INFOMSCIP 2019-2020
lectures 14&15
Oct 21&24, 2019

Sources used for the following slides (also highly recommended for further reading):

- J. Borchers' course on "Current Topics in Media Computing and Human-Computer Interaction" at RWTH Aachen
  https://hci.rwth-aachen.de/cthci
- J. Landay's slides "James & Friends' Systems How To – A guide to systems & applications research"
  https://www.slideshare.net/jlanday/systems-researchsocspi20120619
- "How (and How Not) to Write a Good Design Paper:
  A Metaphrase of Roy Levin's and David D. Redell's Evaluation of the Ninth SOSP Submissions"
  http://www.ida.liu.se/~matar/designpaper.pdf
- "How to Read an Engineering Research Paper"
  http://cseweb.ucsd.edu/~wgg/CSE210/howtoread.html
- S. MacKenzie's course on "Empirical research methods
  in human-computer interaction" at ACM CHI 2016
  http://www.yorku.ca/mack/CourseNotes.pdf
- Zobel, Justin. *Writing for computer science*. Springer, 2015
  (available as eBook and PDF via the university library)

Recap: the scientific method

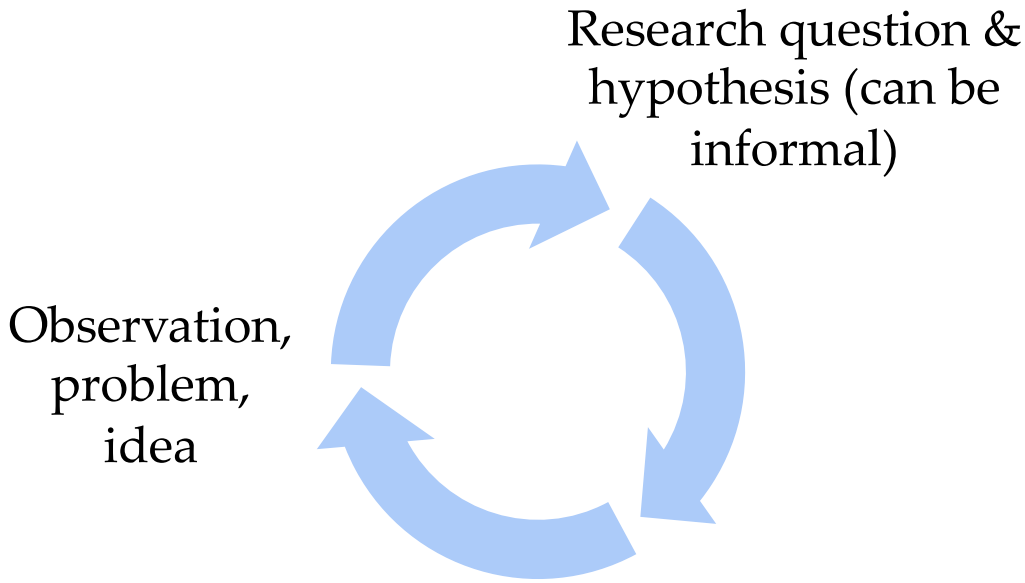
A linearized, pragmatic scheme of the four points above is sometimes offered as a **guideline for proceeding**:

1. Define a question (or: identify a research problem)
2. Gather information and resources (observe)
3. Form an explanatory hypothesis (or: specify research question (& hypoth.))
4. Test the hypothesis by performing an experiment and collecting data in a reproducible manner
5. Analyze the data
6. Interpret the data and draw conclusions that serve as a starting point for new hypothesis
7. Publish results
8. Retest (frequently done by other scientists)

The iterative cycle inherent in this step-by-step method goes from point 3 to 6 back to 3 again.

From Wikipedia, "Scientific method"

In GMT, mostly:



- Fundamental research
- Experimental research
- User studies
- Other (design, engineering, systems)

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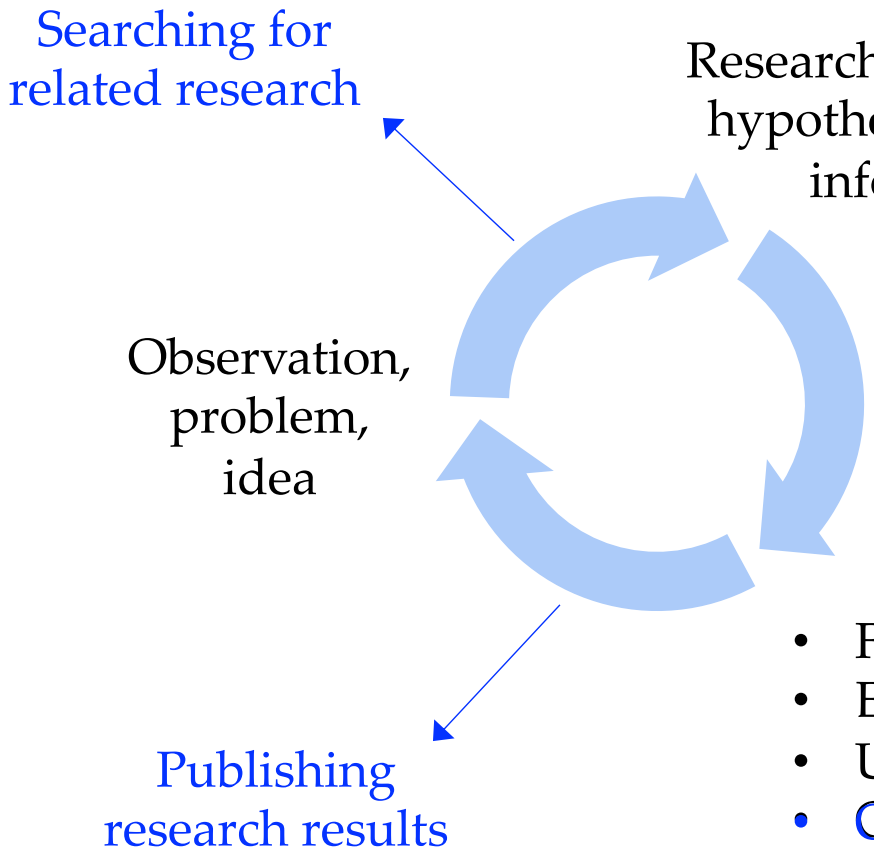

- Fundamental research
- Experimental research
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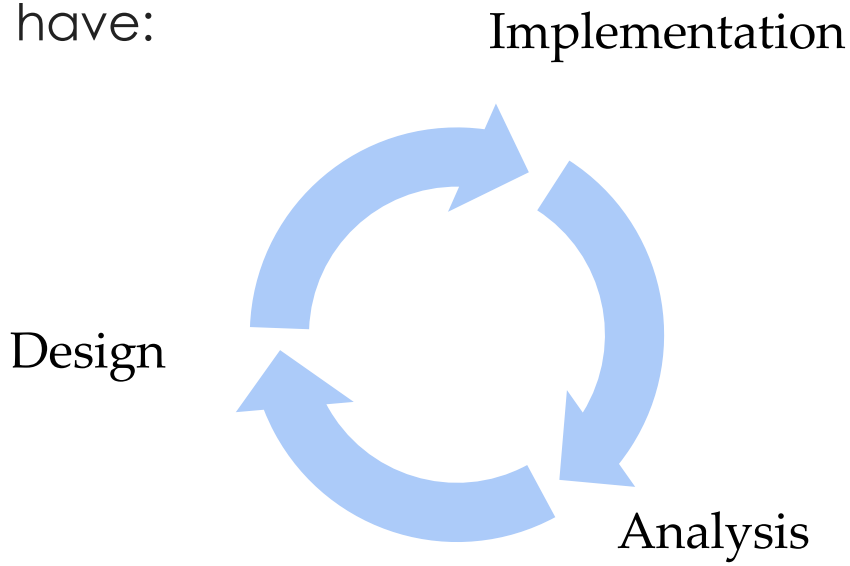
From lecture 1 (introduction)

Applied research follows
a similar approach,
e.g. in HCI, we often have:



But how is this different than "just" implementing and testing?
Because the analysis follows scientific guidelines,
so we are not just testing a concrete implementation but its characteristics.

Scientific perspectives on GMT (INFOMSCIP)

Systems & design research

- Systems & design research
  Key attributes, approaches, characteristics
- How to write a good design paper
  Guidelines and criterial for good design, systems, and engineering research papers

Contribution types in HCI

Empirical research contributions

Artifact contributions

Methodological contributions

Theoretical contributions

Database contributions

Survey contributions

Opinion contributions

Wobbrock, J.O. and Kientz, J.A., 2016. Research contributions in human-computer interaction. *interactions*, *23*(3), pp.38-44.

From lecture 12 (user studies & HCI)

What does it mean to do research in human computer interaction?

Wobbrock and Keintz classify HCI research into these seven categories of contributions.

They have been adopted by the ACM CHI conference series to categorize their submissions.

If you will ever do an HCI-related project, it is highly recommended that you have a look at this paper.

For each contribution type, it also lists some example papers that can serve as inspiration, help, or even blueprint for your own research.

Contribution types in HCI

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From lecture 12 (user studies & HCI)

ARTIFACT CONTRIBUTIONS

HCI is driven by the creation and realization of interactive artifacts. Whereas empirical contributions arise from descriptive discovery driven activities (science), artifact contributions arise from generative design-driven activities (invention).

Artifact research contributions are **evaluated** according to the type of artifact that gave rise to them. They are often accompanied by empirical studies but do not have to be, and sometimes should not be.

This contribution type might be even more important for GMT than for HCI, since we often introduce new concepts, ideas, … (e.g., a new interaction method for games)

In GMT, “artifact or system” contributions are very common. E.g., the implementation of a new, innovative idea.

Yet, there are differences between just ”doing something new” and creating scientific knowledge by doing so.

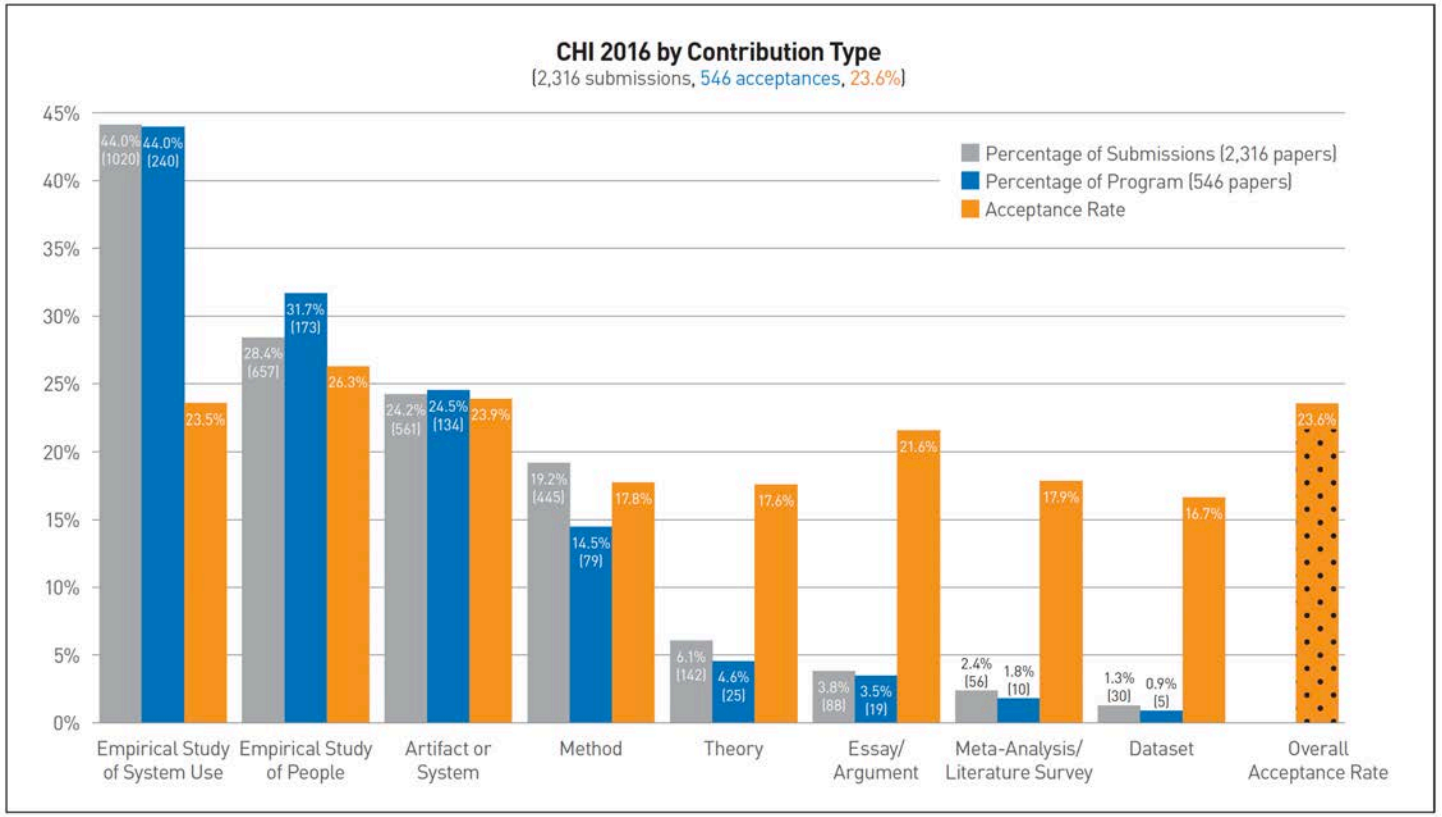
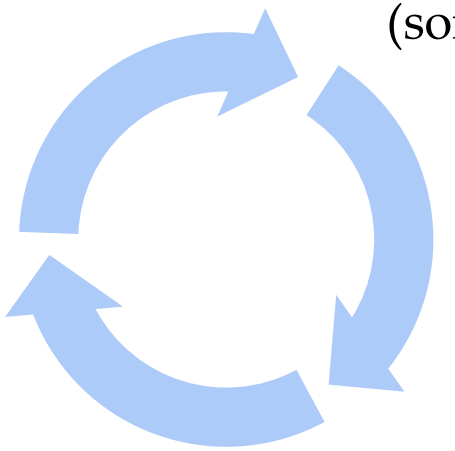


Figure 2.
CHI 2016 submissions and acceptances
by contribution type, sorted by descending number of submissions.

From lecture 12 (user studies & HCI)

Engineering & design

Implementation
It generally includes a (sometimes prototypical) implementation …



Design
It often starts with an informal idea resulting from an observation, identified problem, etc.

Analysis
… and some sort of verification that proves the validity of the idea & design (or indicates for improvement in a new design circle)

Objective: solve a problem with a solution that works
(or come up with a better working new solution to a solved problem)

Also: make sure that your solution is relevant (E.g., if no one has done it before, maybe it's because nobody cares? Or because your solution is obvious?)

Engineering & design: Key attributes

Compelling target

For example:

- Solve a concrete, compelling problem with demonstrated need
- Solve a set of problems using a unified set of principles
- Explore how people will interact with computers in the future

Technical challenge

For example:

- A solution that requires novel, non-trivial algorithms, or configurations of components

Deployed when possible

For example:

- System is deployed and intended benefits and unexpected outcomes documented

Keep in mind: "contribution to GMT" is NOT just an implementation of something related to that domain, but something that "advances the (scientific) field", e.g., by introducing something new (and relevant) and proving that it works (and why).

Engineering & design: Approaches

Strongly depend on targeted attributes and proposed solutions.

General recommendations:

- Match the type of evaluation with how you expect the system to be used
- Use multitude of metrics to get a holistic view

For complex systems, not all ***HCI techniques*** can be applied.

For example:

- **Empirical studies** ➔ for complex systems:
  not meaningful to isolate a small number of variables
- **Usability & A/B tests** ➔ can't tell much about a complex system

Engineering & design: Approaches

Idea evaluation: test overall value of system or application

- If extremely novel, the fact that it works & logical argument to explore "boundaries of value"
- Real world deployment (expensive in time & effort)

Technical evaluation: measure key aspects from technical perspective

- Toolkit: expressiveness (*Can I build it*?), efficiency (*How long will it take*?), accessibility (*Do I know how*?)
- Performance improvement: benchmark (error, scale, efficiency, …)
- Novel component: controlled lab study (*) may not generalize to real-world conditions

Effectiveness evaluation:

- Usability improvement: controlled lab study (*)
- Conceptual understanding: case studies w/ a few real external users

---

(*) may not generalize to real-world conditions

Some very good resources in this context

(highly recommended if you want to do a systems, design, or implementation focused thesis)

J. Landay's slides "James & Friends' Systems How To – A guide to systems & applications research"
https://www.slideshare.net/jlanday/systems-researchsocspi20120619

Good sources illustrating the style and type of design and systems papers (and thus research), including comments on writing that are relevant for all kinds of research papers:

"How (and How Not) to Write a Good Design Paper: A Metaphrase of Roy Levin's and David D. Redell's Evaluation of the Ninth SOSP Submissions"
http://www.ida.liu.se/~matar/designpaper.pdf.

"How to Read an Engineering Research Paper"
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Implementation & design works

- Is this research?
- Can it be published?
- Is it acceptable as a master thesis?

The answer depends on what you are proving and how.

Examples for more **systems- and implementation-oriented conferences**:

- ACM Multimedia Systems Conference (***ACM MMSys***)
- ACM Symposium on Operating Systems Principles (***SOSP***)
- …

Also many papers at graphics events (e.g., ***SIGGRAPH***)
and human-computer interaction venues (e.g., ***ACM CHI, UIST***;
see 'artifacts' contributions in Wobbrock & Kientz's paper)

Advice for your thesis: when it comes to design and systems research, the borderline between scientific research and pure implementation can be smooth. Some of my colleagues might see things differently. Always discuss your research plans with your supervisor before diving into a topic.

