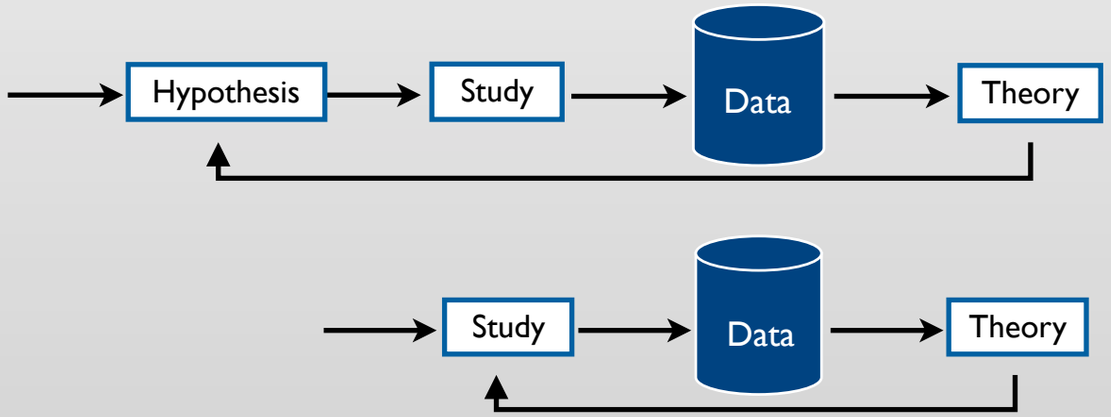
Last Tuesday in Current Topics…

- Contrast between empirical science and ethnography approach
- Triangulation



- Three key attributes of good research using engineering & design approach
- How to treat "other variables"
- Internal validity vs. external validity

“Current” Topics

HCI Research Literacy III

Results and Dissemination with Examples from Midair Input

Applications of Midair Input

A Handlebar Metaphor

Available at: http://dl.acm.org/citation.cfm?id=2208585

3D spatial interactions

Song et al., CHI ’12

Going beyond the surface

Available at: http://dl.acm.org/citation.cfm?id=2208583

Expanding interactive surfaces

Spindler et al., CHI ’12

Understanding Naturalness and Intuitiveness in Gesture Production

Available at: http://dl.acm.org/citation.cfm?id=1979061

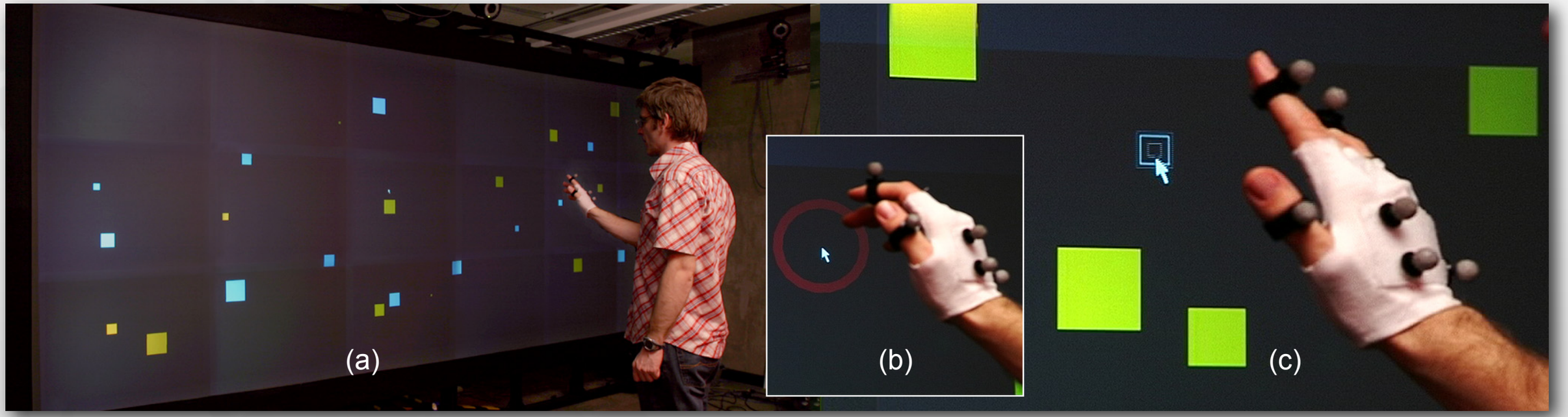
Communication with gestures

Grandhi et al., CHI '11

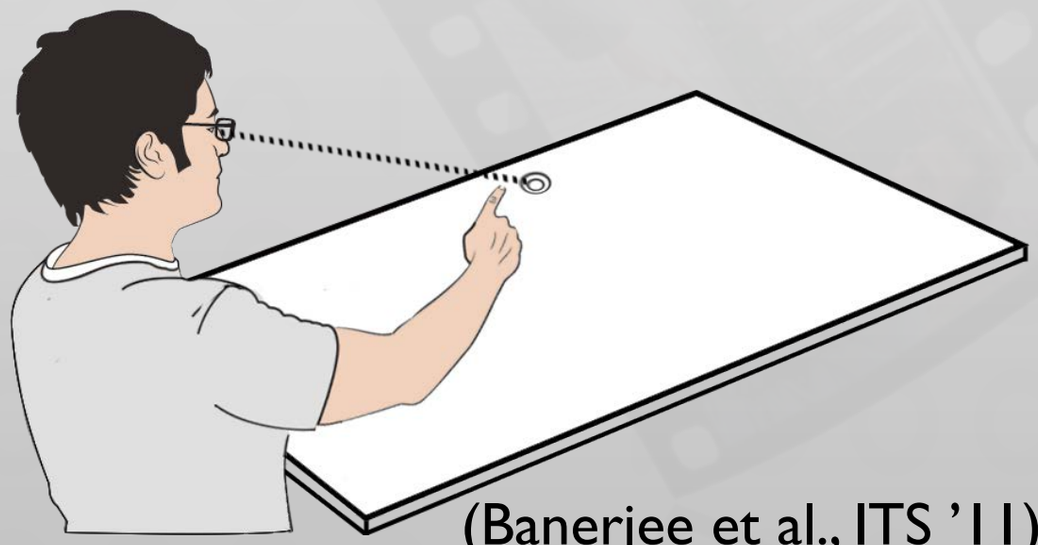
Benefits and Drawbacks of Midair Input

+ High degree-of-freedom
+ Move beyond desk/mobile
+ Natural way for gestural communication
— Noisy input and accidental activation
— Exertion: The Gorilla Arm problem
— Privacy and social acceptance

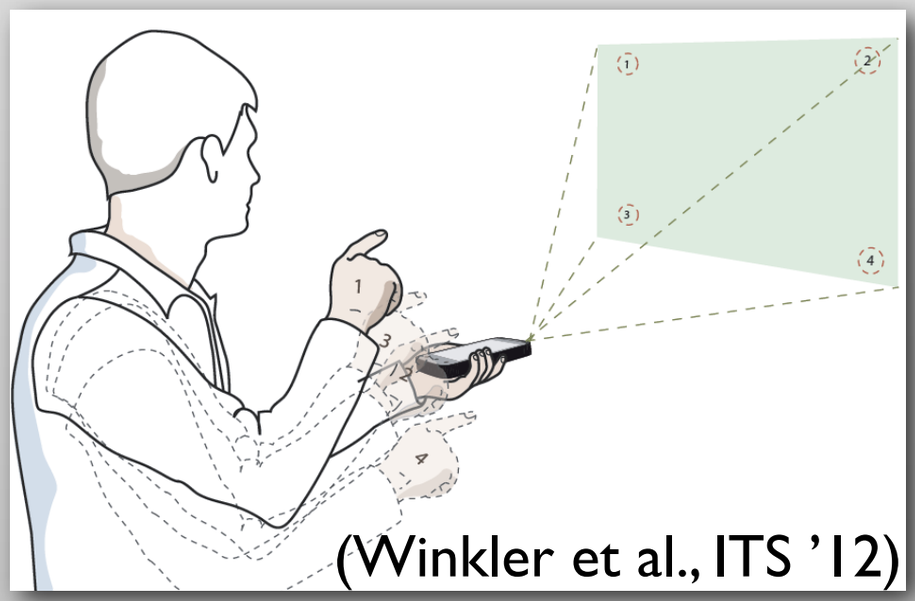
Midair Pointing



(Vogel & Balakrishnan, UIST '05)

