**
5. **Theoretical**
6. **Theoretical**
7. **Dataset**
8. **Opinion**
9. **Survey**



CHAPTER 7

How to Read a Scientific Paper

How to Read A Scientific Paper

See: '**How to Read a Scientific Article'** (Purugganan & Hewitt 2004)

1. Read the **title**, determine your interest

2. **Skim** the **paper** and identify the **structure**
   - For empirical research, **IMRD** structure is popular: Abstract, **I**ntroduction, **M**ethods, **R**esults, and **D**iscussion

3. Read **abstract**: motivation, research problem, methodology, some results & conclusion

4. Jump to **figures**: identify experiments and results

5. At this point you decide whether to continue, store it for later, or discard it

How to Read A Scientific Paper

- **Introduction**
  - Purpose: create interest, clarify the domain, “shortest path to the problem”
  - Common knowledge statement (broad)
  - What is known about the topic
  - What is not known
  - What question the authors asked and answered (specific)
- **Related work**
  - Similar work and base knowledge

How to Read A Scientific Paper

- **Methods** (more on that next week)
  - What experiments were done
  - What variables were considered
- **Results** (objective)
  - Statements of what was found (from observation & data analysis), and reference to the data in figures and tables
- **Discussion**
  - Show how results (don’t) answer your question
  - Identify unexpected findings

Ask Yourself These Questions While Reading

- What specific **problem** does this research address? Why is it important?
- Is the **method** used a good one? The best one?
- What are the specific **findings**? Am I able to summarize them in short?
- Are the findings supported by persuasive **evidence**?
- Is there an **alternative interpretation** of the data that the author did not address?
- How are the **findings unique/new/unusual** or supportive of other work?
- How do these results relate to the **work I am interested** in?

CHAPTER 8

Contribution and Benefit Statements

Contribution and Benefits

- Reading: '**Statement of Contribution and Benefits**' (Newman 2002)
- Describes the **contribution made** by the paper to HCI and the **benefit to people**
- **30 words** or less
- Examples:
  - *Describes a camera-based technique for tracking a laser pointer on a large display, and appropriate interactor widgets: provides an inexpensive way to support group interaction with one display.*
  - *Offers guidelines for the design of interfaces to be used by brain-injured people via the Cyberlink interface; usage can lead to improved communication by the brain-injured.*

Contribution

- The generic nature of the contribution and its **type** (technique, system, model)
  - ***A technique*** *for tracking a pointer on a large display*
  - ***Guidelines*** *for the design of interfaces to be used by brain-injured people*

- How it is **unique**
  - *a* ***camera-based*** *technique for tracking a pointer on a large display*
  - *guidelines for the design of interfaces to be used by brain-injured people via the* ***Cyberlink interface***

Benefit

- If several benefits, choose the main one
- Describe the **nature** of the benefit
- Describe the **improvement** generated by it
- Examples:
  - ***Cost*** *of supporting group interaction is* ***reduced***
  - ***Communication*** *by the brain-injured is* ***improved***

More Examples

- *Describes a system providing an audio background whilst a paper-based book is read; a way of applying interactive audio technology to enrich the reader's experience.*

- *Presents findings concerning the effect of input device size on steering tasks: can assist designers in optimally sizing input devices.*

- *Finds differences in the effectiveness of three tools for building GOMS models, when examined in terms of four criteria; offers recommendations for improvements in future GOMS tools.*

- *Presents a case study of a mixed-reality performance, offering observations about participants' experiences; suggests how participant engagement might be enhanced.*

In-class Exercise: Write a Contribution and Benefit Statement

Improving Command Selection with CommandMaps

Joey Scarr, Andy Cockburn, Carl Gutwin, and Andrea Bunt. CHI 2012.

Designers of GUI applications typically arrange commands in hierarchical structures, such as menus, due to screen space limitations. However, hierarchical organisations are known to slow down expert users. This paper proposes the use of spatial memory in combination with hierarchy flattening as a means of improving GUI performance. We demonstrate these concepts through the design of a command selection interface, called CommandMaps, and analyse its theoretical performance characteristics. We then describe two studies evaluating CommandMaps against menus and Microsoft's Ribbon interface for both novice and experienced users. Results show that for novice users, there is no significant performance difference between CommandMaps and traditional interfaces — but for experienced users, CommandMaps are significantly faster than both menus and the Ribbon.

What to do next?

- Join the lab this Wednesday, April 15th