Example: ACM MMSys

From the ACM MMSys 2019 website:

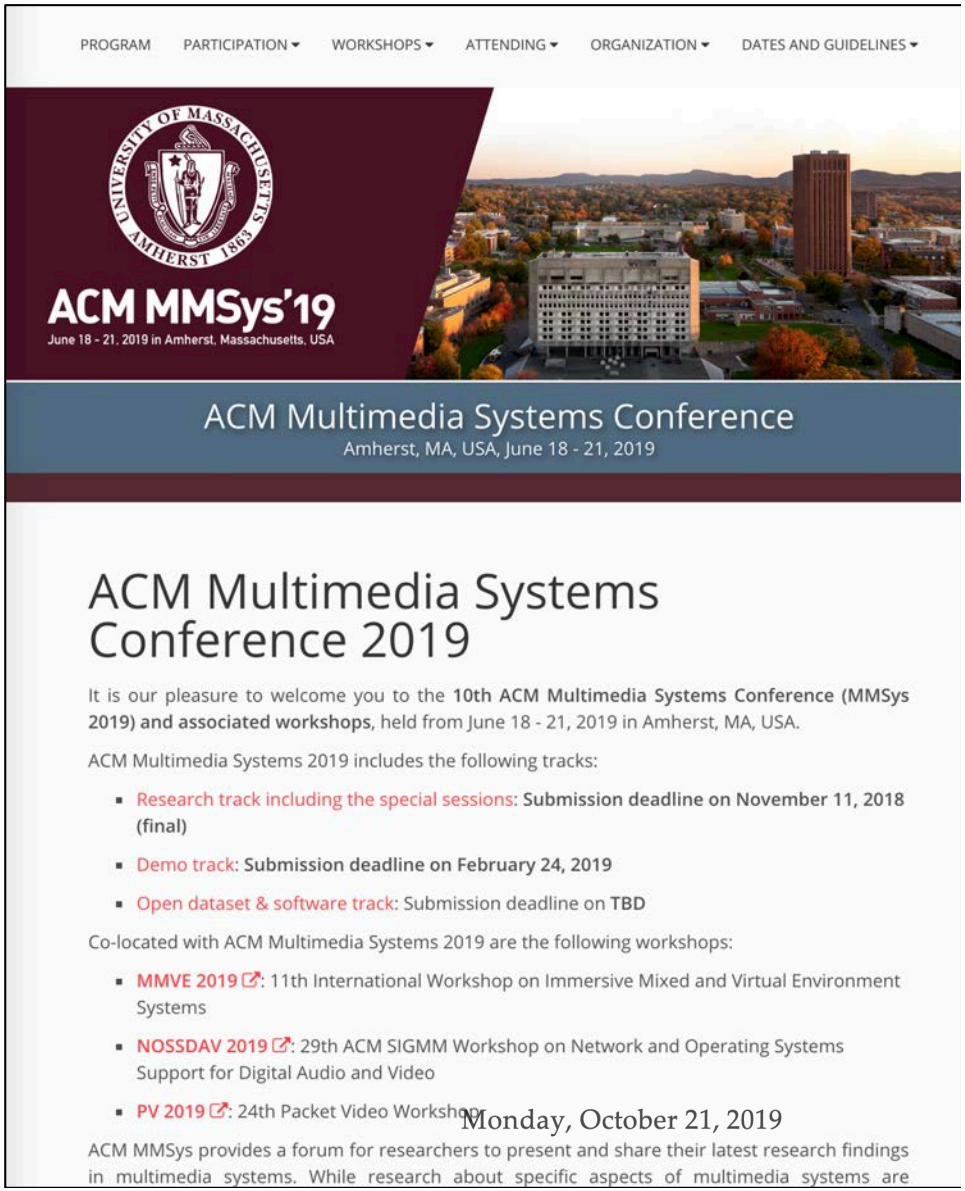
http://www.mmsys2019.org/

MMSys is a venue for researchers who explore:

- Complete multimedia systems that provide a new kind of multimedia experience or system whose overall performance improves the state-of-the-art through new research results in more than one component, or
- Enhancements to one or more system components that provide a documented improvement over the state-of-the-art for handling continuous media or time-dependent services.

Such individual system components include:

- Operating systems
- Distributed architectures and protocols
- Domain languages, development tools and abstraction layers
- Using new architectures or computing resources for multimedia
- New or improved I/O architectures or I/O devices, innovative uses, and algorithms for their operation
- Representation of continuous or time-dependent media
- Metrics and measurement tools to assess performance



Example: SOSP

From the ACM SOSP 2019 website:

http://sigops.org/sosp/sosp19/cfp.html

Papers will be judged on novelty, significance, clarity, relevance, and correctness. A good paper will:

- Consider a significant problem.
- Propose and implement an interesting, compelling solution.
- Demonstrate the practicality and benefits of the solution.
- Draw appropriate conclusions.
- Clearly describe what the authors have done.
- Clearly articulate the advances beyond previous work.

Scientific perspectives on GMT (INFOMSCIP)

Scientific publications

- Why publish?
  The relevance of publications for science
- Who publishes?
  Academic careers (& the relevance of publications for them)
- Where to publish?
  Types of publications, quality measures, venues & scientific publishers

Extend existing knowledge with new findings
⇒ Normally done by **scientific publications**

Why publishing research results?

- To make your newly created knowledge know to everyone
  ⇒ It is only useful for society, if it is made available

- To get promoted
  ⇒ Notice that this should not be the motivation for your research, but you should see it as means to spread your results

Phrases every PhD student will hear from his/her supervisor at some time:
- "Publish or perish"
- "Demo or die" (this one mostly in applied domains)

Publications have become the main standard to evaluate one's research quality.
Like research, quality of research also needs to be quantified and measurable.

Who does (and publishes) scientific research?

- Universities
- Research labs
  E.g. TNO, CWI, ..
- Companies
  E.g., Xerox PARC, Microsoft Research, …

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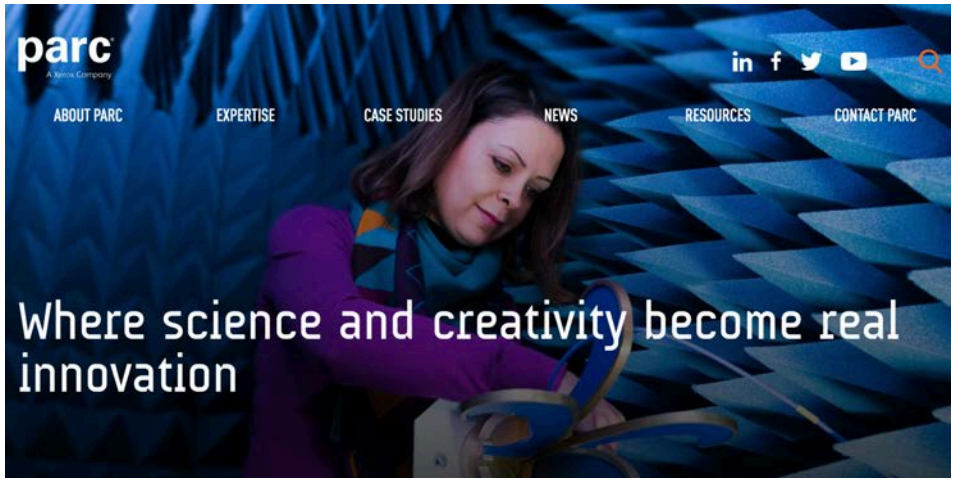
PARC (**Palo Alto Research Center**; formerly **Xerox PARC**) is a research and development company in Palo Alto, California, with a distinguished reputation for its contributions to information technology and hardware systems.



Xerox PARC has been the **inventor and incubator of many elements of modern computing** in the contemporary office work place:

- Laser printers
- Computer-generated bitmap graphics
- The graphical user interface, featuring windows and icons, operated with a mouse
- The WYSIWYG text editor
- Interpress, a resolution-independent graphical page-description language and the precursor to PostScript
- Ethernet as a local-area computer network
- Fully formed object-oriented programming (with class-based inheritance, the most popular OOP model to this day) in the Smalltalk programming language and integrated development environment
- Prototype-based programming (the second most popular inheritance model in OOP) in the Self programming language
- Model-view-controller software architecture
- AspectJ an aspect-oriented programming (AOP) extension for the Java programming language

From Wikipedia (“PARC (company)”)

Who does (and publishes) scientific research?

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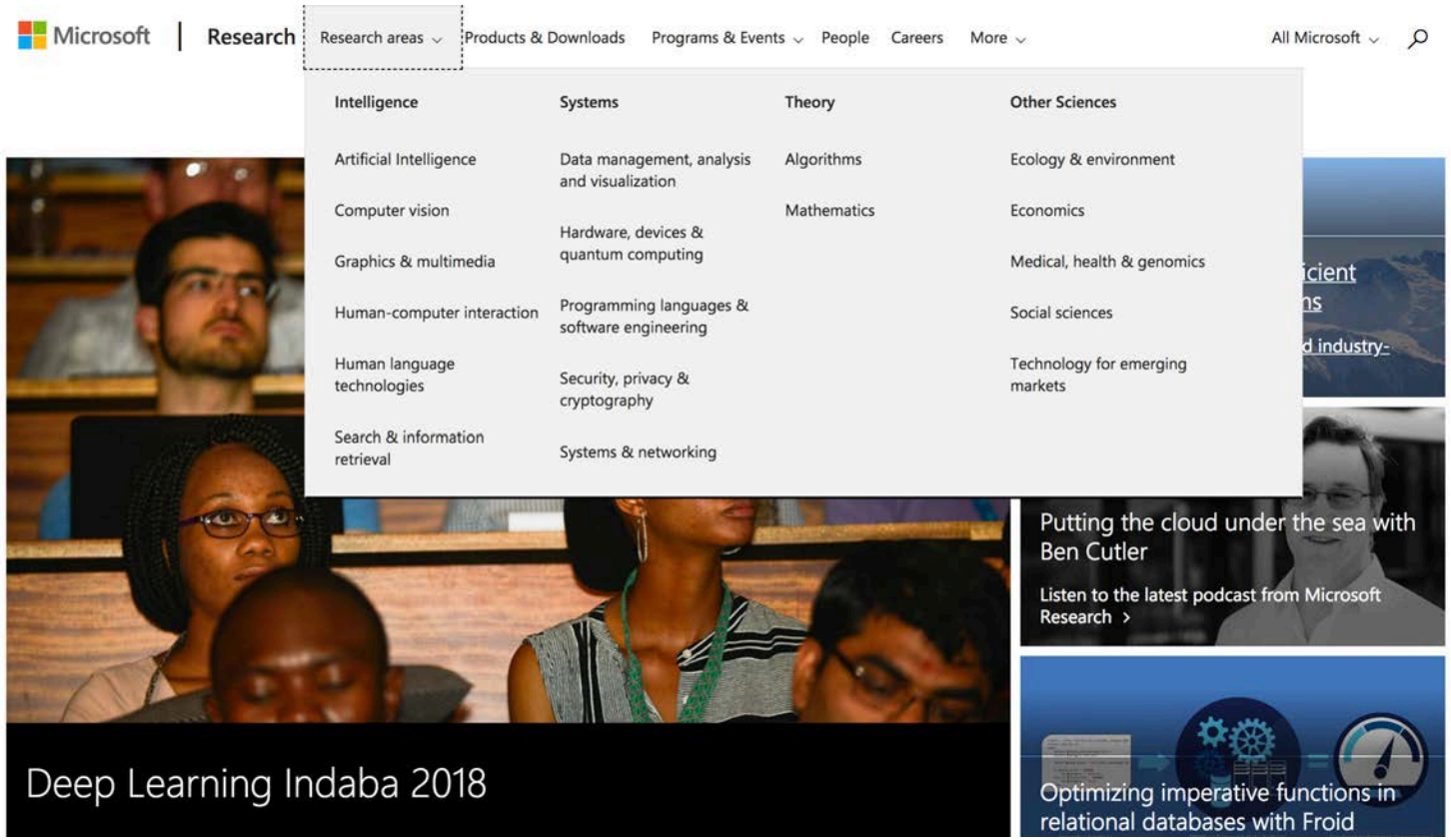
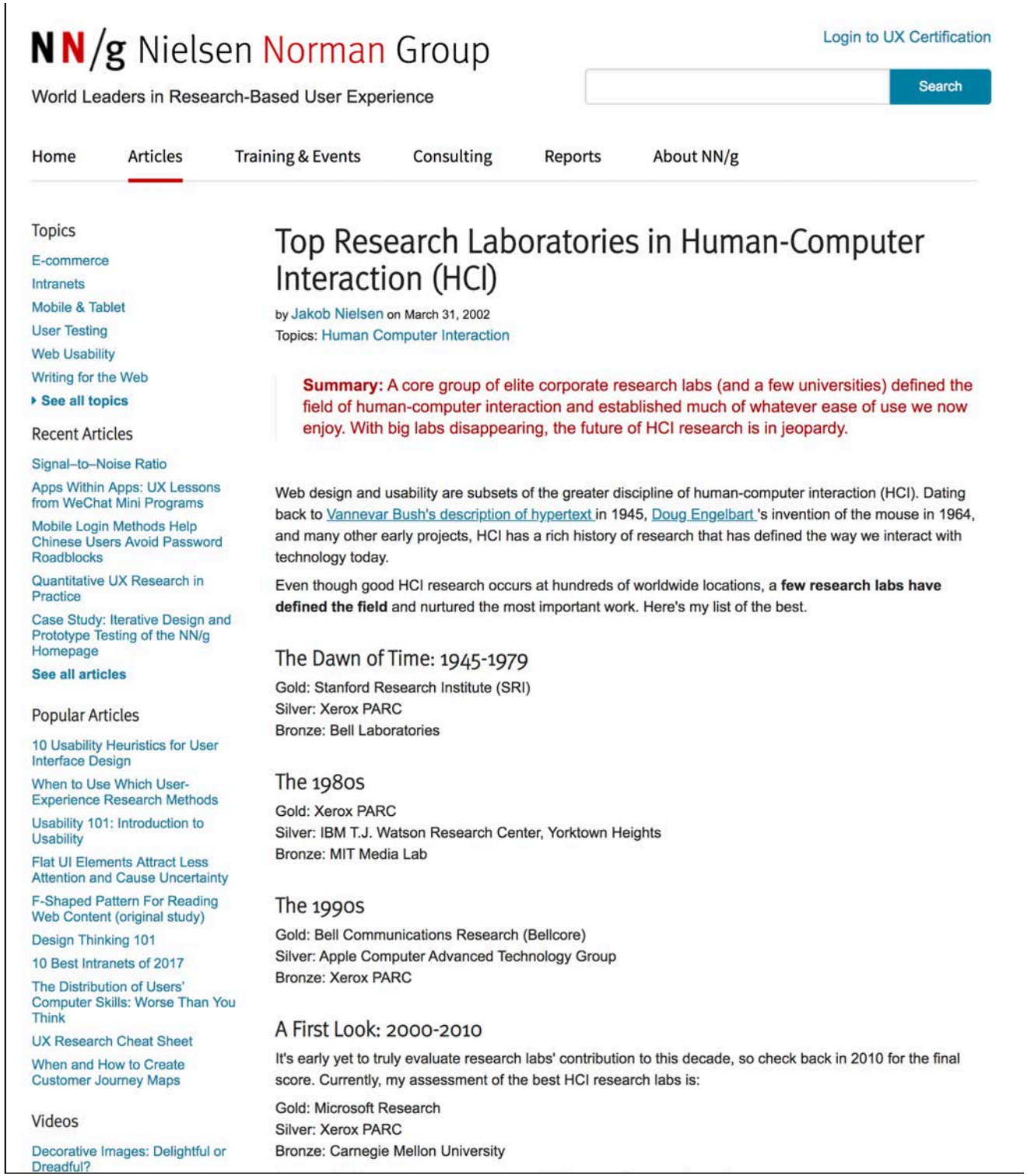
  E.g., Xerox PARC, **Microsoft Research**, …



Microsoft Research is the research subsidiary of Microsoft. It was formed in 1991, with the intent to advance state-of-the-art computing and solve difficult world problems through technological innovation in collaboration with academic, government, and industry researchers. The Microsoft Research team employs more than 1,000 computer scientists, physicists, engineers, and mathematicians, including Turing Award winners, Fields Medal winners, MacArthur fellows, and Dijkstra price winners.

An analysis of **top research laboratories in Human-Computer Interaction** (HCI) over the last decades.

Source:
https://www.nngroup.com/articles/top-research-laboratories-in-human-computer-interaction-hci/



NN/g Nielsen Norman Group

World Leaders in Research-Based User Experience

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UX Research Cheat Sheet
When and How to Create Customer Journey Maps

Videos

Decorative Images: Delightful or Dreadful?

Top Research Laboratories in Human-Computer Interaction (HCI)

by Jakob Nielsen on March 31, 2002
Topics: Human Computer Interaction

Summary: A core group of elite corporate research labs (and a few universities) defined the field of human-computer interaction and established much of whatever ease of use we now enjoy. With big labs disappearing, the future of HCI research is in jeopardy.

Web design and usability are subsets of the greater discipline of human-computer interaction (HCI). Dating back to Vannevar Bush's description of hypertext in 1945, Doug Engelbart's invention of the mouse in 1964, and many other early projects, HCI has a rich history of research that has defined the way we interact with technology today.

Even though good HCI research occurs at hundreds of worldwide locations, a **few research labs have defined the field** and nurtured the most important work. Here's my list of the best.

The Dawn of Time: 1945-1979

Gold: Stanford Research Institute (SRI)
Silver: Xerox PARC
Bronze: Bell Laboratories

The 1980s

Gold: Xerox PARC
Silver: IBM T.J. Watson Research Center, Yorktown Heights
Bronze: MIT Media Lab

The 1990s

Gold: Bell Communications Research (Bellcore)
Silver: Apple Computer Advanced Technology Group
Bronze: Xerox PARC

A First Look: 2000-2010

It's early yet to truly evaluate research labs' contribution to this decade, so check back in 2010 for the final score. Currently, my assessment of the best HCI research labs is:

Gold: Microsoft Research
Silver: Xerox PARC
Bronze: Carnegie Mellon University

An analysis of **top research laboratories in Human-Computer Interaction** (HCI) over the last decades (by Jakob Nielsen, 2002, updated 2013).

The Dawn of Time: 1945-1979

- Gold: Stanford Research Institute (SRI)
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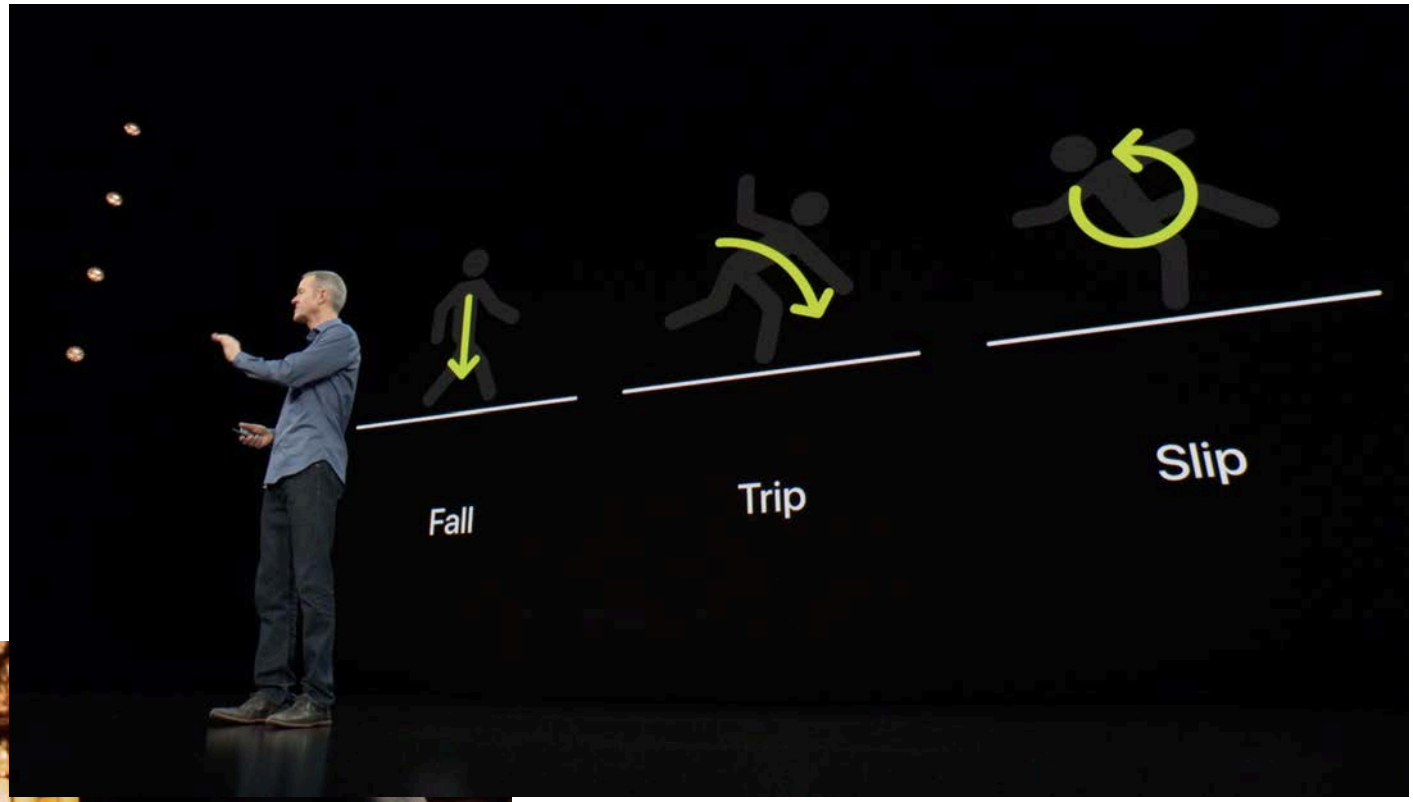
(**Update 2013**: I think my assessment in 2002 proved fairly predictive for the decade, because now with the benefit of hindsight I would still give out the same "medals.")