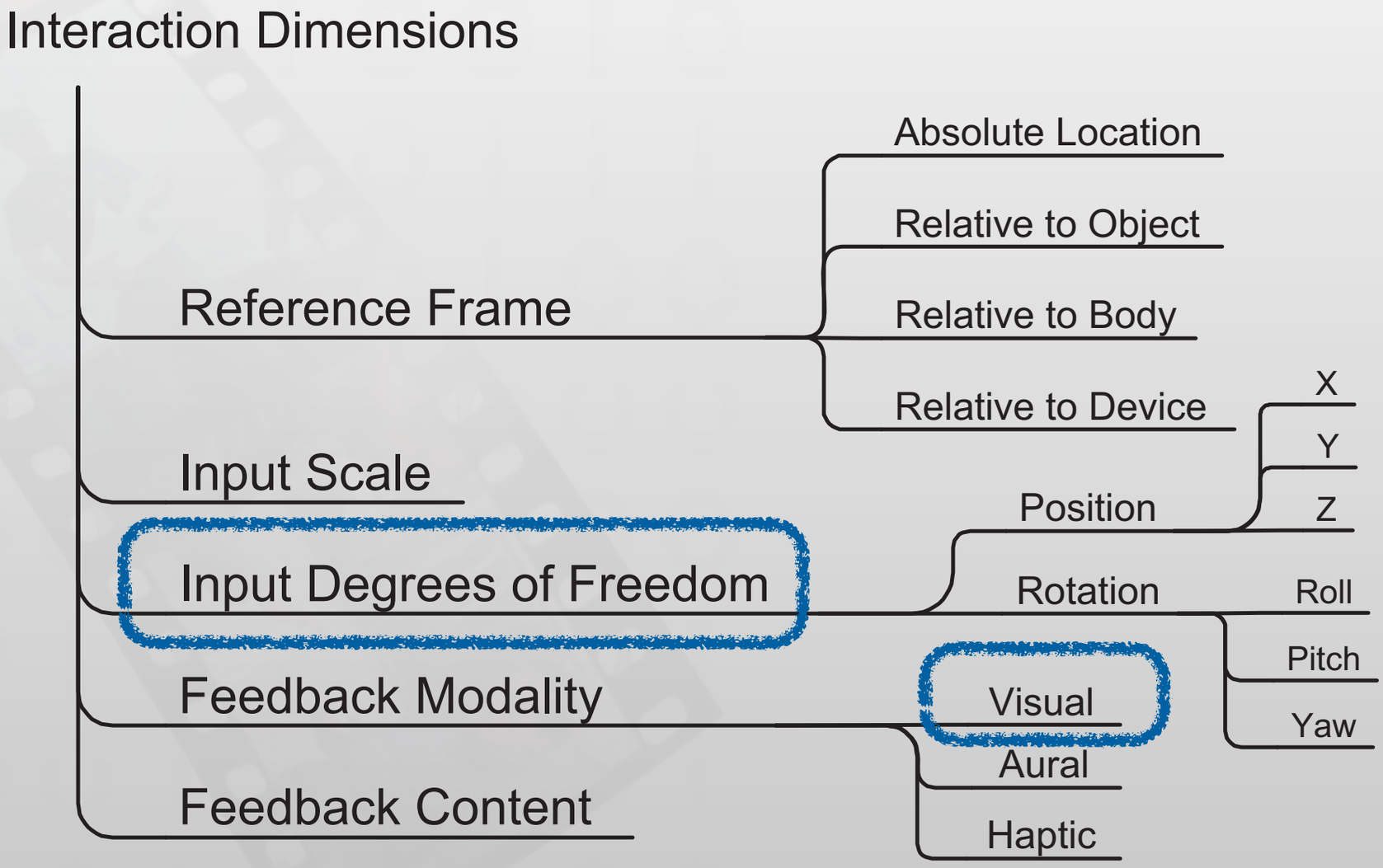


(Banerjee et al., ITS '11)



(Winkler et al., ITS '12)

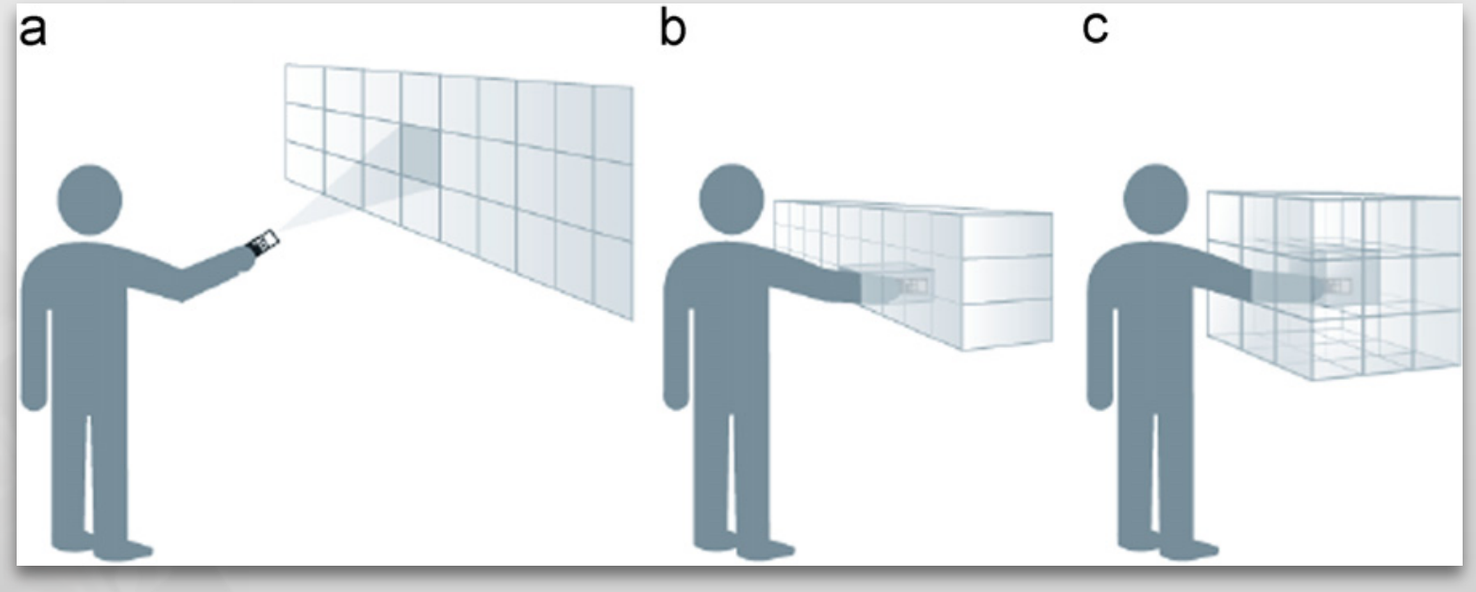
Characterizing Design Space of Midair Pointing



(Cockburn et al, International Journal of Human-Computer Studies '11)