Source: https://www.nngroup.com/articles/top-research-laboratories-in-human-computer-interaction-hci/

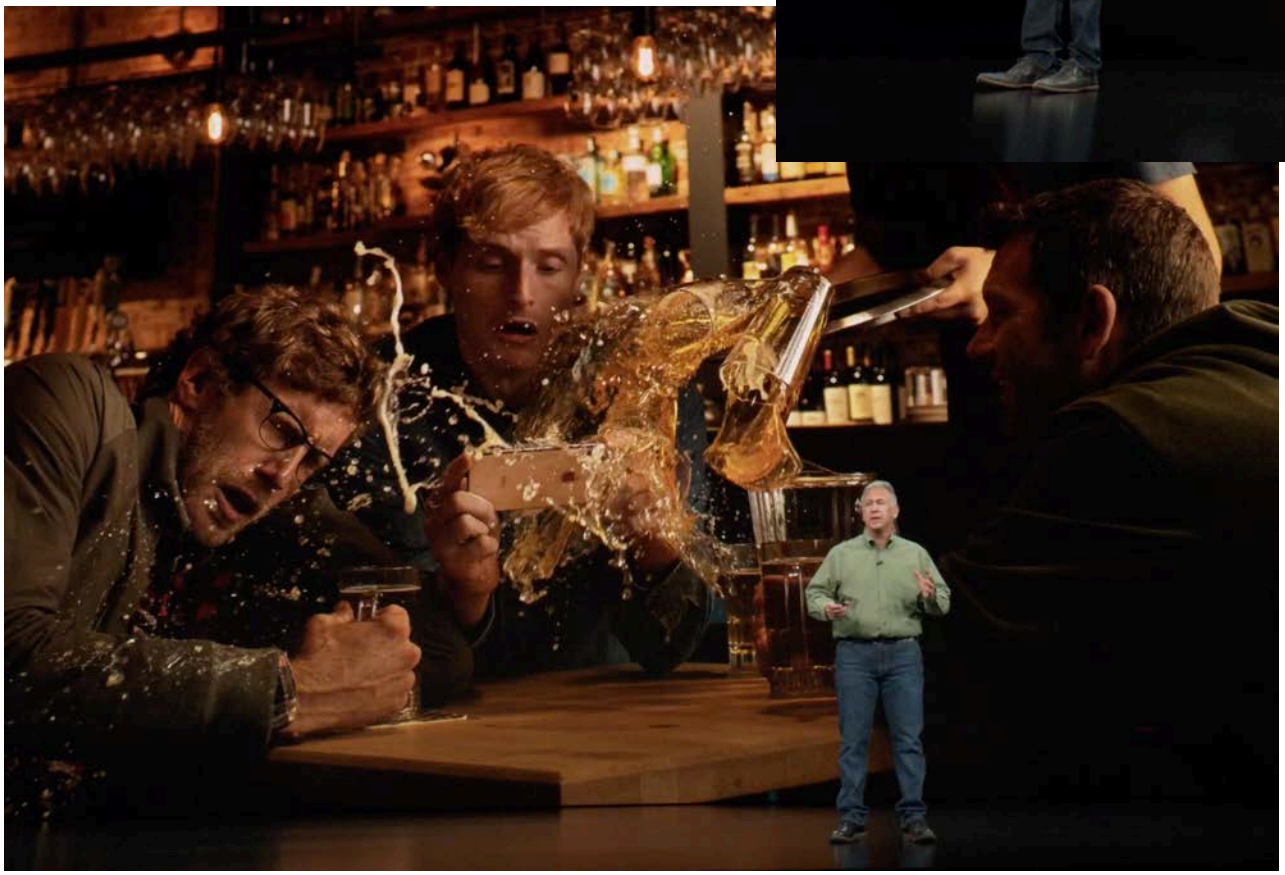
Unpublished research from industry

Examples from Apple's announcement of new iPhones on September 12, 2018

See https://www.apple.com/lae/apple-events/september-2018/



Fall detection



Material testing

Question: is this really research?

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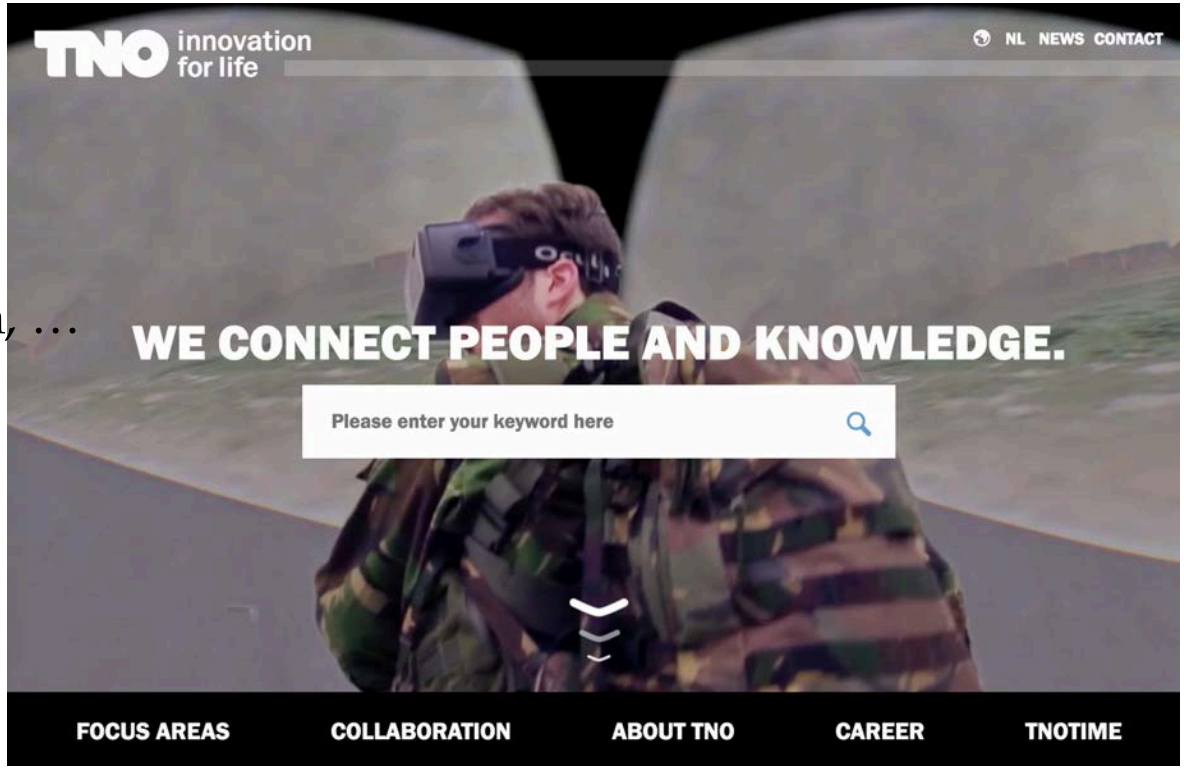
  E.g. **TNO**, CWI, ..
- Companies
  E.g., Xerox PARC, Microsoft Research, …



Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (**TNO**; English: Netherlands Organisation for Applied Scientific Research) is an independent research organisation in the Netherlands that focuses on applied science.

The organisation also conducts contract research, offers specialist consulting services, and grants licences for patents and specialist software. TNO tests and certifies products and services, and issues an independent evaluation of quality. Moreover, TNO sets up new companies to market innovations.

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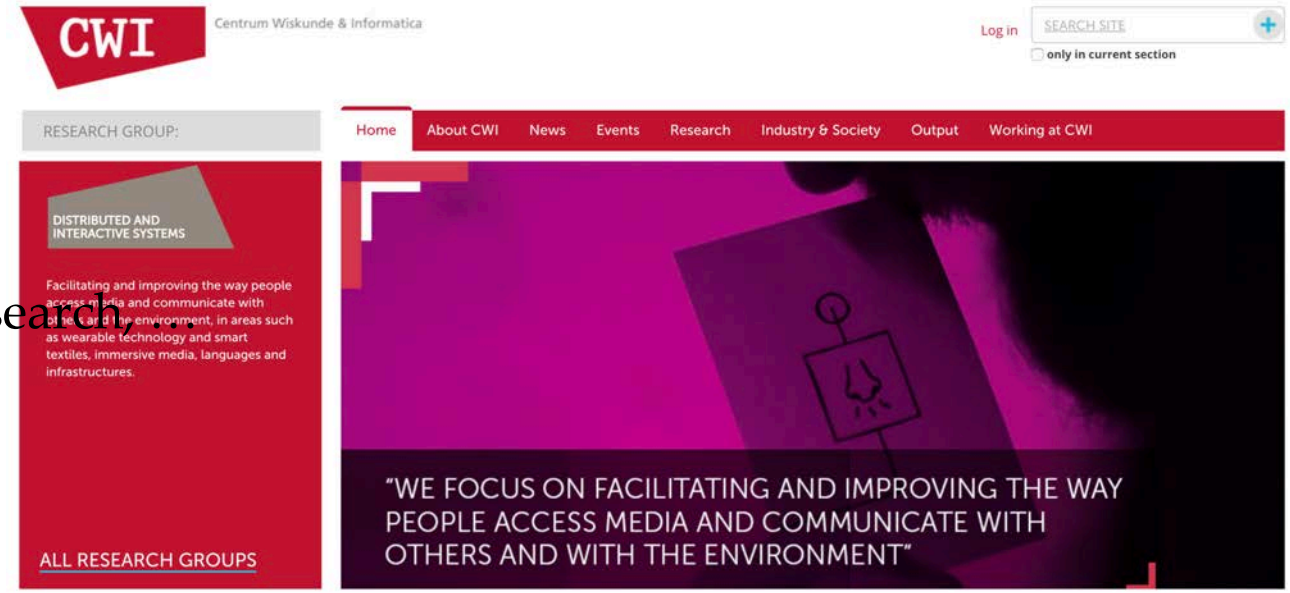
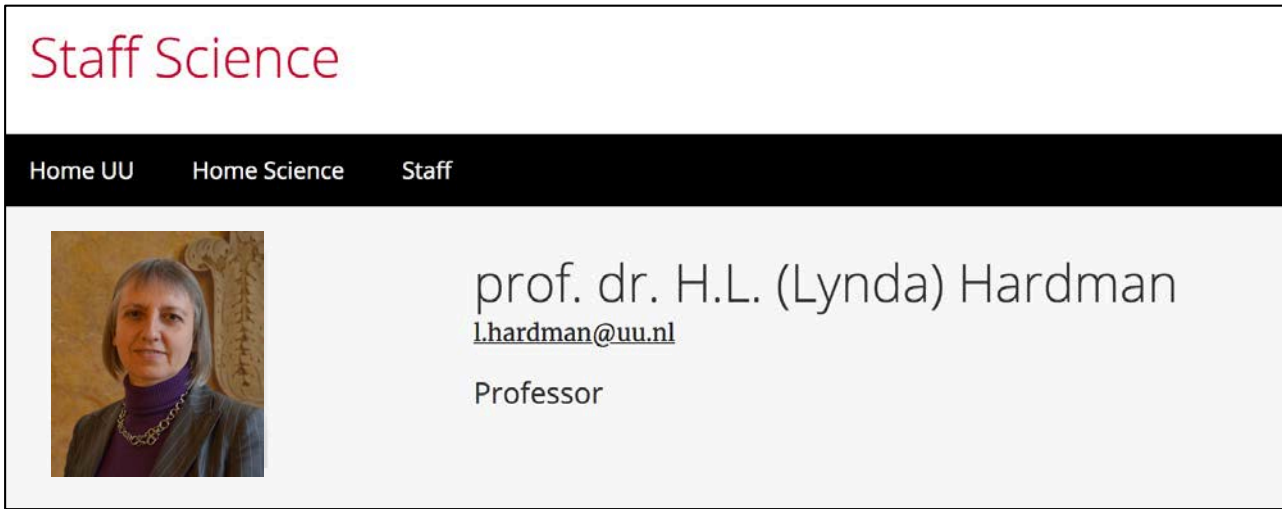


The **Centrum Wiskunde & Informatica** (abbr. **CWI**; English: "National Research Institute for Mathematics and Computer Science") is a research center in the field of mathematics and theoretical computer science. It is part of the Netherlands Organization of Scientific Research (NWO) and is located at the Amsterdam Science Park. This institute is famous as the creation ground of the Python Programming Language. It was a founding member of the European Research Consortium for Informatics and Mathematics (ERCIM).



Phases of a common academic career

- BSc students / undergraduate students
- MSc students / graduate students
- PhD students (NL: AIOs, assistent in opleiding)
- Post Docs
- Assistant professors (NL: UDs, universitair docent)
- Associate professors (NL: UHDs, universitair hoofddocent)
- Full professors (NL: Hoogleraar)

- BSc students / undergraduate students → Bachelor thesis (but not necessary (publishable) research)
- **MSc students / graduate students** → GMT program: ”thesis results are publishable” is a criteria for a cum laude degree (min. 8.5)
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Some comments on your GMT MSc thesis

- **Paper & annotated appendix versus full report**
- Digital library & examples
- GMT project site

From http://www.cs.uu.nl/education/vak.php?stijl=2&vak=INFOMGMT2

The **first part** comprises 1 period of full-time work. The student will complete (at least) the following deliverables:

- The MSc research application form (asap)
- A completed literature research for the project
- A clear (list of) research question(s)
- A skeleton of the thesis
- A time plan for the second part of the thesis
- A description of the research methodology
- A plan for the evaluation of the results/outcome

The **second part** comprises 25 EC (2 periods). You will complete (at least) the following items:

- Perform and complete scientific research according to the predefined plan;
- Write a scientific report about this research. You may choose between a regular thesis (plus optional appendix), or a scientific conference/journal paper, plus mandatory appendix;
- Give a presentation about the work;
- Produce a dissemination (see below).

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You find **UU theses** (since 2012) here:
http://studenttheses.library.uu.nl/search.php?language=en
The ones from **Computer Science** are here:
http://studenttheses.library.uu.nl/search.php?m=course&course=Computing%20Science&language=en

Example for good thesis reports:

Marries van de Hoef, "**Real-Time Dynamic Radiosity for High Quality Global Illumination**", 2014
https://dspace.library.uu.nl/handle/1874/288879
Marries' thesis won the Science Faculty's thesis prize in 2014.

Examples for good papers with appendix:

Nina Rosa, "**Immersive Multimodal Virtual Reality Experiences - Using Visual and Auditory Stimuli to Improve Tactile Experiences**", 2015
https://dspace.library.uu.nl/handle/1874/317772
Nina's thesis won the Ngi-NGN Informatie Scriptieprijs in 2015 and has been published at ACM ICMI 2015.

Wendy Bolier, "**Drawing in a Virtual 3D Space - Introducing VR Drawing in Elementary School Art Education**", 2017
https://dspace.library.uu.nl/handle/1874/353003
Wendy's thesis will be published at ACM Multimedia 2018 (A* event in the multimedia community)

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- Paper & annotated appendix versus full report
- Digital library & examples
- **GMT project site**

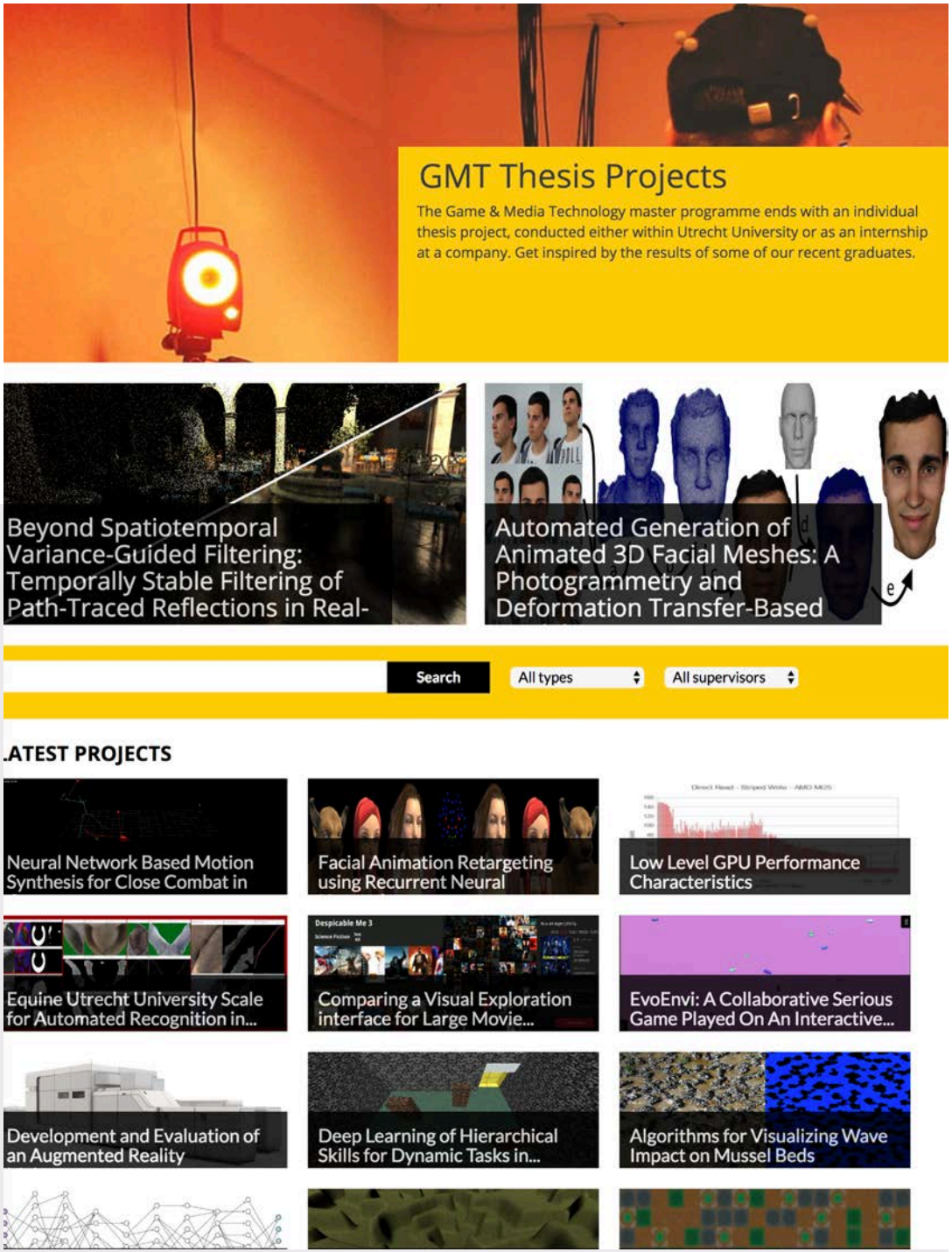
Note: site seems to be down again.

From http://www.cs.uu.nl/education/vak.php?stijl=2&vak=INFOMGMT2

The **second part** comprises 25 EC (2 periods). You will complete (at least) the following items:

- …
- Produce a dissemination (see below).

Dissemination
The dissemination should be targeted at a broad audience, i.e. people who do not have background in computer science.
…
The dissemination needs to be uploaded to the GMT thesis projects site.



https://www2.projects.science.uu.nl/cs-gmt/

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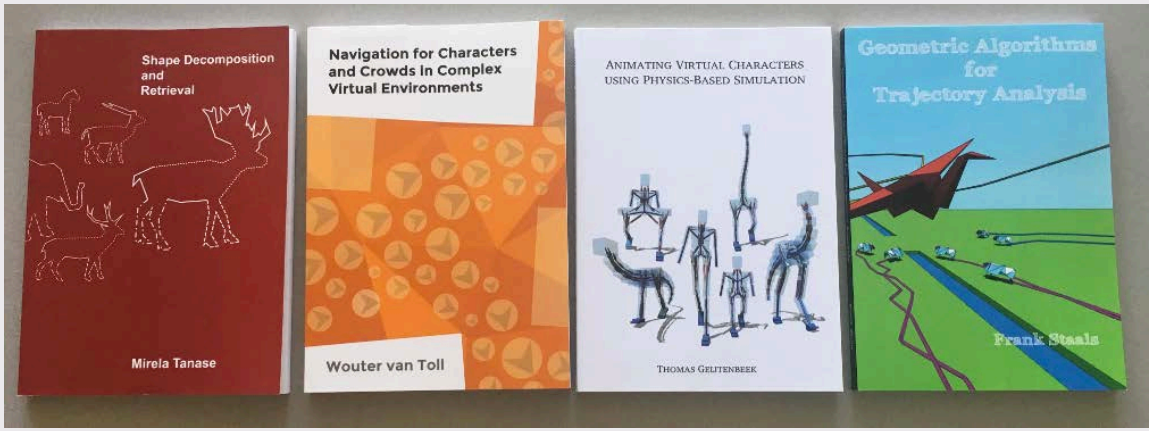
- Assistant professors (NL: UDs, universitair docent)
- Associate professors (NL: UHDs, universitair hoofddocent)
- Full professors (NL: Hoogleraar)

Some comments doing a PhD thesis in the area of GMT @ UU

Some interesting information:

PhD regulations
https://www.uu.nl/en/organisation/phd-programmes/practical-matters/regulations-and-forms

Doctoral Degree Regulations
https://www.uu.nl/en/files/phd-regulations-2017pdf-1



From the "Instructions to the PhD candidate" for the Doctoral Thesis Defence Ceremony:

21. Dress code
PhD candidates are to dress in accordance with the importance Utrecht University attaches to the doctoral thesis defence ceremony. A dark suit with tie or dress suit for male PhD candidates and male paranimfs, and a woman's suit, suitable dress, or the equivalent of a dress suit for female PhD candidates and female paranimfs are deemed appropriate.

- BSc students / undergraduate students → Bachelor thesis (but not necessary (publishable) research)
- MSc students / graduate students → GMT program: "thesis results are publishable" is a criteria for a cum laude degree (min. 8.5)
- PhD students (NL: AIOs, assistent in opleiding) → A good publication record is a requirement for a PhD degree ("publish or perish")
- **Post Docs**
- **Assistant professors (NL: UDs, universitair docent)**
- **Associate professors (NL: UHDs, universitair hoofddocent)**
- **Full professors (NL: Hoogleraar)**

Publications = measure of one's research contributions, quality, and qualification

Question: What are we commonly measuring here?

1. Number
2. Quality
3. Citations

Measuring scientific quality & impact via publications

1. Number
2. Quality
3. Citations

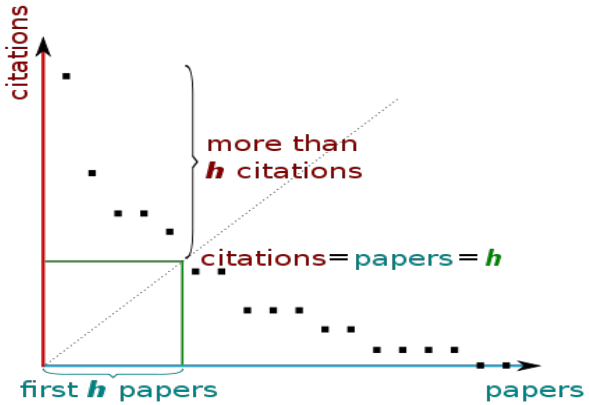
Measuring quality by number of publications and citations
Example: **h-index**

Advantage:

- Combines productivity (number of papers) and impact (number of citations) in a single number

Limitations:

- Does not take into account the number of authors of a paper
- Does penalize early career scientists (it takes time till your work gets cited)
- Gives higher impact to review articles compared to original papers (first are generally cited more often)



Questions:
What makes a good paper?
What makes a good conference?
What makes a good journal?

1. References / citations
   ⇒ Impact factor

2. Acceptance rates
   ⇒ Pros & cons?

3. Organizers
   a. publisher, financial sponsor, supporting groups
   b. organizing committee, program committee
   ⇒ Again pros & cons

From http://phdcomics.com/, a fun website most PhD students will read sometimes during their studies.

The **Impact Factor** is calculated by dividing the number of citations in the JCR year by the total number of articles published in the two previous years. An Impact Factor of 1.0 means that, on average, the articles published one or two year ago have been cited one time.

From https://www.researchgate.net/post/How_is_impact_factor_calculated

Who organizes conferences, publishes scientific papers, etc.?

Different options exist, but mostly:

- Publishing houses (specialized on scientific literature), e.g., Springer, Elsevier, …
- Research organizations, e.g., IEEE, ACM, …

Two (most?) important organizations in Computer Science:

IEEE computer society

IEEE Computer Society (sometimes abbreviated **Computer Society** or **CS**) is a professional society of IEEE. Its purpose and scope is "to advance the theory, practice, and application of computer and information processing science and technology" and the "professional standing of its members." The CS is the largest of 39 technical societies organized under the IEEE Technical Activities Board.

https://www.computer.org/

The **Association for Computing Machinery** (**ACM**) is an international learned society for computing. It was founded in 1947, and is the world's largest scientific and educational computing society. The ACM is a non-profit professional membership group, with more than 100,000 members as of 2011.
The ACM is an umbrella organization for academic and scholarly interests in computer science. Its motto is "Advancing Computing as a Science & Profession".

https://www.acm.org/

Example ACM

- Special Interest Groups (SIGs)
  E.g. SIGGRAPH, SIGCHI, SIGMM, SIGAI, …
- ACM computing classification
  For publications, see last time

- Publications
  Journals & Magazines
- Events
  Conferences, symposia, workshops

You are very much encouraged to go to the IEEE Computer or ACM websites and browse, e.g., special interest groups that you are interested in, look at what journals they publish, what events they organize or co-sponsor, etc.

ACM DL DIGITAL LIBRARY

You can also browse the ACM Digital Library which is freely accessible within the UU network.

SIGCHI

SIGCHI is the premier international society for professionals, academics and students who are interested in human-technology and human-computer interaction (HCI).

Major journals & magazines:

TOCHI ACM Transactions on Computer-Human Interaction

INTERACTIONS ACM *Interactions* magazine

Major event:

CHI 2018 Engage with CHI ACM CHI Conference on Human Factors in Computing Systems

Plus various smaller ones, in-cooperation events,…

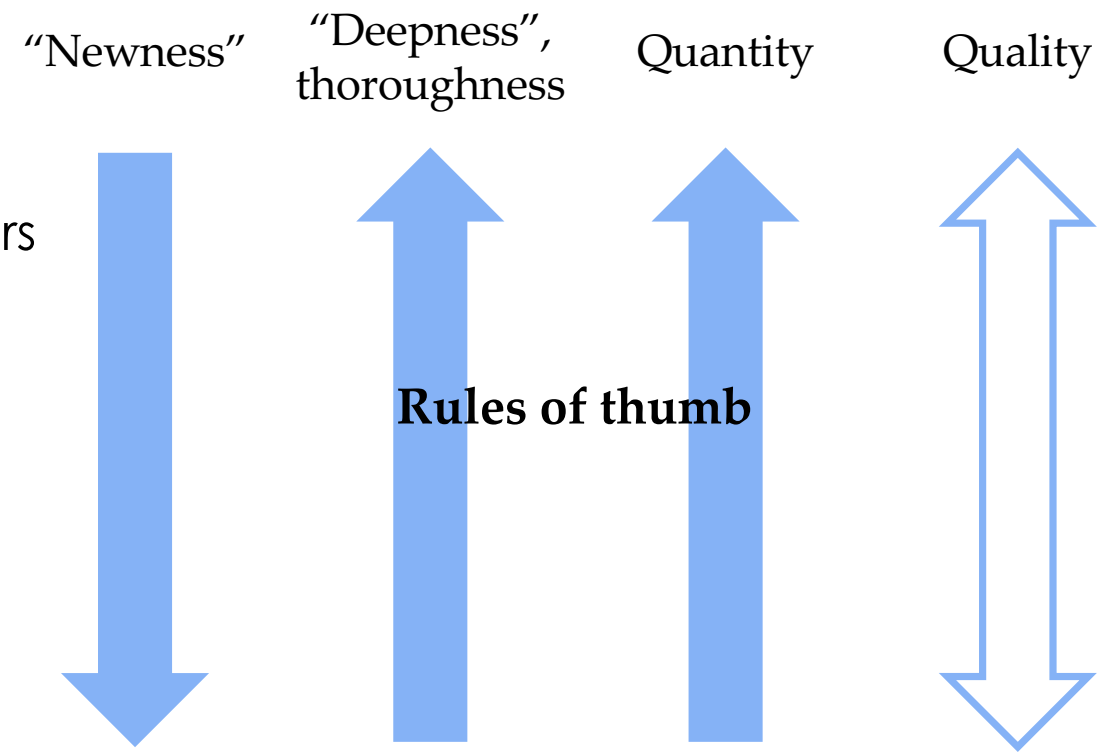
ACM SIGCHI publications in the ACM DL:
https://dl.acm.org/sig.cfm?id=SP923

Publications: types, levels, rankings, …

- Books
- Encyclopedias, book chapters
- Editorials (e.g., LNCS)

- Journal articles
- Magazine articles

- Conference papers
- Symposia papers
- Workshop papers



Note that these are just rules of thumb.
Individual performance indicators
are way more important!

Publications: types, levels, rankings, …

- Books
- Encyclopedias, book chapters
- Editorials (e.g., LNCS)

- Journal articles
- Magazine articles

- Conference papers
- Symposia papers
- Workshop papers

Examples for the relevance of individual performance indicators

Journal with low impact factor or no-name publisher *versus*
established, high ranked conference?

High ranked symposium *versus*
low ranked conference?

E.g.: IEEE/ACM International Symposium on Mixed and Augmented Reality (ISMAR) has an A* CORE rating (despite being called symposium)

Then why do low-ranked events even exist and survive?

Some are just to make money or even scams!
https://en.wikipedia.org/wiki/International_Journal_of_Advanced_Computer_Technology
But others do have true value!

Publications: types, levels, rankings, …

- Books
- Encyclopedias, book chapters
- Editorials (e.g., LNCS)

- Journal articles
- Magazine articles

- Conference papers
- Symposia papers
- Workshop papers

Also note that different contribution types exist, e.g.:

- Survey,
- Research paper,
- Letters,
- …

- Full paper
- Short paper
- Poster
- WIP / late breaking
- Demos
- Videos
- …

Peer-review organization

- Journal articles
- Magazine articles

- Steering committee
- Editor in chief
- Editorial board
- (Reviewers) invited, not fixed

- Conference papers
- Symposia papers
- Workshop papers

- General chairs
- Technical program chairs,
  Poster chairs,
  Demo chairs,
  …
- Technical program committee (reviewers)

Note that this can vary. That's why a look at the organization and review procedure can tell you something about the quality of the publication / event.

Indications for good conferences (and journals):

- Review procedure (number, length of reviews, …)
- Meta reviews
- Reviewer discussion
- Author rebuttal
- In-person meeting of PC, …

Typical review procedure

	Authors	Organizers	
(authors)	Submit paper		
		Assign to reviewers	*(program chairs)*
		Reviewing (min. 2)	*(program committee)*
(authors)	Rebuttal		
		Discussion	*(PC members)*
		Meta review	*(area or PC chairs)*
		PC meeting	*(PC or chairs)*
		Decisions sent	*(program chairs)*
(authors)	Revise if accepted		
(authors)	Submit final version		
(one author)	Present at event		
		Publish proceedings	*(publication chair)*

Note that not all these steps may apply. Again, this can be an indication for quality (or lack thereof) of an event.

Peer review process: problems, pitfalls, what can go wrong, …
(or: why can you find bad papers, even at top events?)

- Not all review processes are done that thorough.
- Fairness? Double-blindness cannot always solve this.
- Reviewer bias (remember the importance of citations for one's career!)
- Sloppy, low quality work.
- Mistakes happen.
- …

Other reasons?

Note: While the scientific peer-reviewing process is well established
(and works to some degree) it has *many* flaws, too.
Thus, criticism and alternative approaches exist (e.g., open publication initiatives).

Some comments on scientific writing

- Recommendations on good scientific writing …
  - In relation to systems and design papers
    from the "How to write a good design paper"
  - In the HCI community
    from S. MacKenzie's CHI course
  - In Computer Science in general
    from J. Zobel's book

"If you want to be a writer, you must do two things above all others: read a lot and write a lot. There's no way around these two things that I'm aware of, no shortcut."

Stephen King, On Writing (2000)

Hopefully, your thesis will not read like a horror story,
but this advice is very true for academic writing as well.

"How to Read an Engineering Research Paper"
http://cseweb.ucsd.edu/~wgg/CSE210/howtoread.html

Hint: this article gives you also ideas on how to write engineering focused research report (and on what qualifies as engineering *research* in the first place).

The questions you want to have answered by reading a paper are the following:

1. **What are *motivations* for this work?**
2. **What is the proposed *solution*?**
3. **What is the work's *evaluation* of the proposed solution?**
4. **What is your analysis of the identified problem, idea and evaluation?**
5. **What are the *contributions*?**
6. **What are *future directions* for this research?**
7. **What questions are you left with?**
8. **What is your take-away message from this paper?**

Some comments from the paper "**How (and How Not) to Write a Good Design Paper**: A Metaphrase of Roy Levin's and David D. Redell's Evaluation of the Ninth SOSP Submissions" that give hints for good scientific writing. http://www.ida.liu.se/~matar/designpaper.pdf.

Original ideas

Can you state the new idea concisely? If your paper is to advance the state of knowledge, your reader must be able to find the new ideas and understand them.

Hint: it often makes for a strong paper or thesis, if you finish the introduction with a list of contributions.

Are comparisons with previous work clear and explicit?
You cannot simply say: "Our approach differs somewhat from that adopted in the BagOfBits design [3]." Be specific: "Our user interface approach uses tangible pieces rather than a touchscreen as in the BagOfBits design [3], with the expected improvements in co-operation and engagement of several users."

We will come back to this when talking about *literature studies* next time.

What is the oldest paper you referenced? The newest? Have you referenced similar work at another institution? Have you referenced technical reports, unpublished memoranda, non-reviewed online material, personal communications? The answers to these questions help alert you to blind spots in your knowledge or understanding.

This is also a helpful advice for a *literature study*.

Lessons

What have you learned from the work? If you didn't learn anything, it is a reasonable bet that your readers won't either, and you've simply wasted their time and a few trees by publishing your paper.

What should the reader learn from the paper?

Spell out the lessons clearly. Many people repeat the mistakes of history because they didn't understand the history book.

How generally applicable are these lessons?

…

This is very important: you are writing for the reader, not for yourself.
Note: that also means that you must know your readership
(usage of appropriate terminology, level of explanations, …).

Choices

What were the alternatives considered at various points, and why were the choices made the way they were?

A good paper doesn't just describe, it explains. …

Avoid diary or journal style (we did this, we did that, …).
Focus less on what you did, but more on why you did it.

Did the choices turn out to be right, and, if so, was it for the reasons that motivated them in the first place? If not, what lessons have you learned from the experience?

This is also important for the future work section.
Hint: don't just write about things that you knew before in this section.

Presentation

Are the ideas organized and presented in a clear and logical way?
Are terms defined before they are used?
Are forward references kept to a minimum?

Have alternate organizations been considered?

Was an abstract written first? Does it communicate the important ideas of the paper?
Abstracts in papers describing design are sorely abused. The abstract is more often a prose table of contents than a precis of the technical content of the paper. It tends to come out something like this: "A design based on Keysworth's conceptualization of user interaction [4] has been developed and tested. Some preliminary results are presented and directions for future work considered." No reader skimming a journal is likely to keep reading after that. Avoid the passive voice (despite tradition) and include a simple statement of assumptions and results. "We designed and evaluated a user interface following the ideas of Keysworth and discovered that converting the personal computer interaction model to a full-body interaction model increases navigation speed as well as engagement by 15%. However, accuracy decreased dramatically when we piped rock music instead of Muzak™ into the office." Leave discussion and argument for the paper. It helps to write the abstract before the paper (despite tradition) and even the outline, since it focuses your attention on the main ideas you wants to convey.

Note: different opinions exist on this.

Writing Style

Is the writing clear and concise? Are words spelled and used correctly? Are the sentences complete and grammatically correct? Are ambiguity, slang, and cuteness avoided?