User Study: Effect of DoF and Visual Feedback

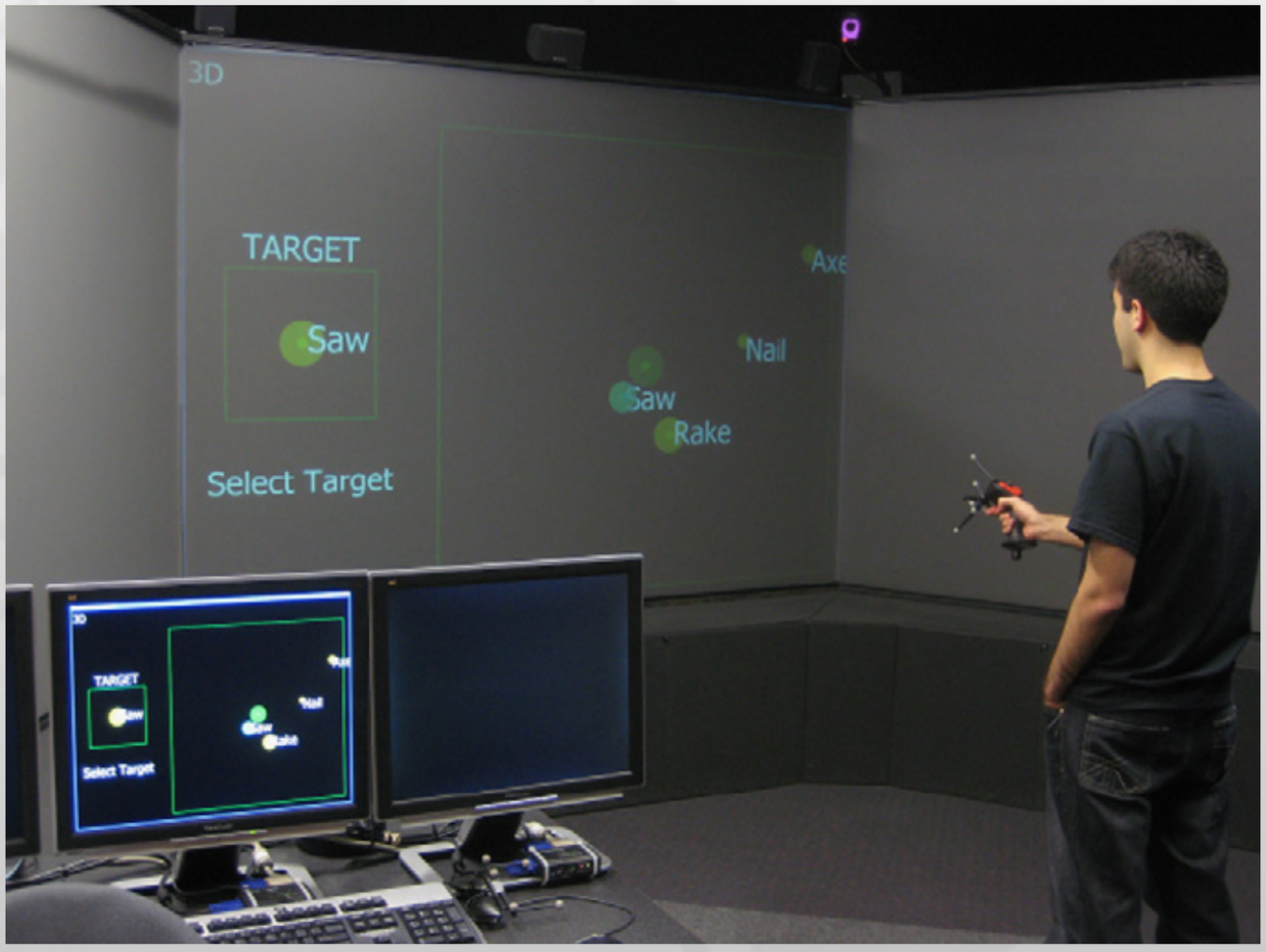
- Degrees of freedom
  - Ray casting: pitch and yaw
  - 2D plane: high, left
  - 3D volume: high, left, back



Raycasting 2D plane 3D volume

(Cockburn et al, International Journal of Human-Computer Studies '11)

User Study: Effect of DoF and Visual Feedback



- Gradually reducing feedback
  - Full visual feedback: target location, origin, cursor
  - Hide the cursor
  - Hide the origin location, target, and cursor
  - No visual feedback

(Cockburn et al, International Journal of Human-Computer Studies '11)

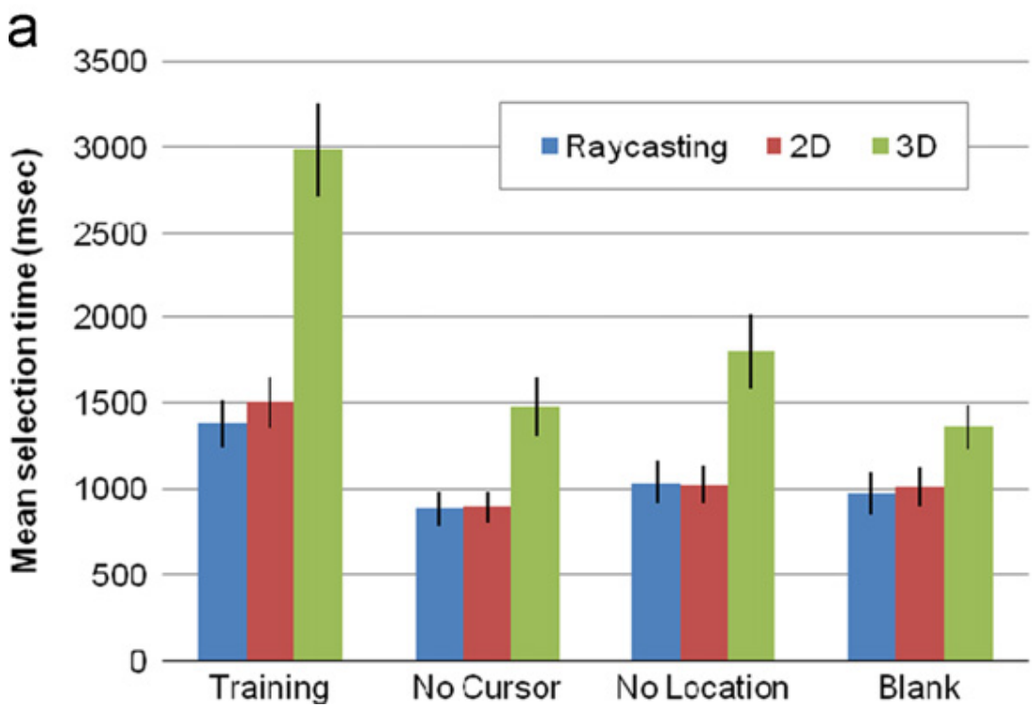
User Study: Effect of DoF and Visual Feedback

- Degrees of freedom
  - Ray casting: pitch and yaw
  - 2D plane: high, left
  - 3D volume: high, left, back
- Gradually reducing feedback
  - Full visual feedback: target location, origin, cursor
  - Without cursor
  - Without origin location and cursor
  - No visual feedback

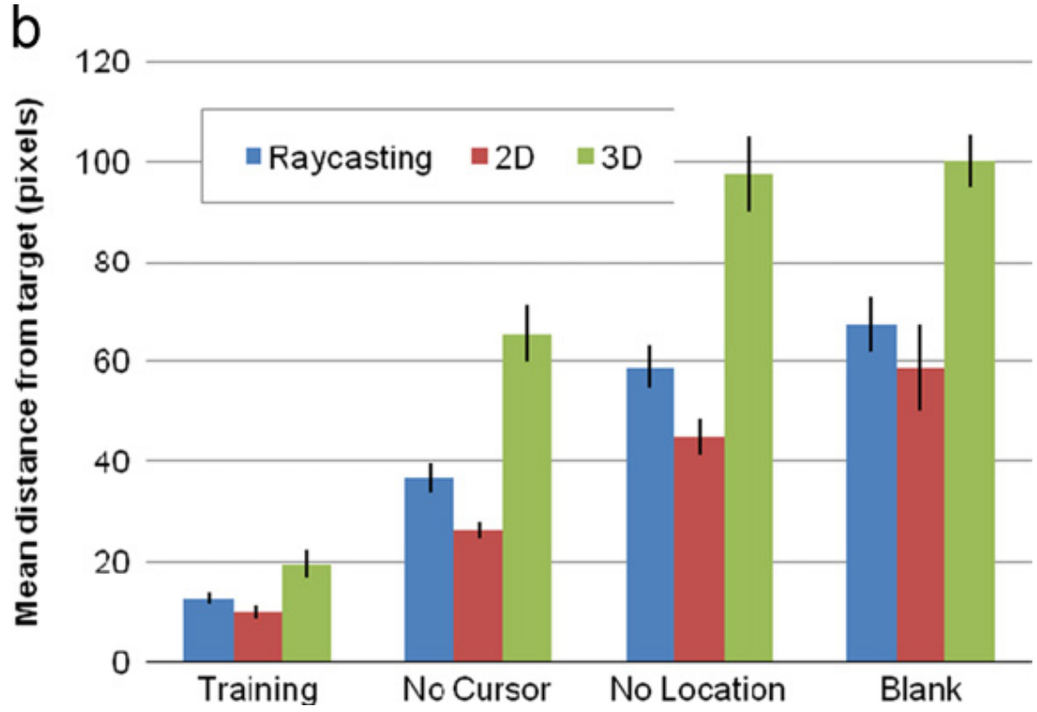
Speed, accuracy, …

In-class exercise: Sketch two graphs showing the result

(Cockburn et al, International Journal of Human-Computer Studies '11)



Speed: selection time



Accuracy: distance from target

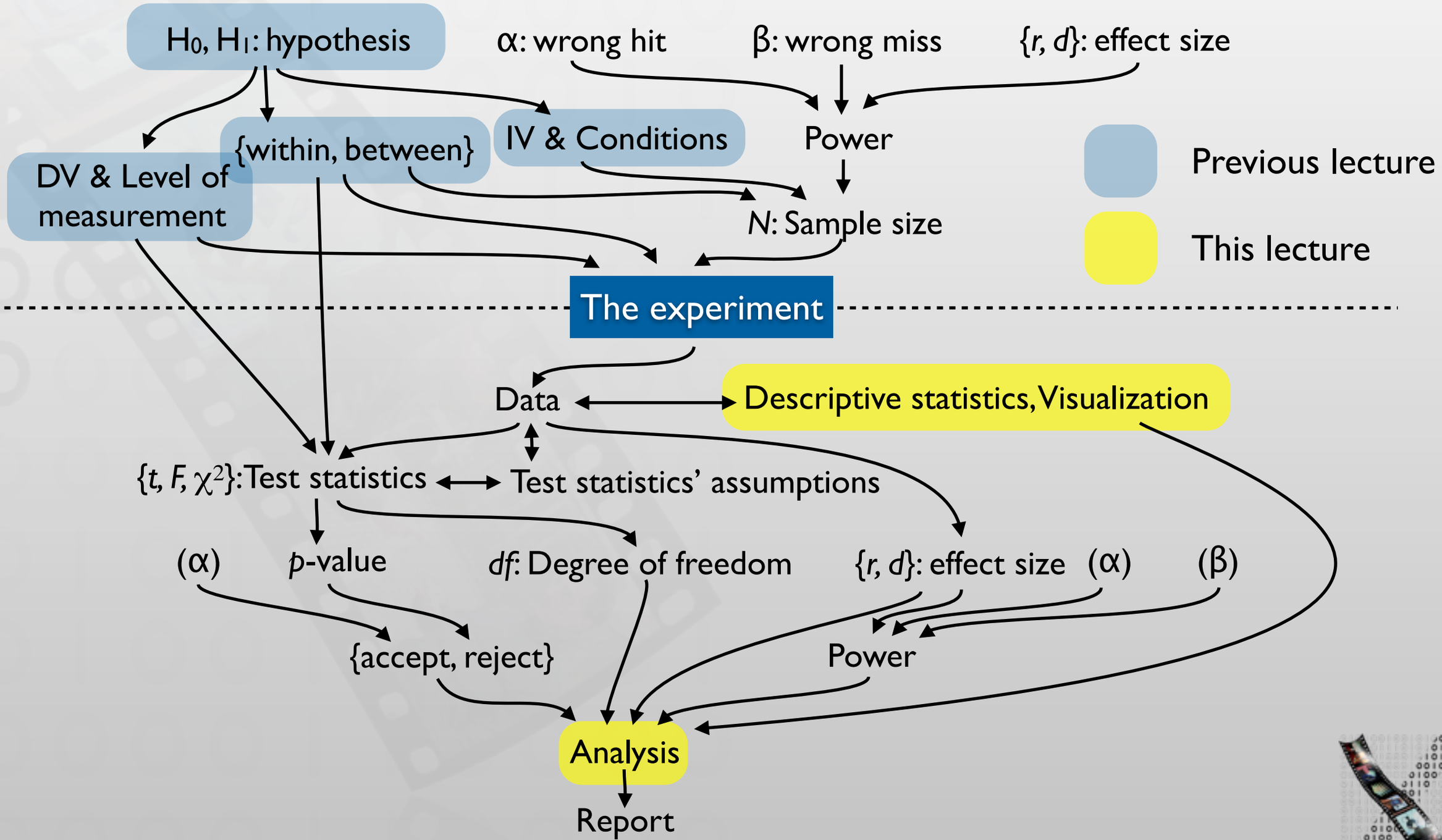
(Cockburn et al, International Journal of Human-Computer Studies '11)

DATA: BY THE NUMBERS

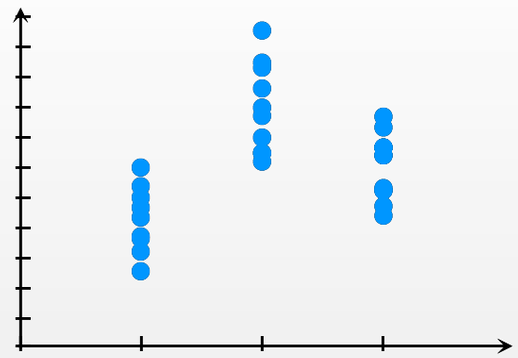
"Piled Higher and Deeper" by Jorge Cham www.phdcomics.com

Reading the Results

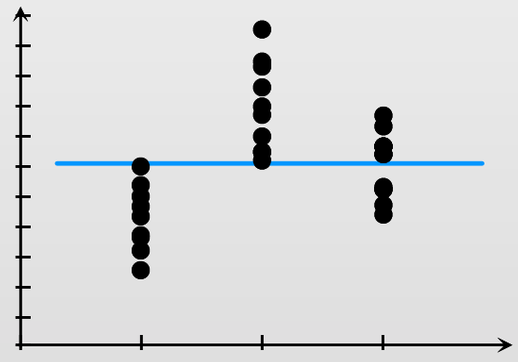
Statistics in Experimental Research



ANOVA: Analysis of Variance

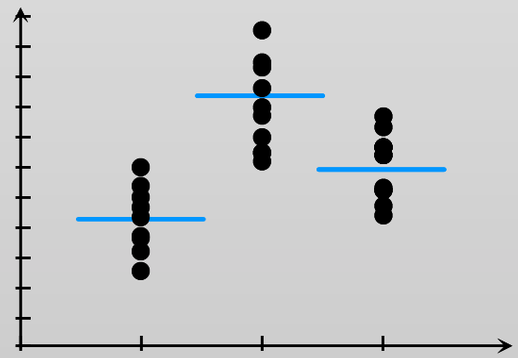


Maximal model



Null model

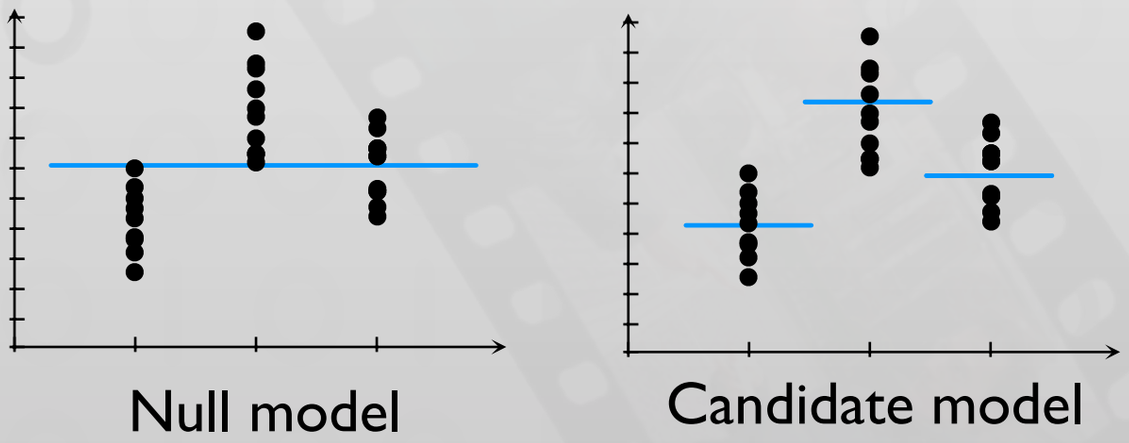
- Goal: partition the variance from different sources
- Method: fit different models and determine how good the models explain the data
  - Maximal model: one parameter per data point
  - Null model: all data points are represented by
  - Determine just adequate candidate model that fits the data