Parts of a research paper

From S. MacKenzie's course on "Empirical research methods in human-computer interaction" at ACM CHI 2016, http://www.yorku.ca/mack/CourseNotes.pdf

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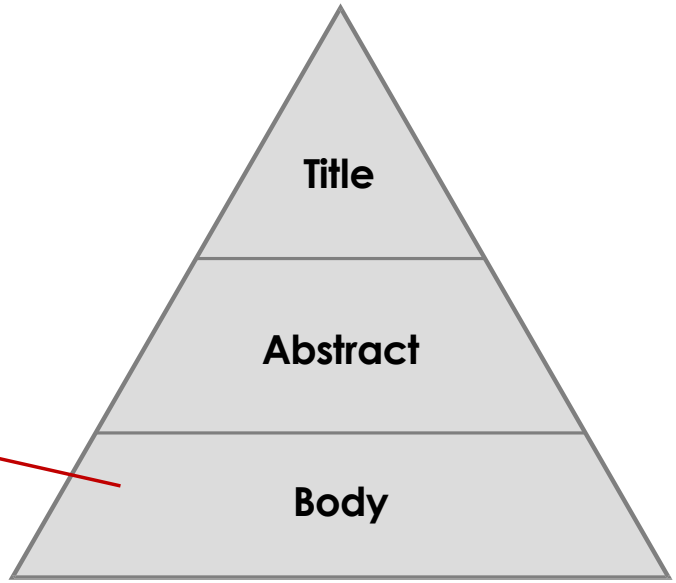
Research Paper

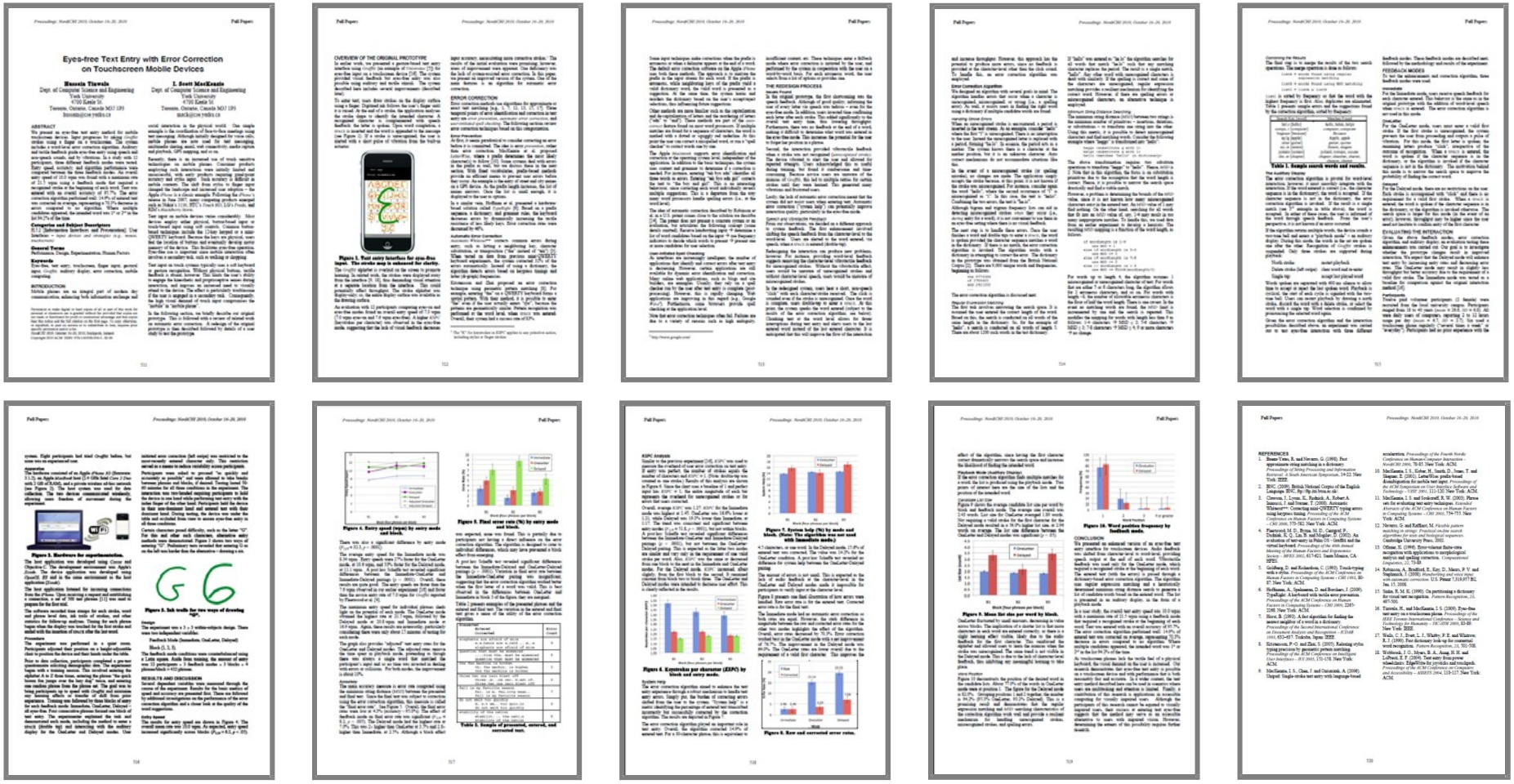
- Research is not finished until the results are published!
- Organization

Main sections…
- Introduction
- Method
  - Participants
  - Apparatus
  - Procedure
  - Design
- Results and Discussion
- Conclusions



Note:
- The introduction is generally followed by a **related work** section.
- This is from HCI. Publications in other areas may differ (even for HCI, it's a typical, but not mandatory structure)

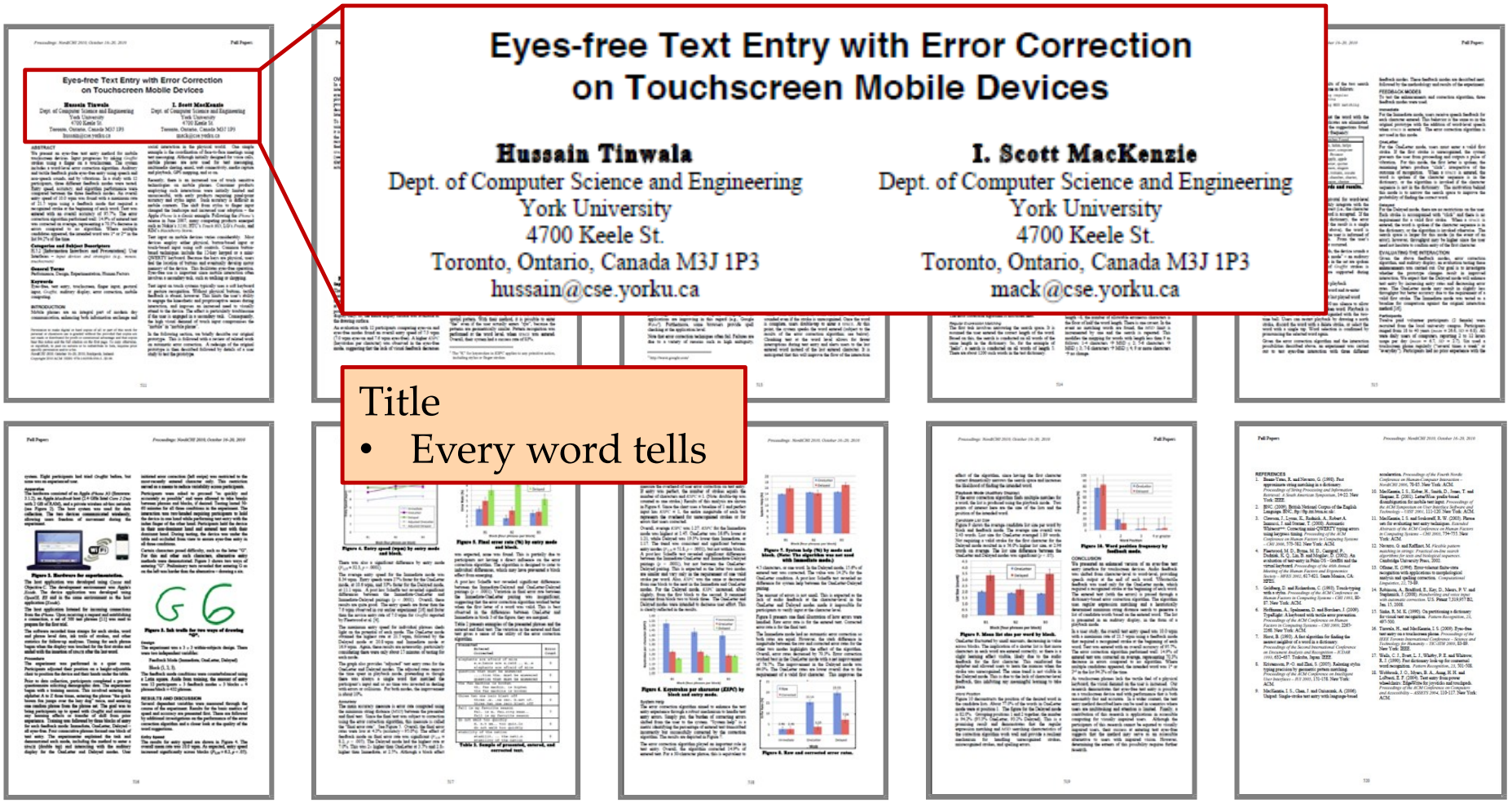
Example Publication: Structure of a common HCI paper



Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

Example Publication: Title, author(s), affiliation(s)

Different rules and opinions exist on co-authorship and order.

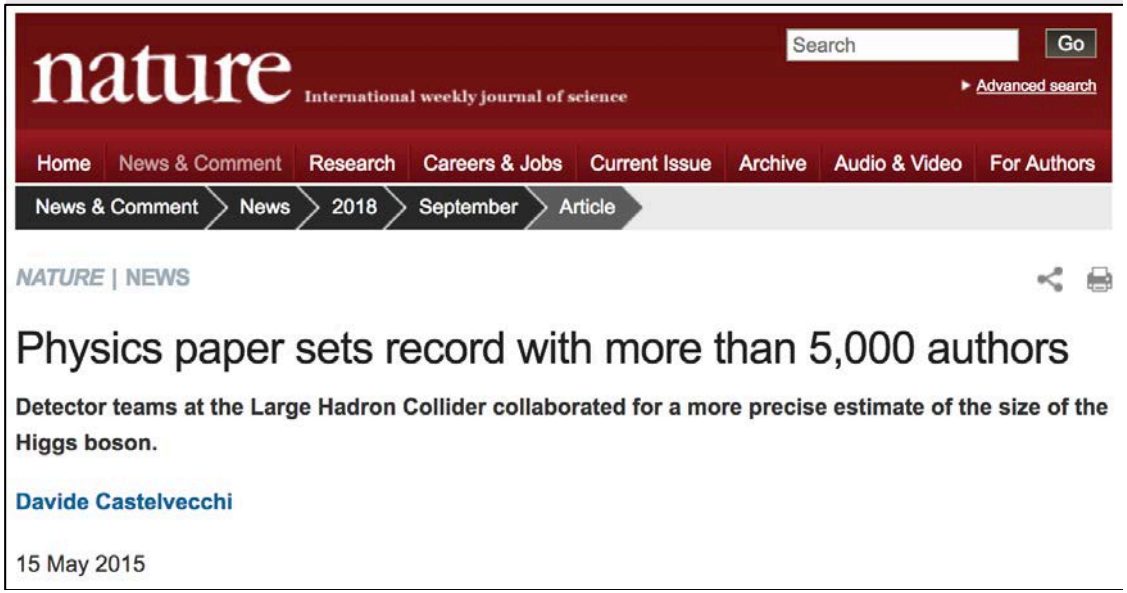


Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

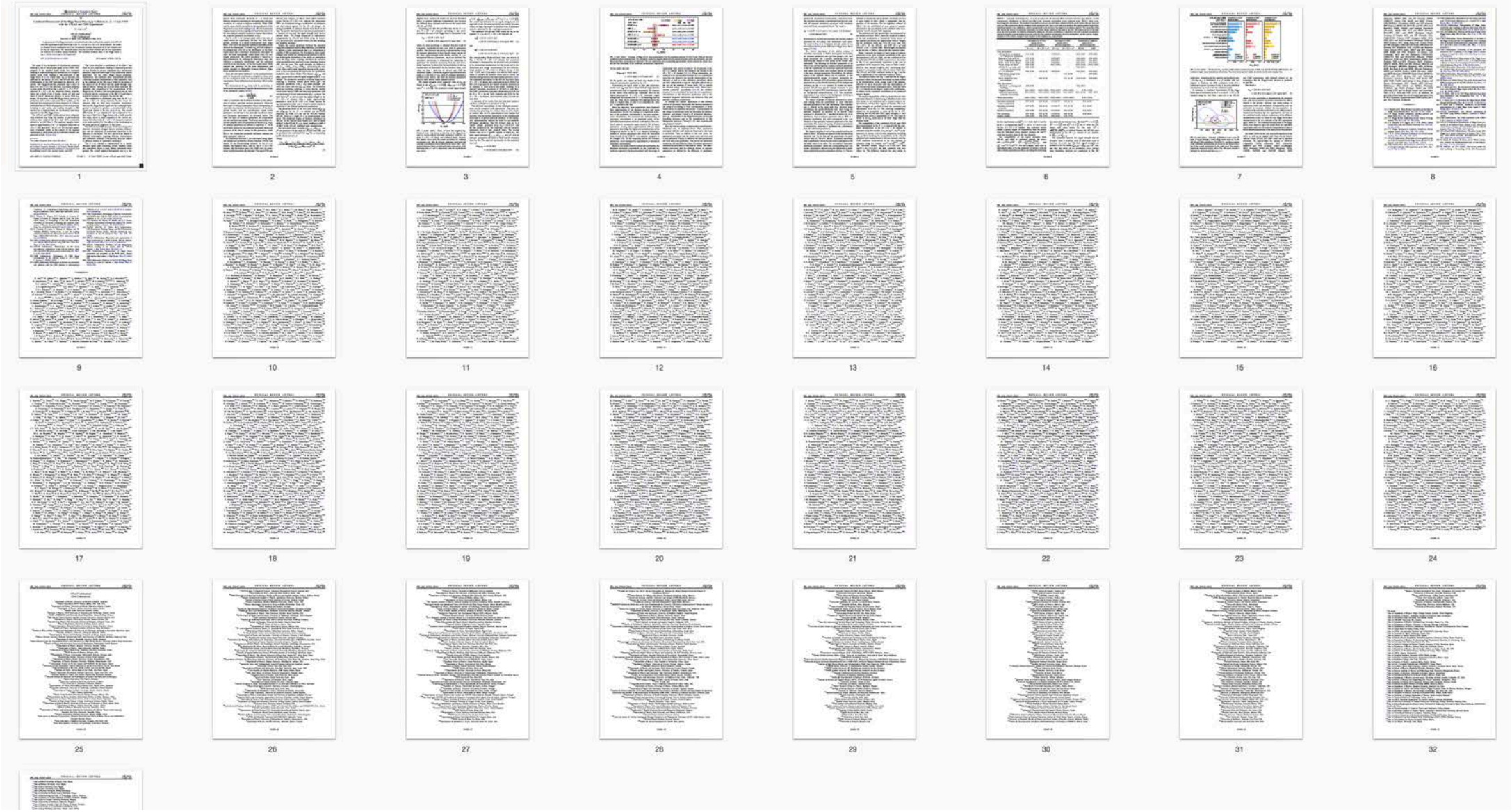
Fun fact: What is the paper with the highest number of co-authors?

- The scientific paper with the longest author list has 5154 co-authors.
- It has 33 pages, of which only about 7.5 are actual content, 1 is references, 15.5 list the authors' names, and 9 their institutions.
- It is a first joint paper from the two teams that operate ATLAS and CMS, two massive detectors at the Large Hadron Collider (LHC) at CERN, Europe's particle-physics lab near Geneva, Switzerland. Each team is a sprawling collaboration involving researchers from dozens of institutions and countries.

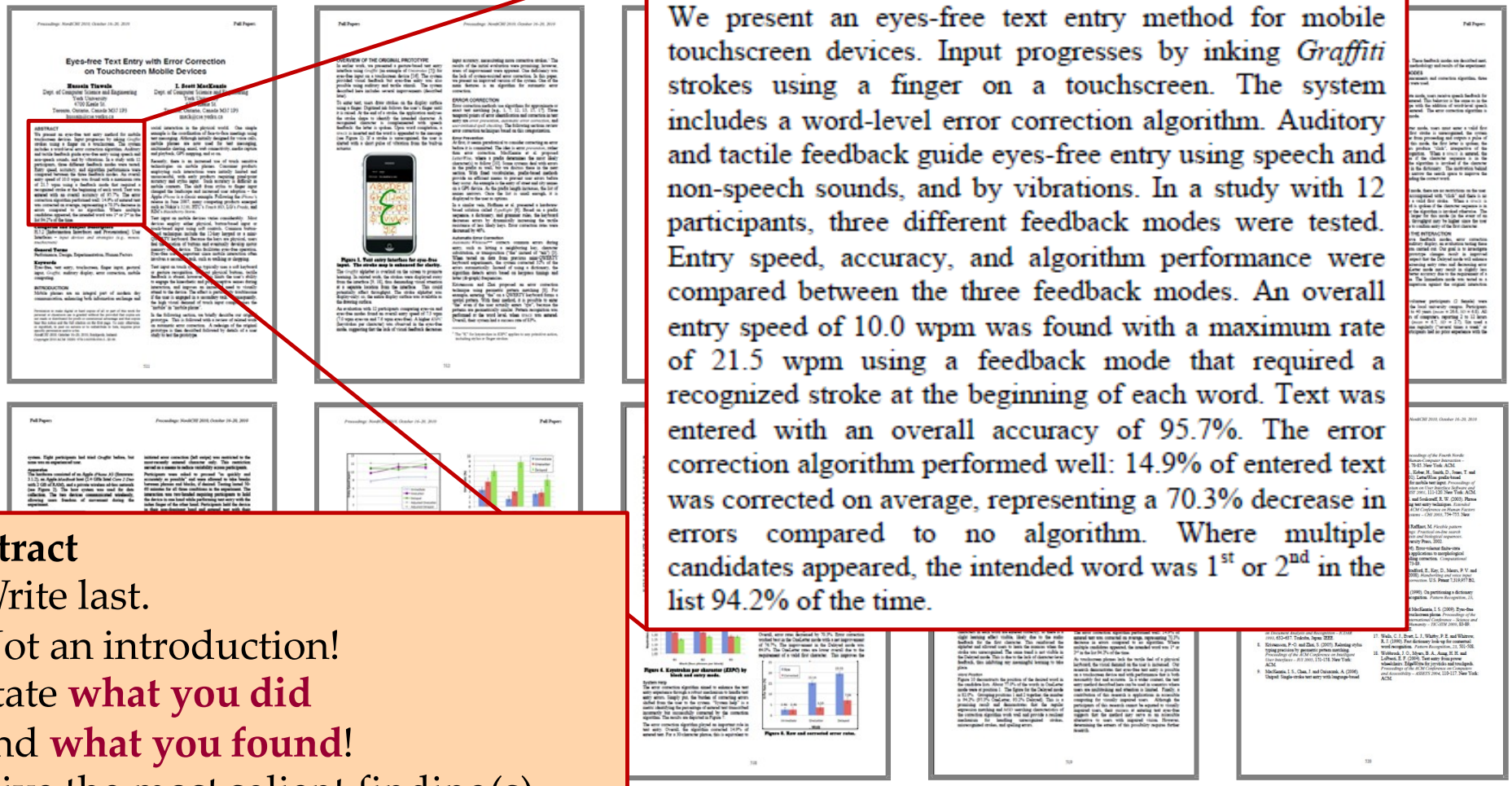
Robert Garisto, an editor of *Physical Review Letters*, says that publishing the paper presented challenges above and beyond the already Sisyphean task of dealing with teams that have thousands of members. "The biggest problem was merging the author lists from two collaborations with their own slightly different styles," Garisto says. "I was impressed at how well the pair of huge collaborations worked together in responding to referee and editorial comments," he adds.