A candidate model

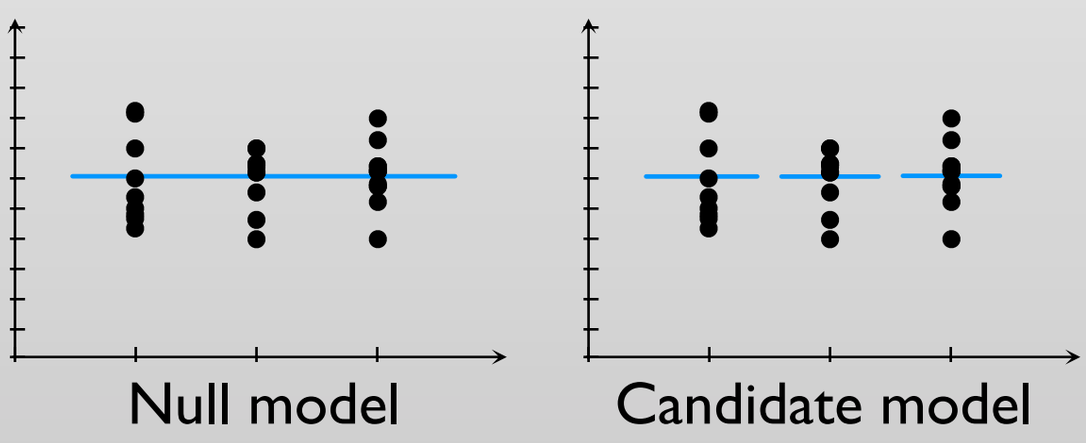
ANOVA: Analysis of Variance

- Assess goodness of fit
  - Candidate model fits better than null model ⇒ The effect is statistically significant
  - Candidate model fits as well as null model ⇒ The effect is not statistically significant
- Both mean and variance matter: Examples here are simplified



Statistically significant

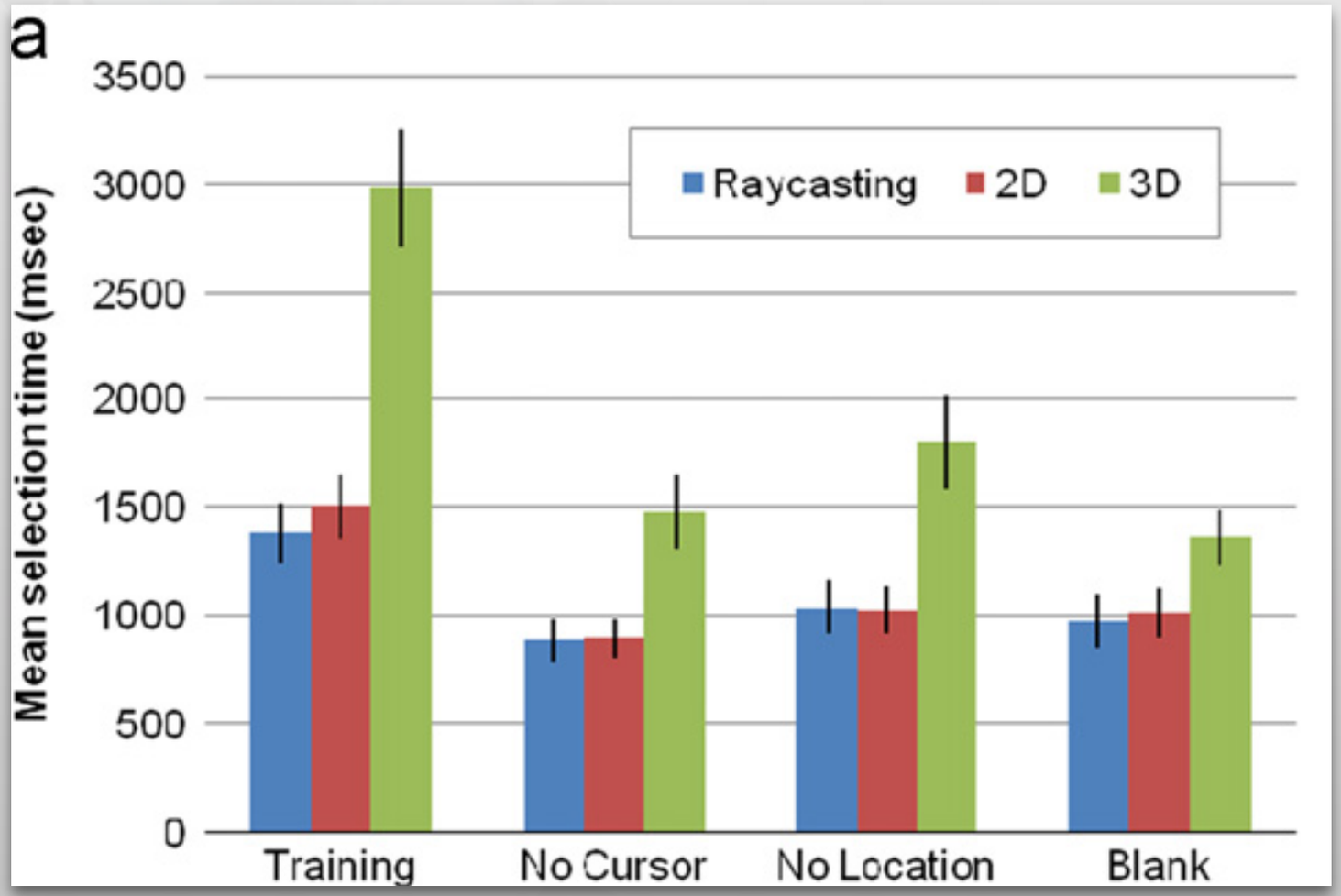
E.g., $F_{2, 28} = 73.07, p < .001$

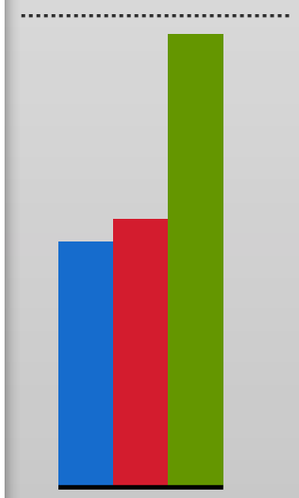


Not statistically significant

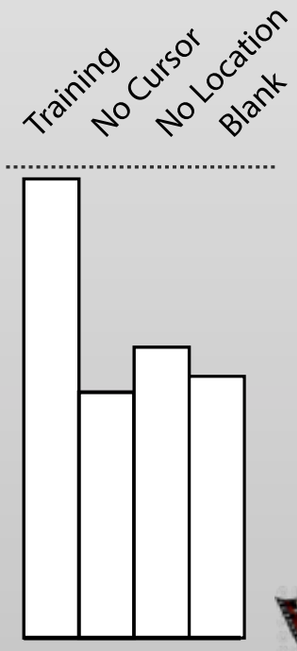
Main Effect

- Effect that each independent variable has to the dependent variable
  - Shown by mean of each level of a variable
- Main effect of interface and feedback type to selection time





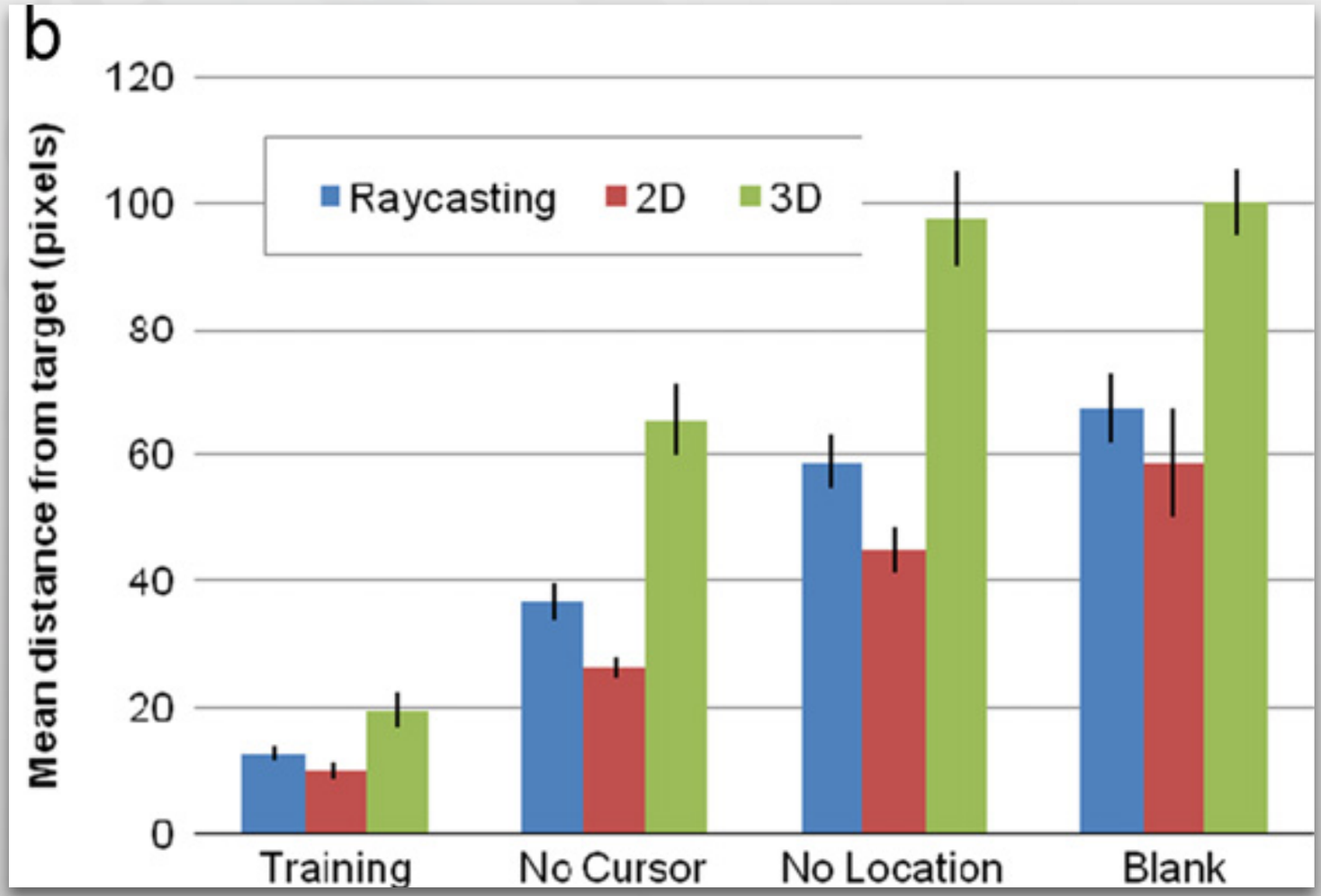
Average across interfaces

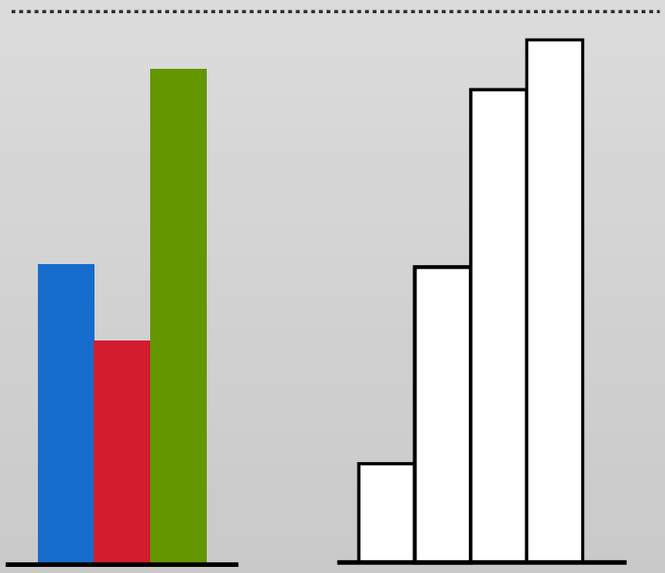


Average across feedbacks

In-class Exercise: Main Effect

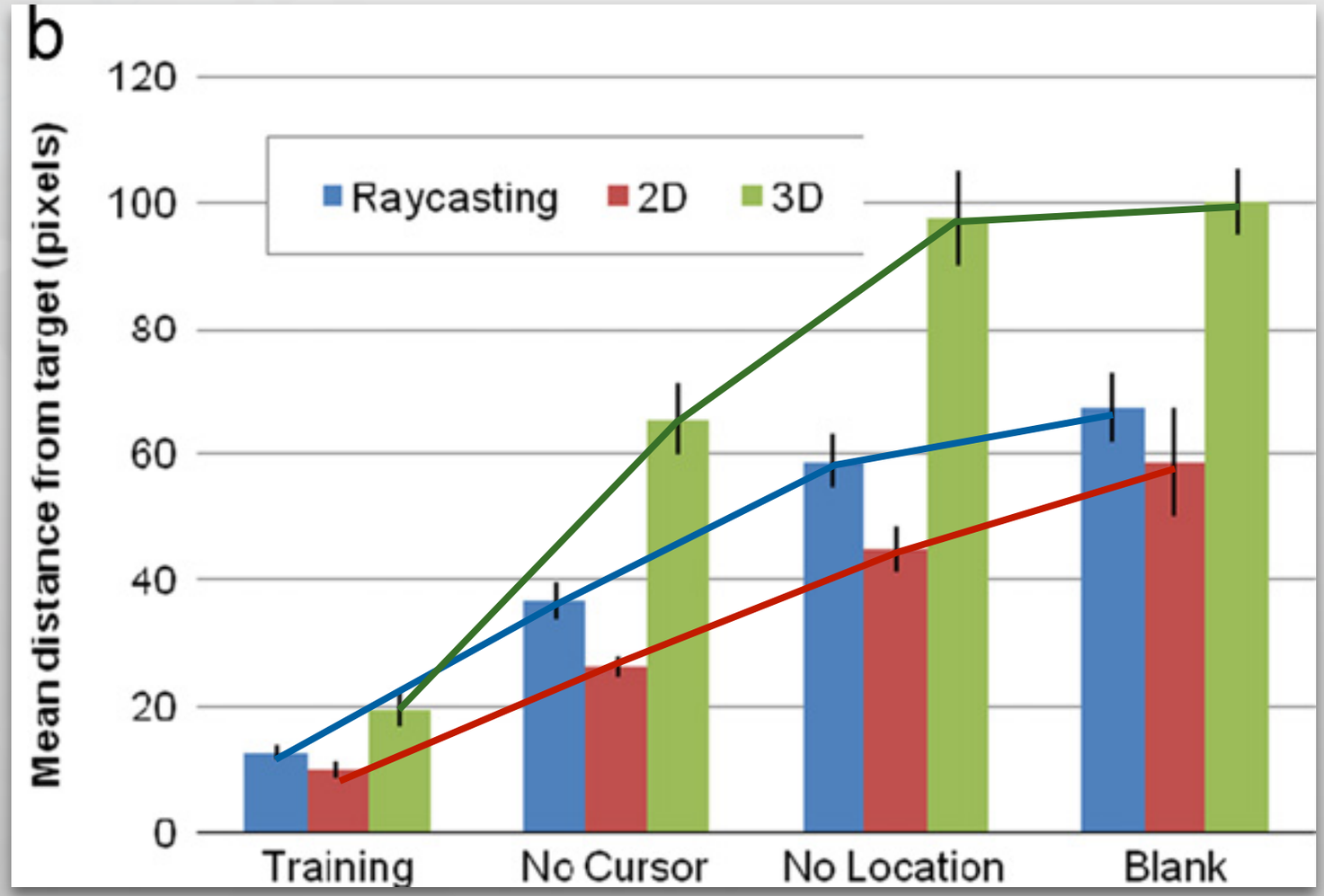
- Draw graphs comparing the main effects of interface and feedback to the accuracy and discuss your analysis with your neighbor