A paper with > 5000 co-authors:



Example Publication: Abstract



ABSTRACT

We present an eyes-free text entry method for mobile touchscreen devices. Input progresses by inking *Graffiti* strokes using a finger on a touchscreen. The system includes a word-level error correction algorithm. Auditory and tactile feedback guide eyes-free entry using speech and non-speech sounds, and by vibrations. In a study with 12 participants, three different feedback modes were tested. Entry speed, accuracy, and algorithm performance were compared between the three feedback modes. An overall entry speed of 10.0 wpm was found with a maximum rate of 21.5 wpm using a feedback mode that required a recognized stroke at the beginning of each word. Text was entered with an overall accuracy of 95.7%. The error correction algorithm performed well: 14.9% of entered text was corrected on average, representing a 70.3% decrease in errors compared to no algorithm. Where multiple candidates appeared, the intended word was 1st or 2nd in the list 94.2% of the time.

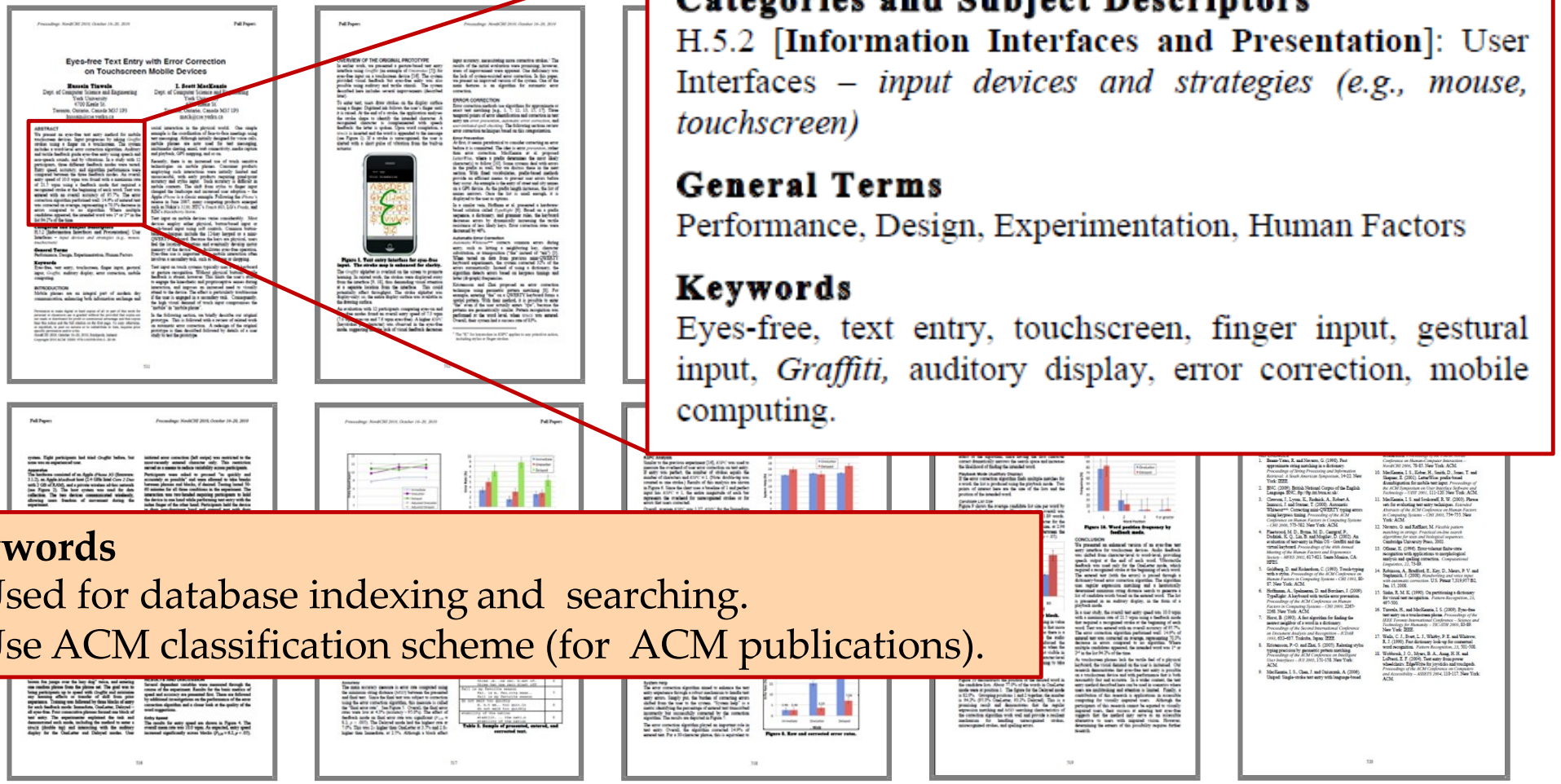
Abstract

- Write last.
- Not an introduction!
- State **what you did** and **what you found**!
- Give the most salient finding(s).

Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

Notice that there are reasons to write an abstract first or last. What's best depends on the situation and personal benefit.

Example Publication: Keywords



Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *input devices and strategies (e.g., mouse, touchscreen)*

General Terms

Performance, Design, Experimentation, Human Factors

Keywords

Eyes-free, text entry, touchscreen, finger input, gestural input, *Graffiti*, auditory display, error correction, mobile computing.

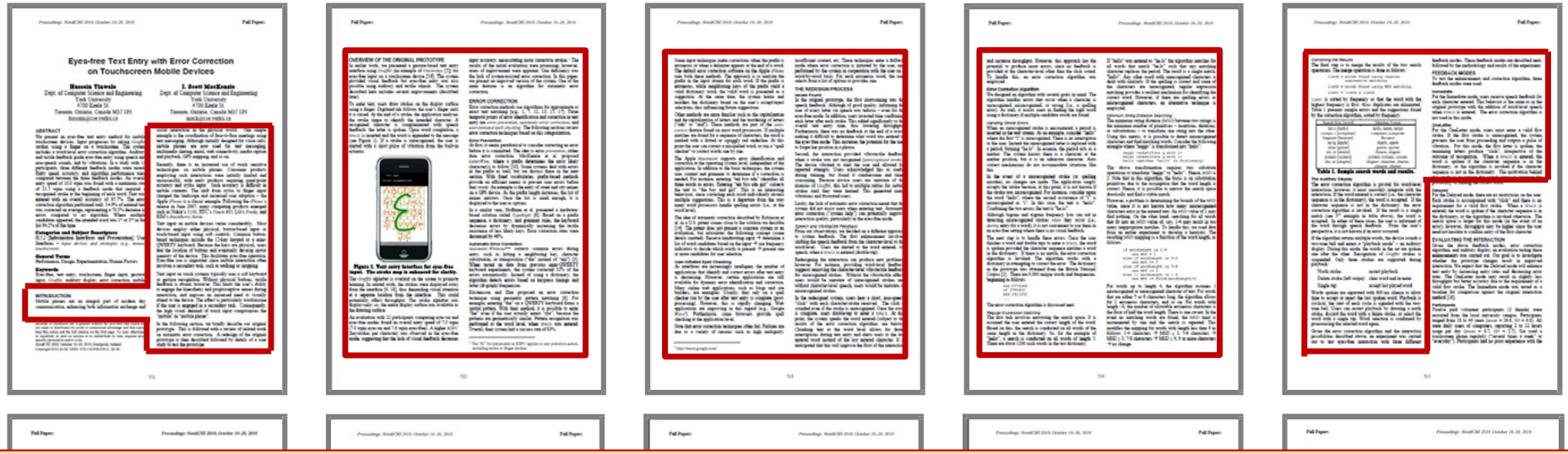
Keywords

- Used for database indexing and searching.
- Use ACM classification scheme (for ACM publications).

Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

Keywords are also often used to select reviewers when submitting papers to conferences or journals

Example Publication: Introduction



Introduction

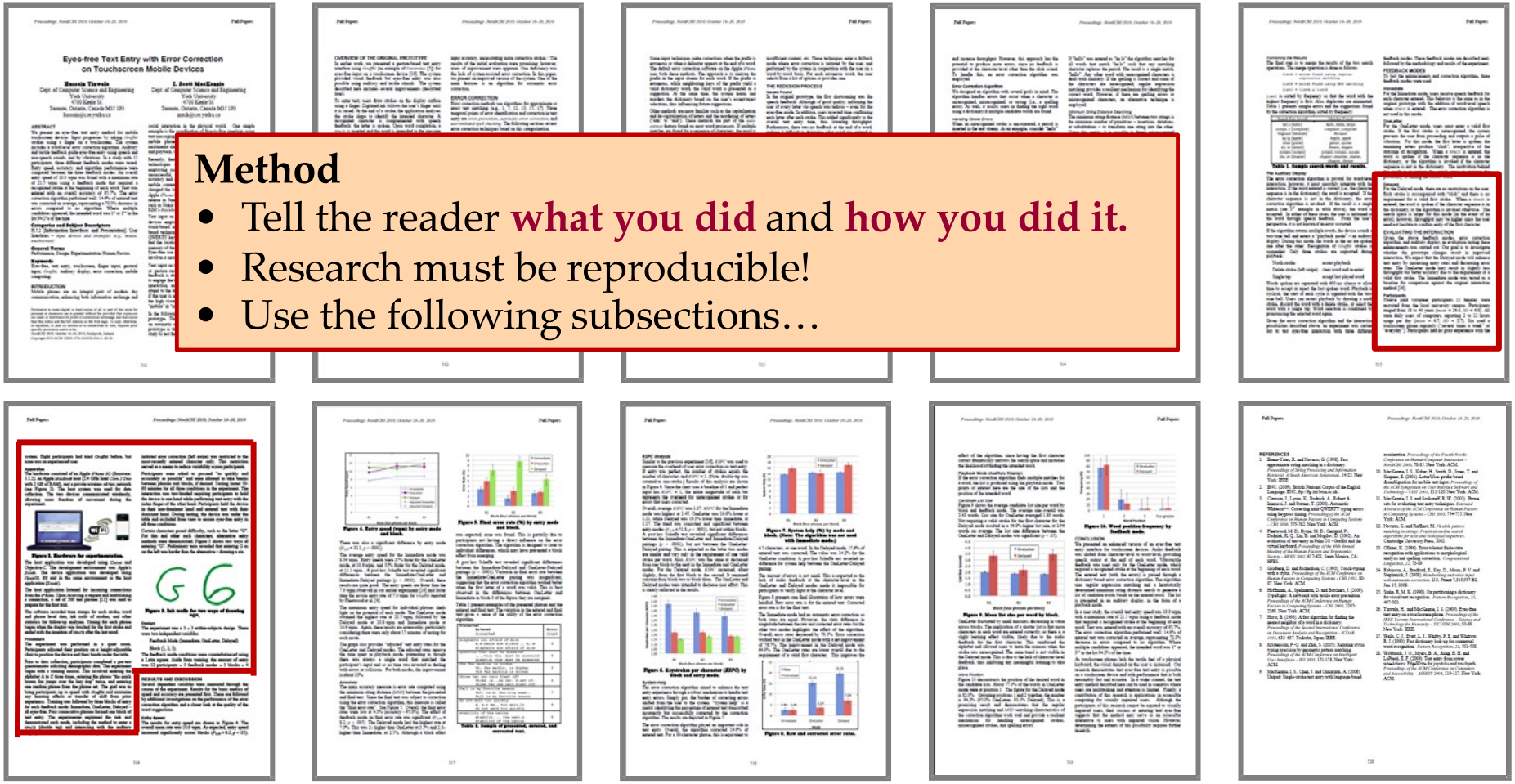
- Give the context for the research, stating why it is interesting and relevant.
- Identify a UI problem or challenge as it currently exists.
- Give an overview of the contents of the entire paper.
- State the contribution of the work.
- Identify, describe, cite **related work**.
- Describe and justify your approach to the problem.
- Follow the formatting requirements of conference or journal.
- **It's your story to tell!**

Usually, this is done in a separate **related work** section.

devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

Example Publication: Method

Notice again that this is from HCI.
Other communities might use different style and terms!



Method

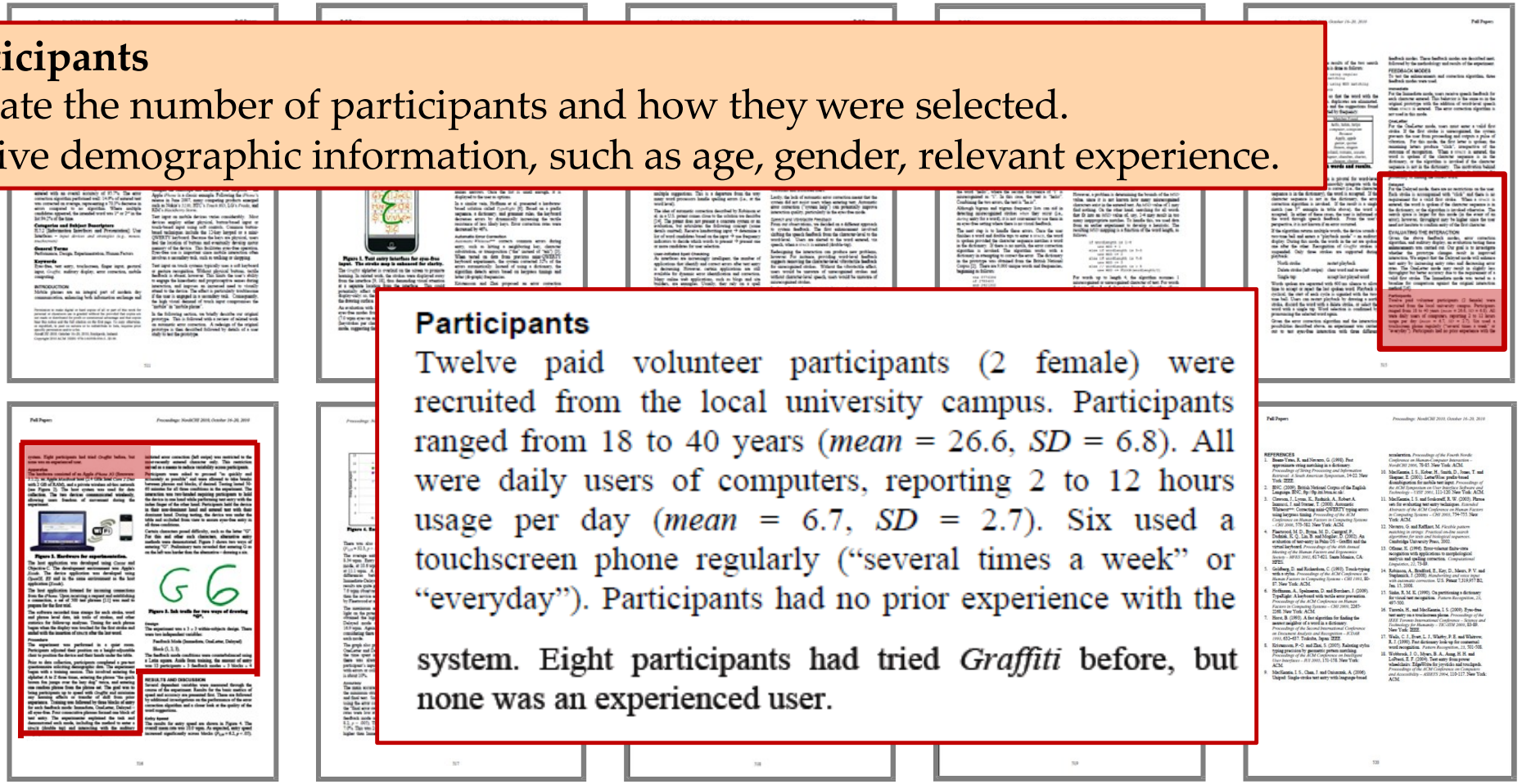
- Tell the reader **what you did** and **how you did it.**
- Research must be reproducible!
- Use the following subsections…

Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

Example Publication: Method - Participants

Participants

- State the number of participants and how they were selected.
- Give demographic information, such as age, gender, relevant experience.



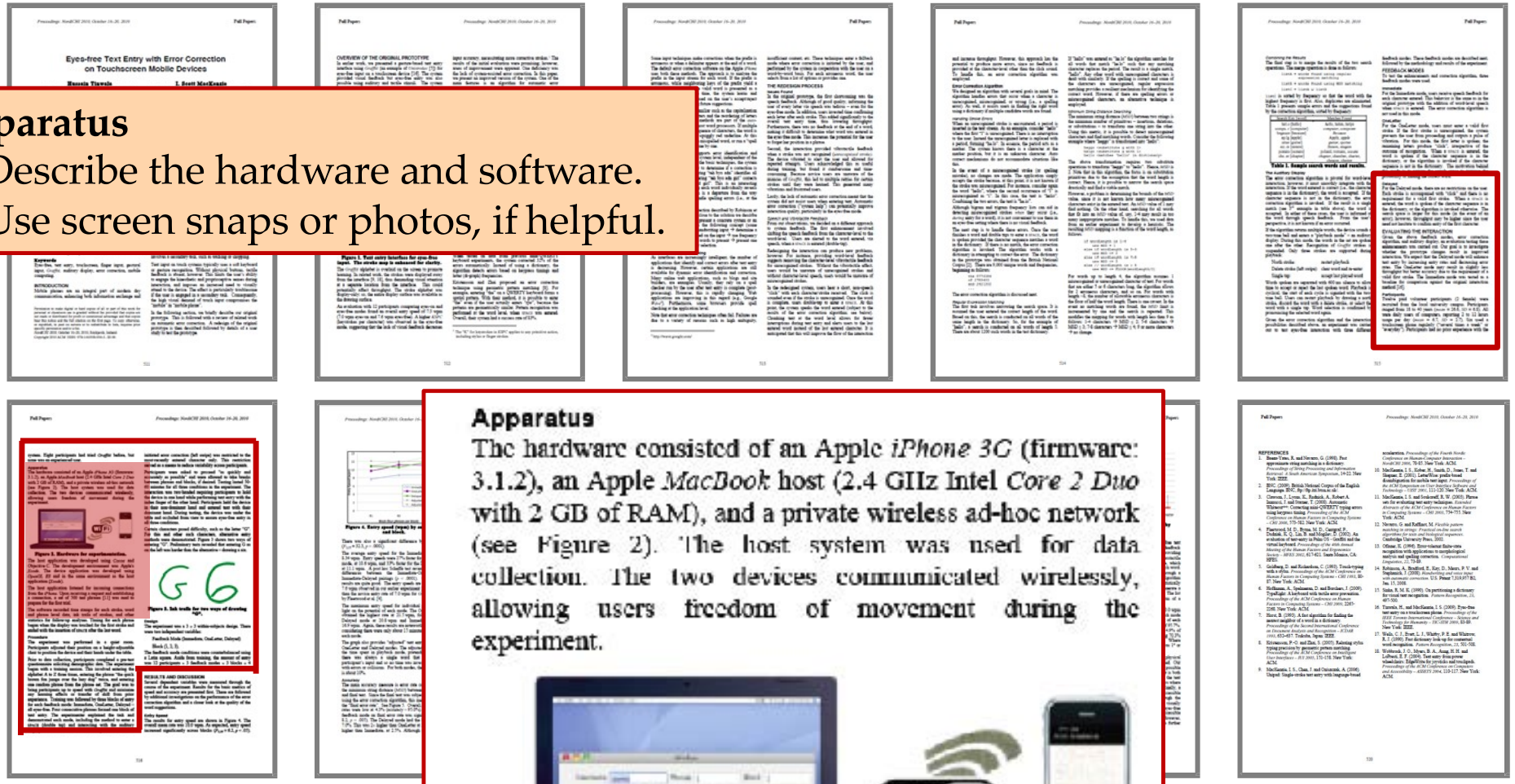
Participants

Twelve paid volunteer participants (2 female) were recruited from the local university campus. Participants ranged from 18 to 40 years (*mean* = 26.6, *SD* = 6.8). All were daily users of computers, reporting 2 to 12 hours usage per day (*mean* = 6.7, *SD* = 2.7). Six used a touchscreen phone regularly ("several times a week" or "everyday"). Participants had no prior experience with the system. Eight participants had tried *Graffiti* before, but none was an experienced user.

Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

Example Publication: Method - Apparatus

Apparatus
- Describe the hardware and software.
- Use screen snaps or photos, if helpful.



Apparatus

The hardware consisted of an Apple *iPhone 3G* (firmware: 3.1.2), an Apple *MacBook* host (2.4 GHz Intel *Core 2 Duo* with 2 GB of RAM), and a private wireless ad-hoc network (see Figure 2). The host system was used for data collection. The two devices communicated wirelessly, allowing users freedom of movement during the experiment.

Figure 2. Hardware for experimentation.

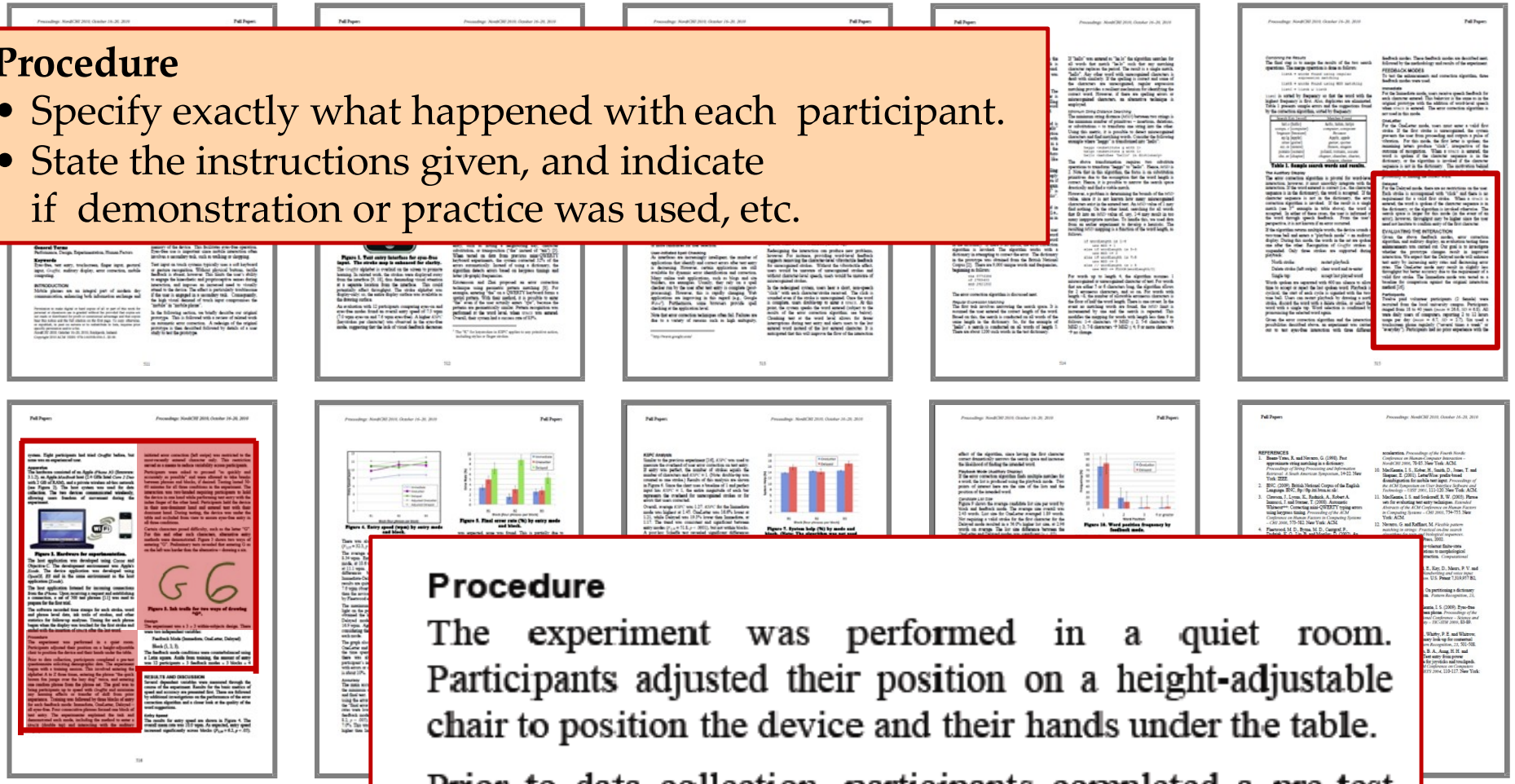
The host application was developed using *Cocoa* and Objective C. The development environment was Apple's

Tinwala, H. and MacKenzie, I. … touchscreen mobile devices, *Proceedings of the 6th N… - NordiCHI 2010,* (New York: ACM, 2010), 511-52…

Example Publication: Method - Procedure

Procedure

- Specify exactly what happened with each participant.
- State the instructions given, and indicate if demonstration or practice was used, etc.



Procedure

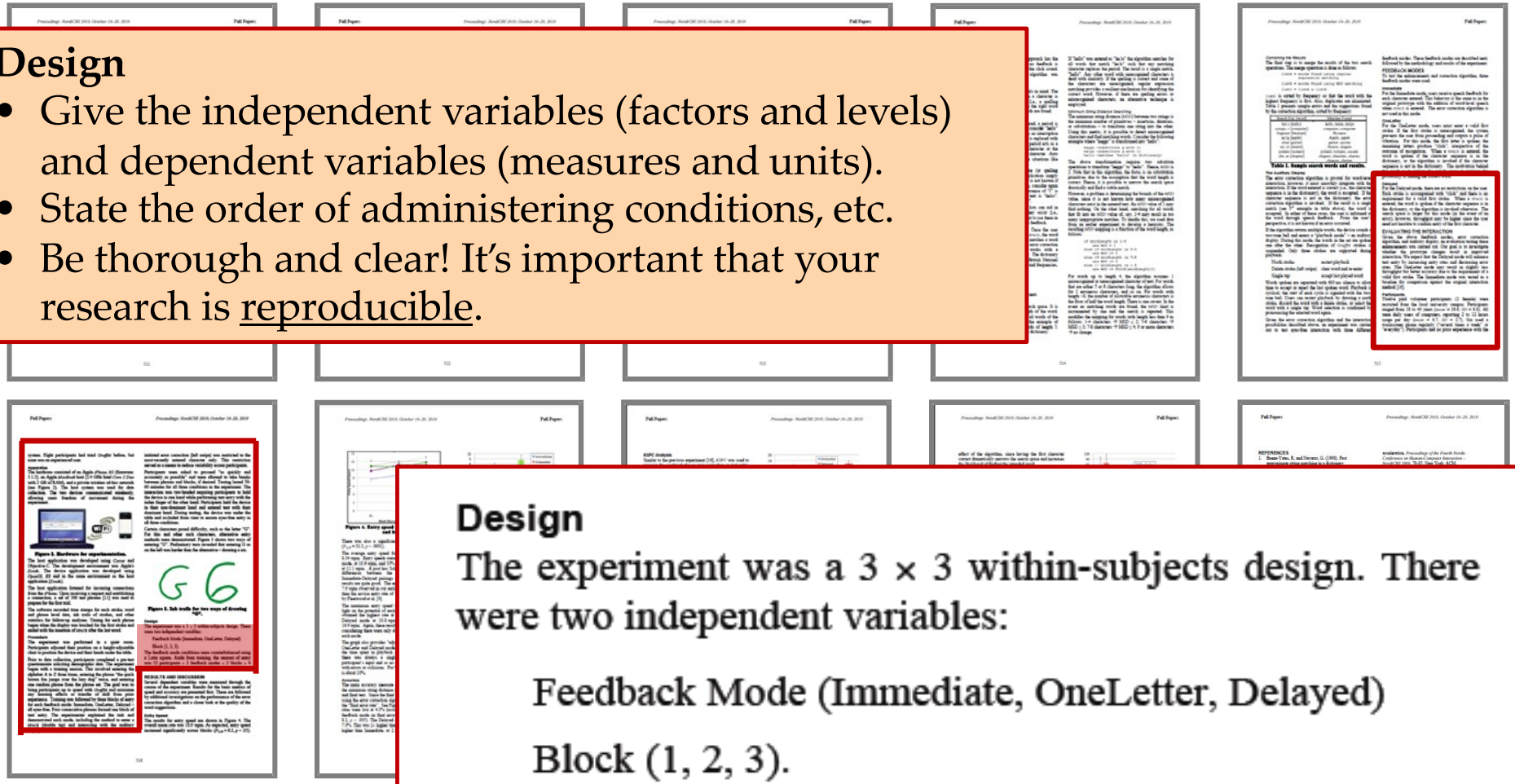
The experiment was performed in a quiet room. Participants adjusted their position on a height-adjustable chair to position the device and their hands under the table.

Prior to data collection, participants completed a pre-test questionnaire soliciting demographic data. The experiment began with a training session. This involved entering the alphabet A to Z three times, entering the phrase "the quick brown fox jumps over the lazy dog" twice, and entering one random phrase from the phrase set. The goal was to bring participants up to speed with *Graffiti* and minimize

Tinwala, H. and MacKenzie … obile devices, *Proceedings of the 6t* …), (New York: ACM, 2010), 51…

Example Publication: Method - Design

Also: make sure to use the correct terminology.



Design

- Give the independent variables (factors and levels) and dependent variables (measures and units).
- State the order of administering conditions, etc.
- Be thorough and clear! It's important that your research is reproducible.

Design

The experiment was a 3 × 3 within-subjects design. There were two independent variables:

Feedback Mode (Immediate, OneLetter, Delayed)

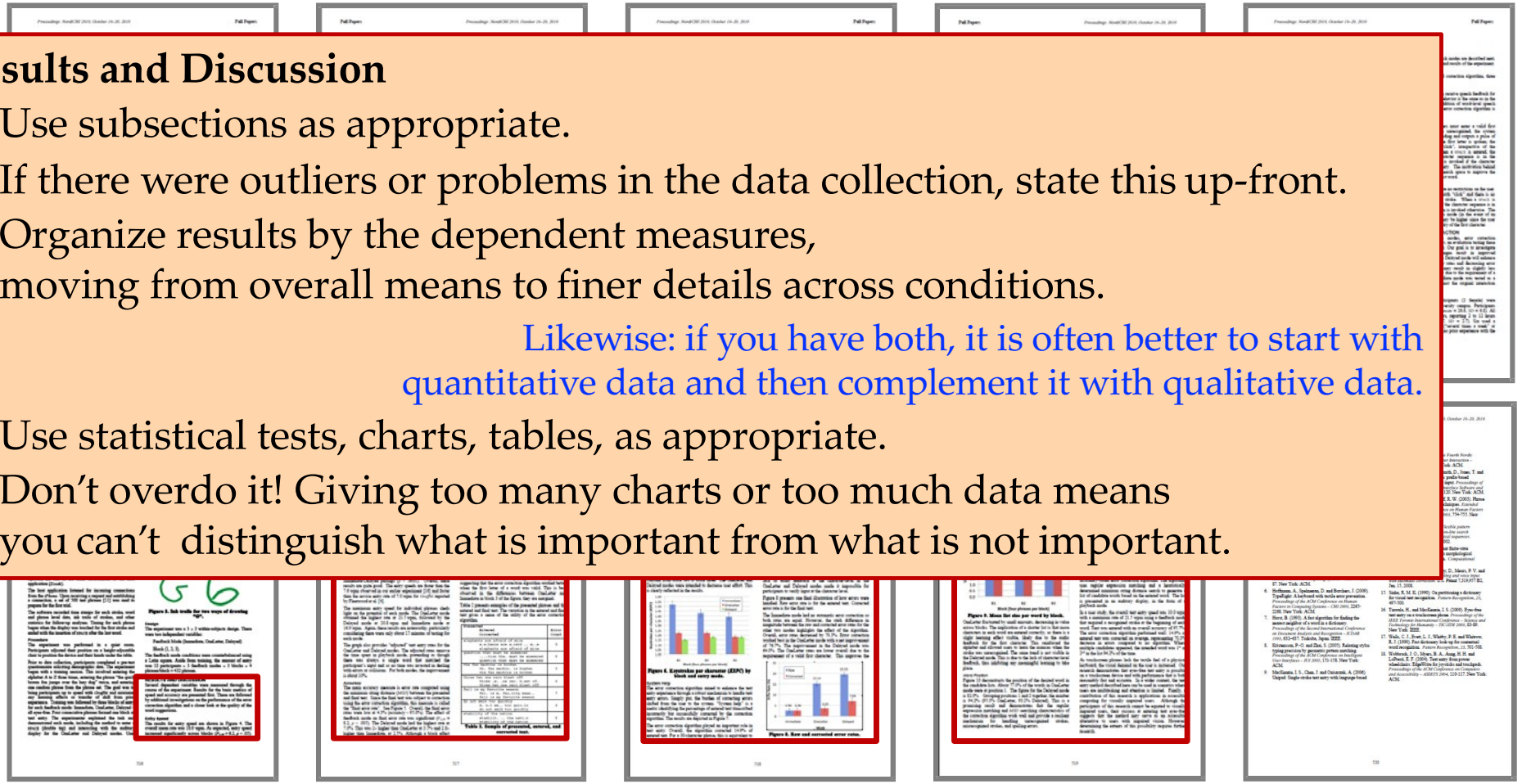
Block (1, 2, 3).

The feedback mode conditions were counterbalanced using a Latin square. Aside from training, the amount of entry was 12 participants × 3 feedback modes × 3 blocks × 4 phrases/block = 432 phrases.

Tinwala, H. and MacKenzie, devices, *Proceedings of the 6th* (New York: ACM, 2010), 511-

Example Publication: Results & discussion

Do not mix facts with interpretation and speculation!



Results and Discussion

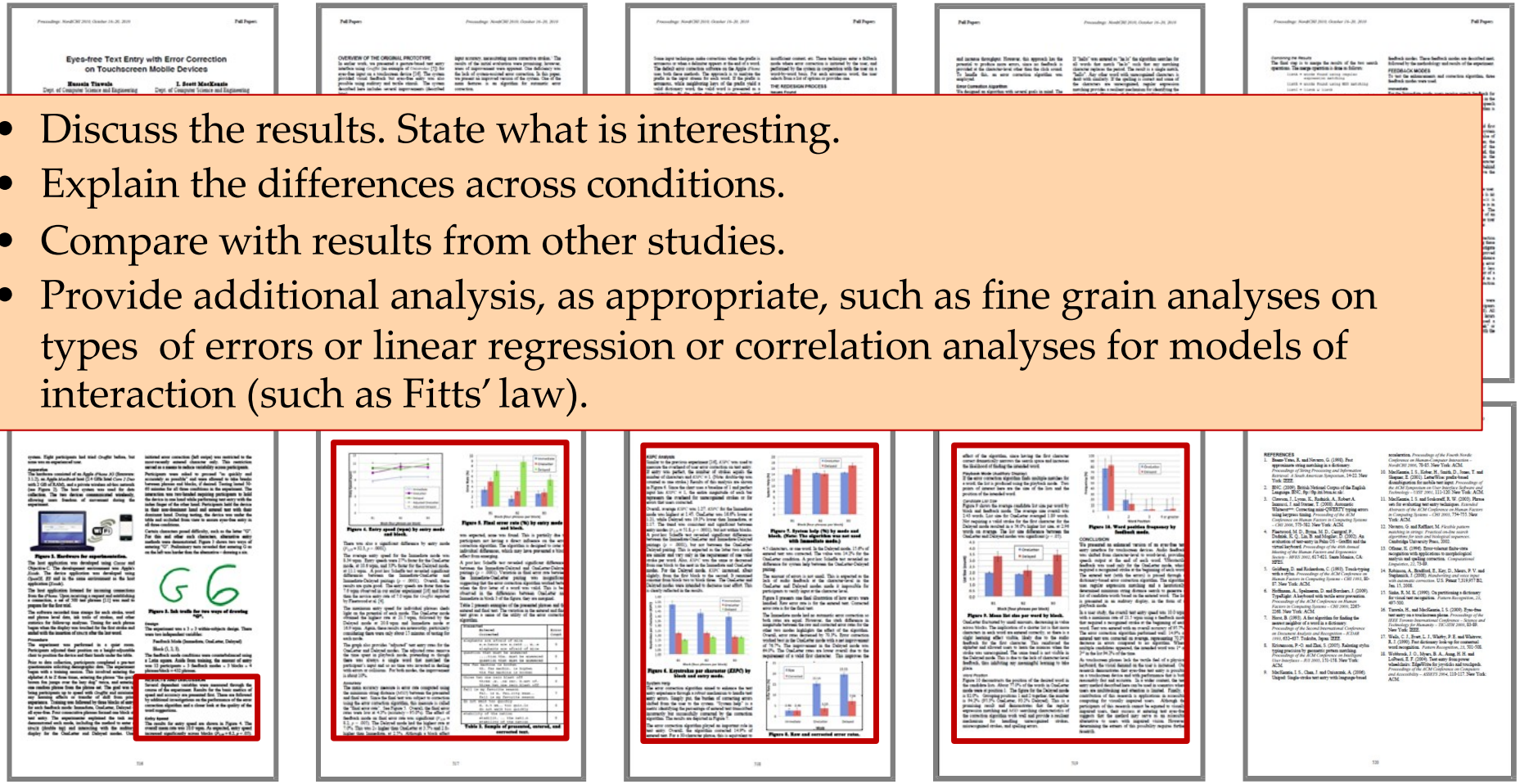
- Use subsections as appropriate.
- If there were outliers or problems in the data collection, state this up-front.
- Organize results by the dependent measures, moving from overall means to finer details across conditions.

Likewise: if you have both, it is often better to start with quantitative data and then complement it with qualitative data.