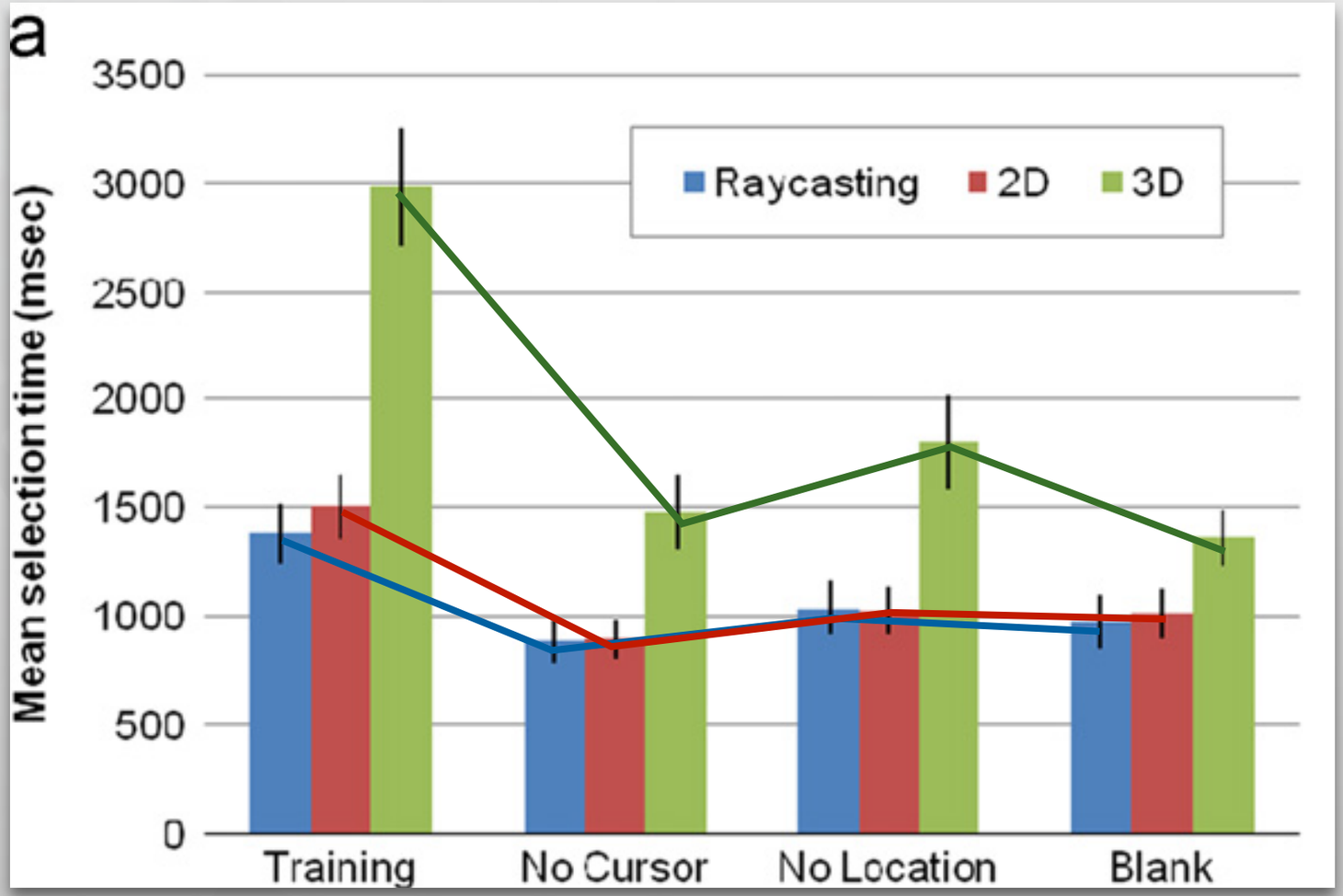
Interaction Effect

- Effect of one independent variable depends on the particular level of another independent variable
  - Visualized by non-parallel lines connecting the same level of a variable
- Distance increases in 3D more rapidly than in 2D and Raycasting



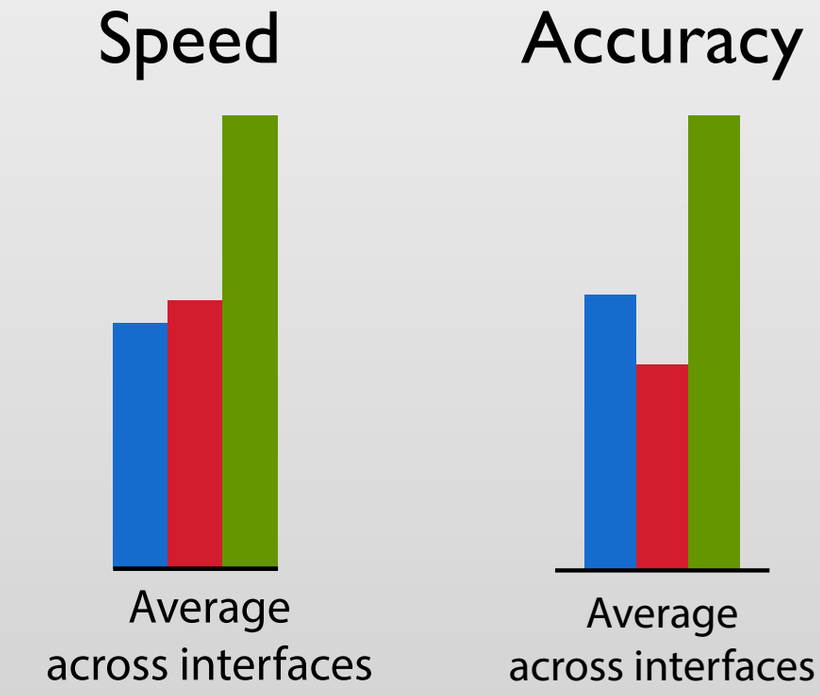
In-class Exercise

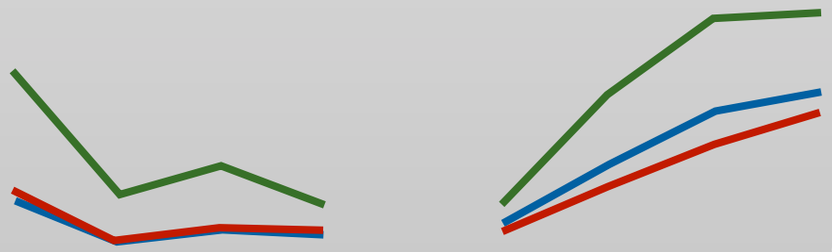
- Draw graphs comparing the interaction effects interface × feedback to the selection time and discuss your analysis with your neighbor



Putting Them All Together

- Regardless of feedback, Raycasting and 2D plane are comparable in speed
- Raycasting is slightly less accurate
- 3D volume is much slower and less accurate across the board

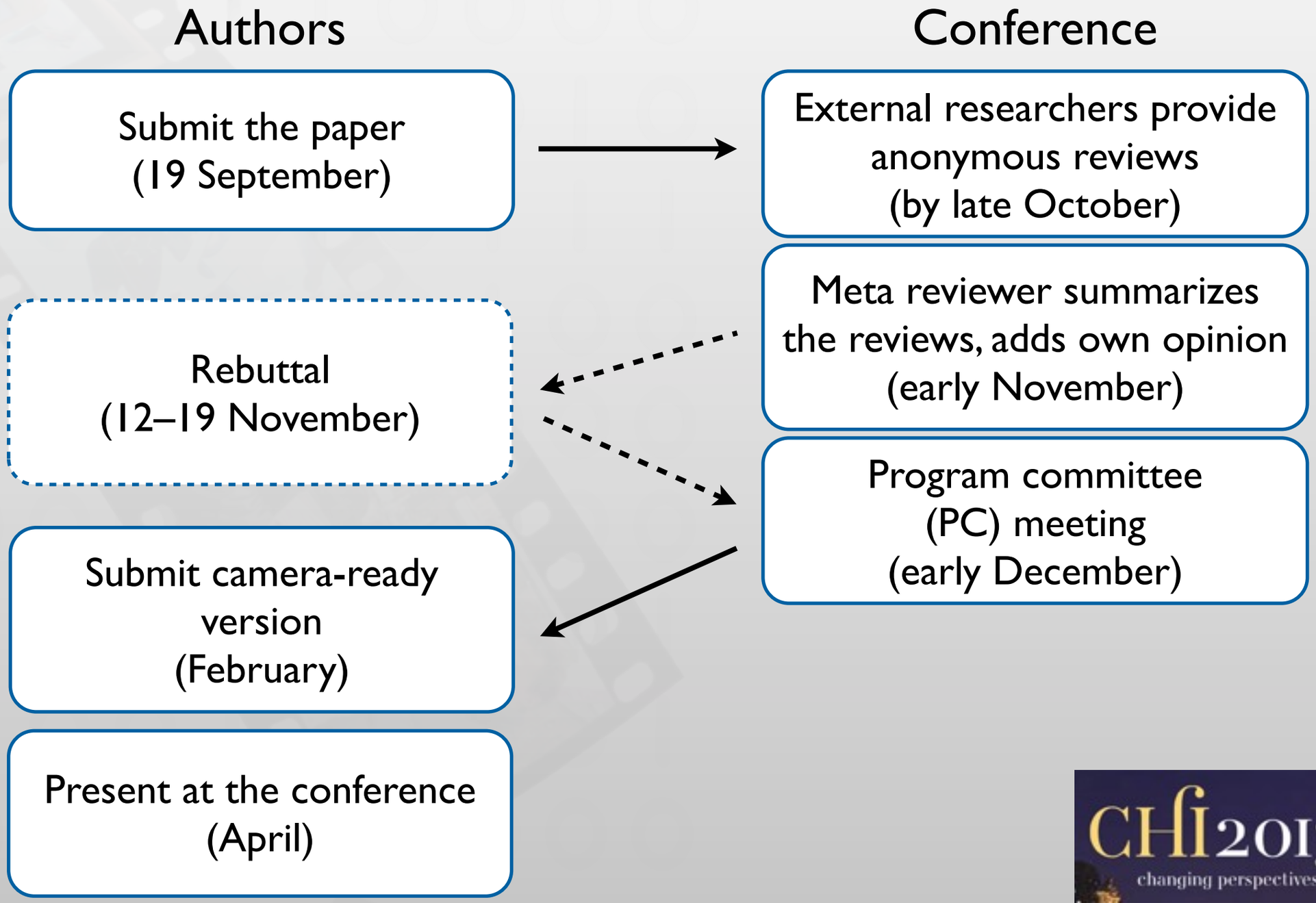




"To call in the statistician after the experiment is done may be no more than asking him to perform a post-mortem examination: he may be able to say what the experiment died of." — Ronald Fisher

Dissemination

Peer Reviewing Process



http://chi2013.acm.org/authors/call-for-participation/papers-notes/

Criteria for a Good Paper

- Contribution: What new insight does it bring to the field?
- Benefits: What can one learn from this / do with this?
- Novelty: Prior publications?
- Validity: Are the claims properly backed up?
- Applicability: How good does the paper match the likely audience?
- Format: Readability and clarity

Structure of a Review

- Overall rating: 1: definite reject – 5: definite accept
- Short summary of the contributions and benefits
  - "This paper presents… (who) will benefit from (what)
- Concerns
  - Originality
  - Validity
  - Clarity
- Suggestions for improvement
- Reviewer's expertise: 1: no knowledge – 4 expert

Reviewing Checklist

- Recommending accept
  - Convince yourself that it has no serious defects
  - Convince the editor that it is of an acceptable standard, by explaining why it is original, valid, and clear
  - List the changes that should be made before it appears in print

    Where possible: indicating not just *what to change* but *what to change it to*
  - Take reasonable care in checking details, e..g, mathematics, formulas, and bibliography

- Recommending reject
  - Clearly explain the faults and, where possible, discuss how they could be rectified
  - Indicate which parts of the work are of value and which should be discarded
  - Check the paper to a reasonable level of detail

From *Writing for Computer Science* (Zobel, 2004)

Reviewing Checklist

- Always do the following in either case
- Provide good references with which the authors should be familiar
- Ask yourself whether your comments are fair, specific, and polite
- Be honest about your limitations as a referee of that paper
- Check your review carefully as you would check one of your own paper prior to submission

From *Writing for Computer Science* (Zobel, 2004)

Assignment 1: Write a Review

- Reading assignments
  - Pointing at 3D Target Projections with One-Eyed and Stereo Cursors (Teather and Stuerzlinger, CHI '13)

REQUIRED

Write a review

  - A Comparison of Ray Pointing Techniques for Very Large Displays (Jota et al., GI '10)

REQUIRED

  - Towards a Standard for Pointing Device Evaluation: Perspectives on 27 Years of Fitts' Law research in HCI. (Soukoreff and MacKenzie, Int. J. Human–Computer Study, 2004)

Skim & Reference

Assignment 1: Write a Review

- In groups of six, write a review for
  - Pointing at 3D Target Projections with One-Eyed and Stereo Cursors (Teather and Stuerzlinger, CHI '13)

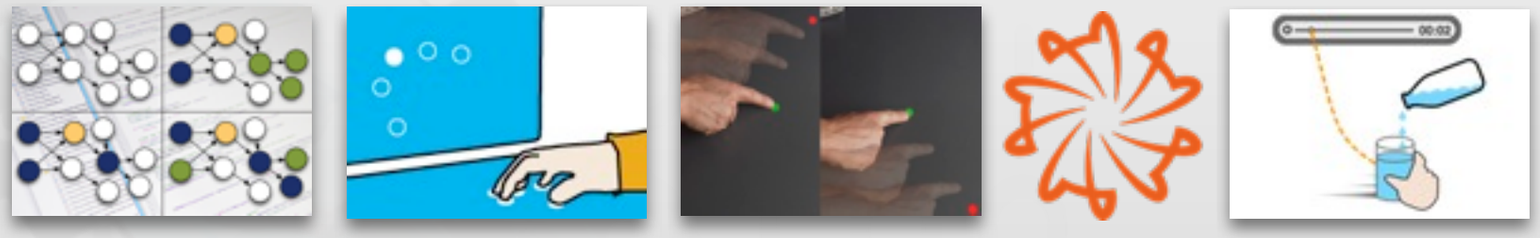
REQUIRED

Write a review

- Submission: One page A4 (Helvetica or Arial 12pt)
- Timeline
  - First submission deadline: Friday, May 3rd, 2013 before 12:00 noon
  - Group feedback: Wednesday, May 8th, 2013 in the lab
  - Revise-and-resubmit deadline: Wednesday, May 14th, 2013 before 12:00 noon
- Graded assignment: 5% total score of the course

Coming Up Next…

- April 30th: No lecture



  - Enjoy your CHI 2013 with video previews: http://chischedule.org/2013/

- May 7th: No lecture: Student Representative Council Meetings
- May 8th: Lab — Feedback of Assignment 1
- May 14th: Lecture — Human Computation by Leonhard Lichtschlag