- Use statistical tests, charts, tables, as appropriate.
- Don't overdo it! Giving too many charts or too much data means you can't distinguish what is important from what is not important.

Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

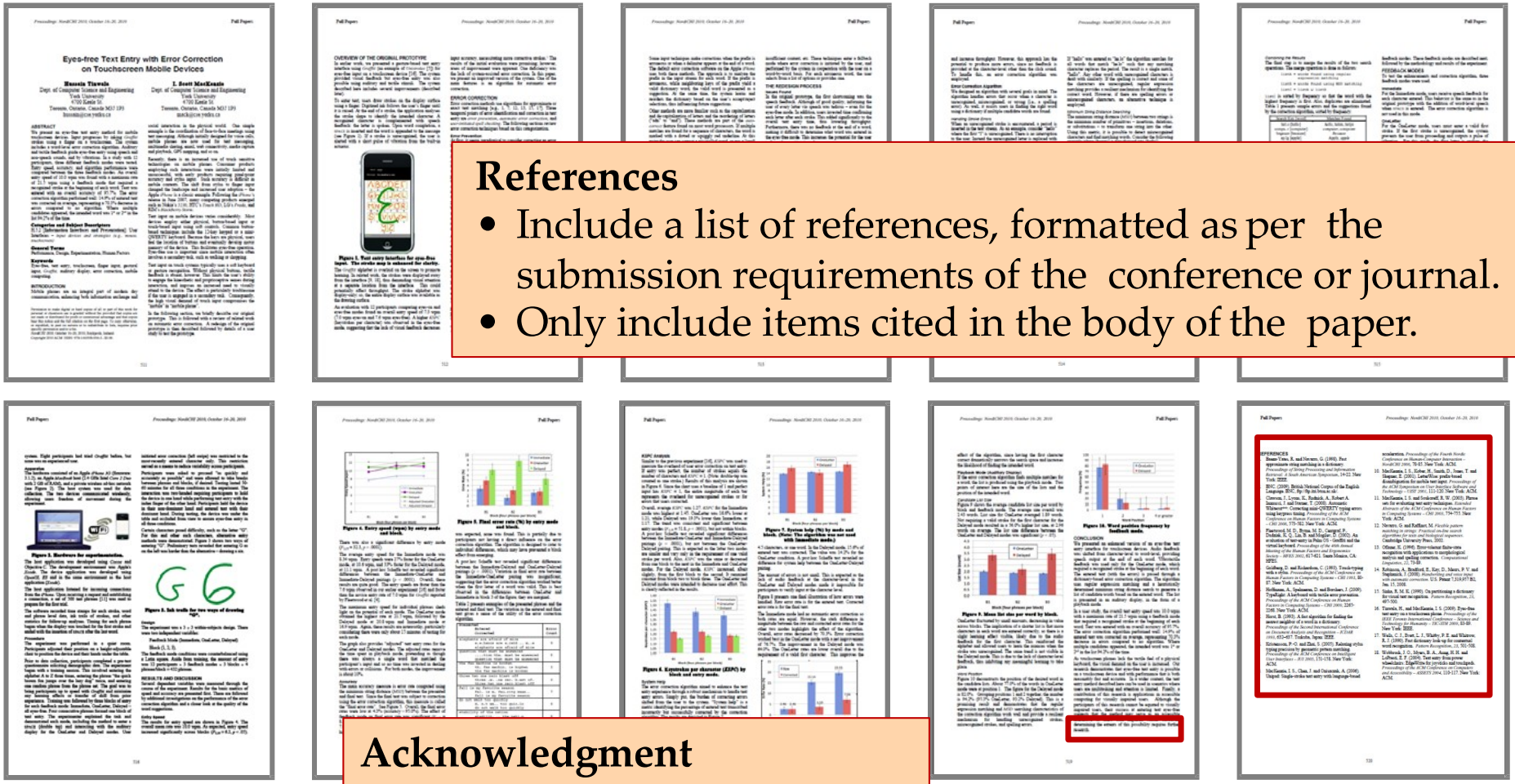
Example Publication: Results & discussion (2)



- Discuss the results. State what is interesting.
- Explain the differences across conditions.
- Compare with results from other studies.
- Provide additional analysis, as appropriate, such as fine grain analyses on types of errors or linear regression or correlation analyses for models of interaction (such as Fitts' law).

Tinwala, H. and MacKenzie, I. S., Eyes-free text entry with error correction on touchscreen mobile devices, *Proceedings of the 6th Nordic Conference on Human-Computer Interaction - NordiCHI 2010*, (New York: ACM, 2010), 511-520.

Example Publication: Acknowledgement & references



References

- Include a list of references, formatted as per the submission requirements of the conference or journal.
- Only include items cited in the body of the paper.

Acknowledgment

- Optional.
- Thank people who helped with the research.
- Thank funding agencies.

Tinwala, H. and MacKenz … or correction on touchscreen mobile devices, *Proceedings of the* … *puter Interaction - NordiCHI 2010,* (New York: ACM, 2010), 5…

A highly recommended source:

Zobel, Justin.
Writing for computer science.
Springer, 2015.

You can get this for free in the UU library (as PDF and eBook).

Focused on Computer Science (including sections on how to present algorithms, mathematical writing, etc.)

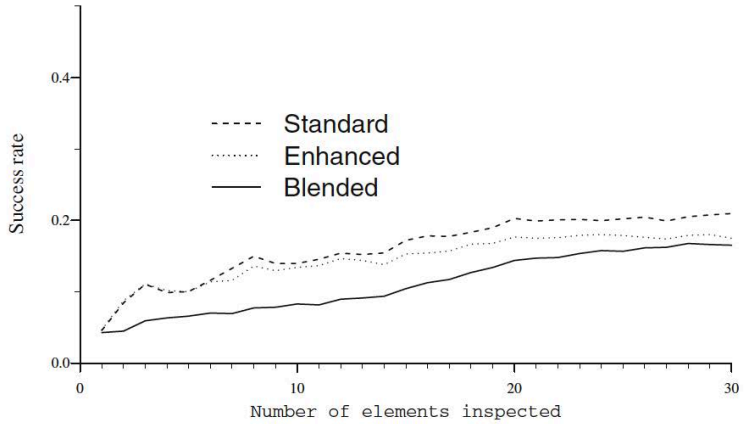
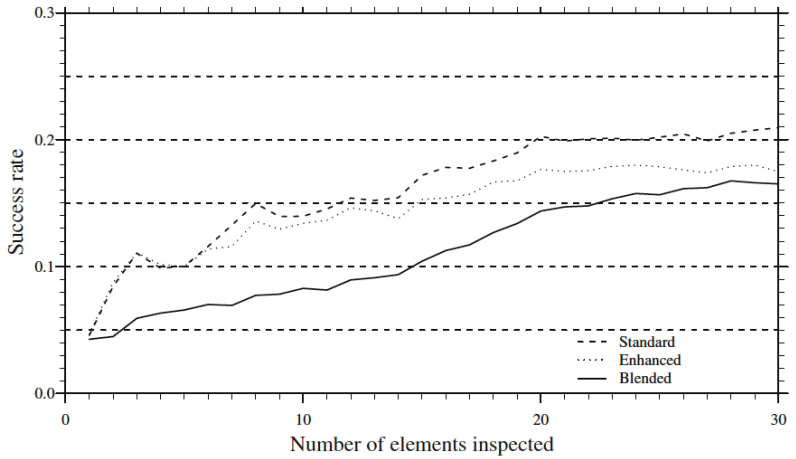


FIGURE 7. *Success rate as the number of inspected items is increased. It is clear that blending is not effective.*



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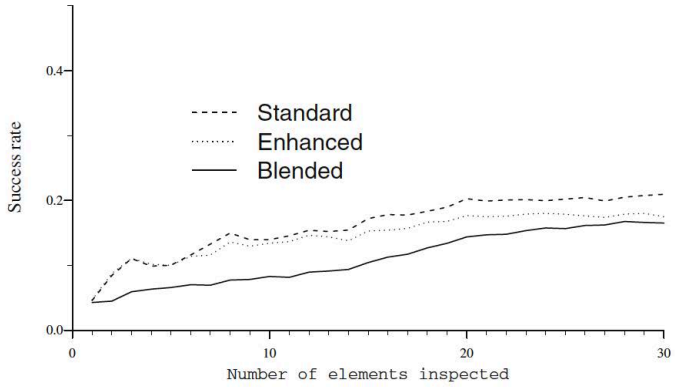

FIGURE 7. *Success rate as the number of inspected items is increased. It is clear that blending is not effective.*

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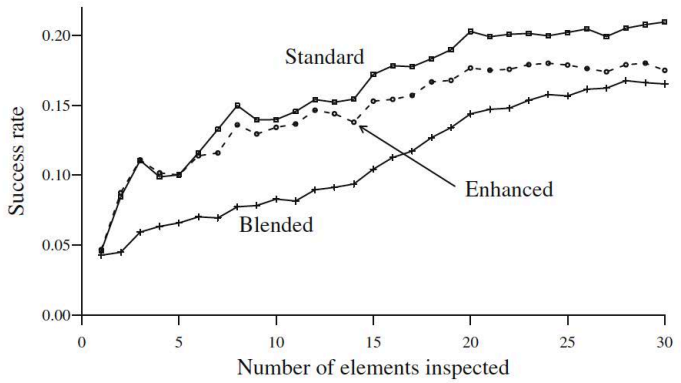

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Example from Zobel, Justin, *Writing for computer science,* Springer, 2015.

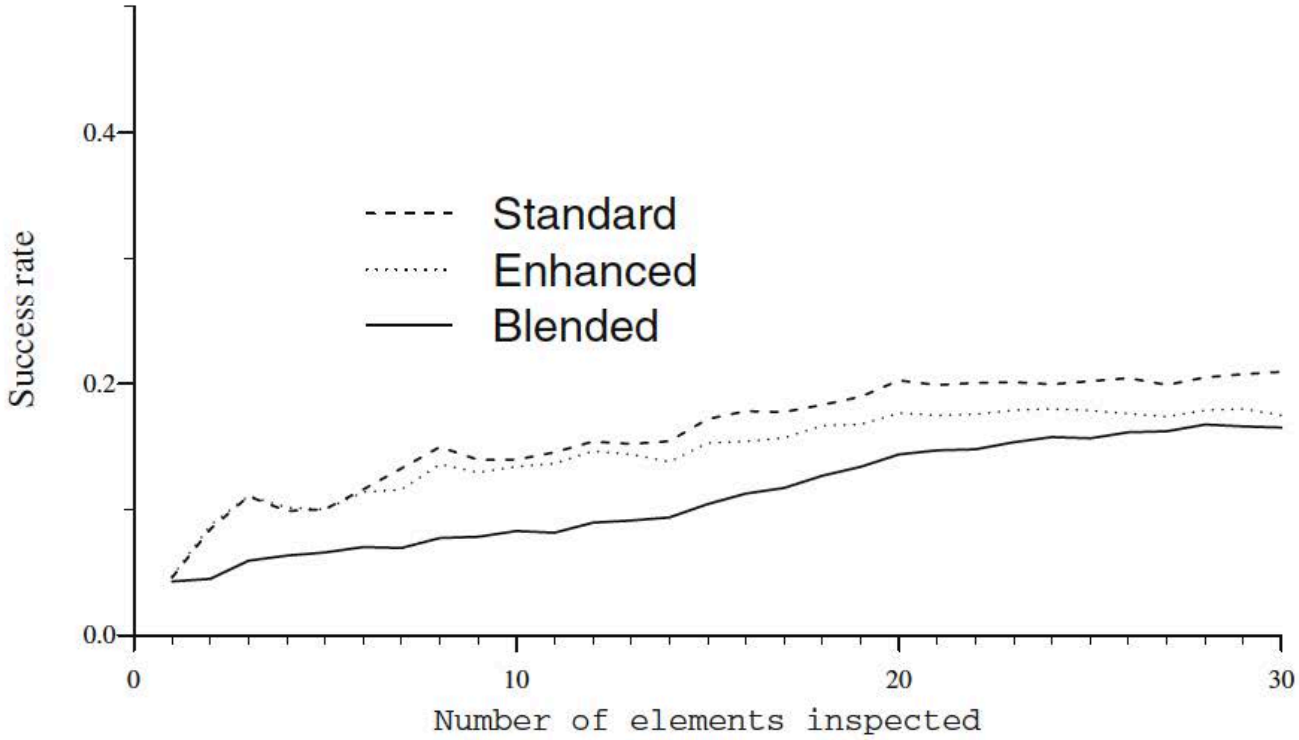

FIGURE 7. *Success rate as the number of inspected items is increased. It is clear that blending is not effective.*

"In the upper version, poor use has been made of the vertical space available, and the legend is awkwardly placed. Fonts and size are changed unnecessarily, and are inconsistent with the main text."

Example from Zobel, Justin, *Writing for computer science,* Springer, 2015.

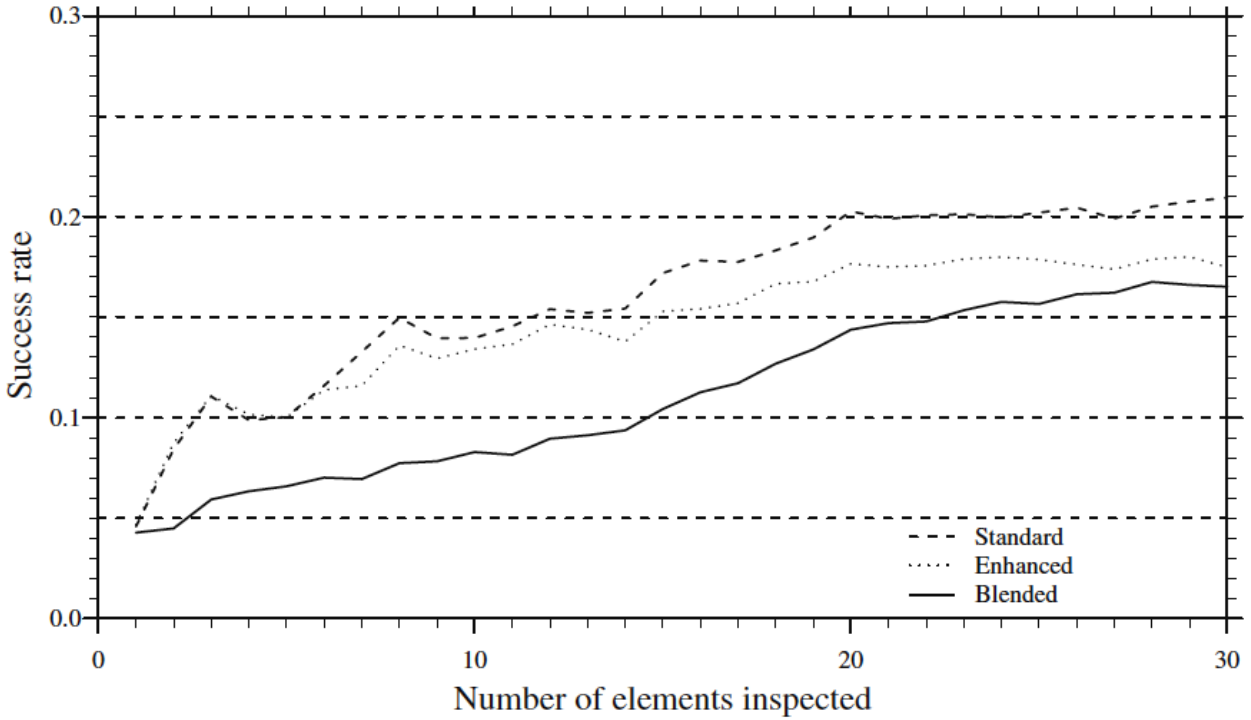

FIGURE 7. *Success rate as the number of inspected items is increased. It is clear that blending is not effective.*

"In the lower version, the vertical scaling and fonts have been partially corrected, but unnecessary ornamentation has been introduced, and the fonts are still too small. The grid lines and heavy border now greatly outweigh the data being presented."

Example from Zobel, Justin, *Writing for computer science,* Springer, 2015.

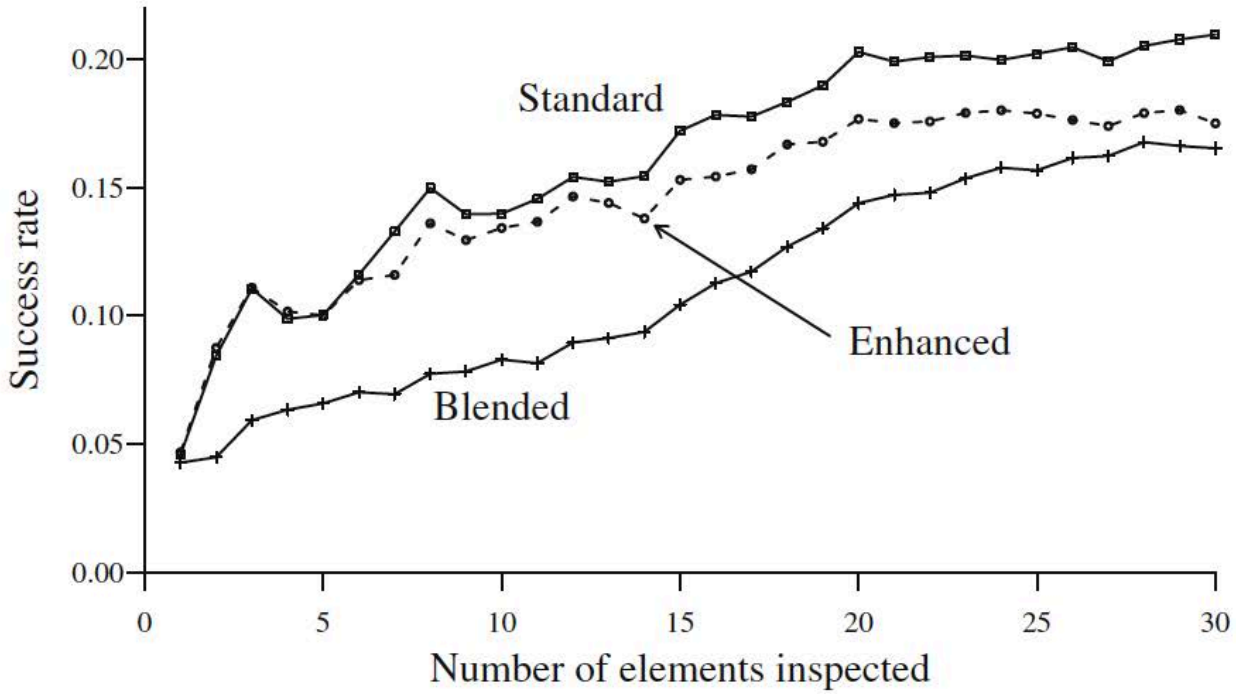

FIGURE 7. *Success rate as the number of inspected items is increased. It is clear that blending is not effective.*

"Graphs reconsidered. These graphs show the same data as those on the previous page. Vertical scale is now completely corrected, and unnecessary tick marks have been removed. …, the data lines are stronger and the legend has been replaced with direct labelling. Line ticks have been introduced to reflect the fact that the data is discrete, that is, non-integer values are not meaningful."