Intro to research & games

Part of: AXM-E0002 - Doing Research in Art and Media

Prof. Perttu Hämäläinen

2024 (2nd iteration, likely to be updated)

Learning goals

- Prepare for carrying out a Master's thesis project: How to pick a good topic, how to execute.

- Some preliminaries on writing the thesis, more on that on Master's thesis seminar next year

- Games user research methods: Playtesting, and more generally: How to know who your players are and what they do, think, and feel?
  - IMPORTANT: This material is now better taught at the **CS-E6010 Games User Research** course, partially building on my old materials, by Christian Guckelsberger. For the best learning experience, you should join his course unofficially and I will award you credits.

Contents

- Understanding research contributions
- Writing research proposals
- Research and Master's theses
- Exercises

Research contributions

What is research?

- A process that produces **new knowledge**

- Different research approaches produce different types of knowledge

- Different research communities value different types of knowledge

- Value and validity of the **research contribution** is determined through **peer review**

Key: Identifying and articulating your research contribution, and understanding how it will be evaluated by reviewers

Jacob O. Wobbrock, University of Washington
Julie A. Kientz, University of Washington

Common contribution types and how to evaluate

- Empirical research
- Artifact (e.g., an experimental game)
- Methodological
- Theoretical
- Dataset
- Survey
- Opinion / essay

https://faculty.washington.edu/wobbrock/pubs/interactions-16.pdf

Research Contributions in Human-Computer Interaction

Insights

→ Knowledge generated by HCI research can be categorized into certain contribution types.
→ Each contribution type has key characteristics that imply how it is judged.
→ The contribution types used for submissions to the CHI conference have evolved over time to distill types of knowledge from other concerns.

All scholarly fields strive to contribute new knowledge. In the field of human-computer interaction (HCI), this new knowledge increasingly comes in rich forms like videos and demos, but the archival research paper remains the most widely used and accepted capture and delivery mechanism for research knowledge. The knowledge contribution made by a research paper—or more precisely, made by the work a research paper describes—is any research paper's central feature. For example, a theoretical physics paper may contribute a new mathematical model for the behavior of light near black holes. A civil

engineering paper may contribute a new method for stress-testing bridges. A social anthropology paper may contribute an account of people's reactions to teen pregnancies in rural religious communities. Whatever the field of inquiry, whatever the phenomenon of interest, every research paper strives to make a research contribution by offering new knowledge. In an effort to distinguish this kind of knowledge from everyday know-how, some scholars even capitalize the term: Knowledge.

In the whole of human inquiry, there are, of course, countless specific research contributions to be made. But

Common contribution types and how to evaluate

- Identifying, articulating, and solving problems

- Evaluation: Significance, Effectiveness, Efficiency, Transfer/generalizability, Confidence

- Problem domains in games: Technology, development methods & tools, player experience…

- Generally: empirical, conceptual, and constructive problems

HCI Research as Problem-Solving

Antti Oulasvirta
Aalto University, Finland

Kasper Hornbæk
University of Copenhagen, Denmark

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ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

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Why bother with a meta-scientific paper at a technical conference? Because the stakes are high. Philosophies of science are at worst an impotent topic worthy of hallway conversations. But if the critics are right, our field is seriously crippled, from the project level to the larger arenas of research *Realpolitik*. Lacking a coherent view of what HCI is, and what *good* research in HCI is, how can we communicate results to others, assess research, co-ordinate efforts, or compete? In addition, as we show, philosophical views offer thinking tools that can aid in generating ideas and generally enhance the quality of research.

The contribution here lies in describing HCI as *problem-solving*. An overview is given in Figure 1. The view originates from Larry Laudan's philosophy of science [28]. Laudan describes scientific progress in terms of two foundational concepts: *research problem* and *solution*. Laudan's 'problem' is not what we mean by the term in ordinary language. It is defined via inabilities and absences occurring in descriptions; knowledge; or, as often in HCI, constructive solutions. For example, a research problem may involve lack of understanding of how colour schemes on a web page affect the aesthetic experience of its use. More generally, Laudan's research problem subsumes what we traditionally understand in HCI as a 'design problem' but also problems to do with theory and empirical research.

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Research Through Design (RtD)

- Earlier/alternative view of artifact and problem solving contributions

- *"Emphasizes practicing design and producing artifacts as a way of generating knowledge"* (https://dl.acm.org/doi/pdf/10.1145/3290607.3299011)

- Evaluation criteria (Zimmerman et al. 2007): Process, Invention, Relevance, Extensibility

- Gaver et al. 2012 argue against too restrictive evaluation criteria and embracing a diversity of RtD approaches and results https://dl.acm.org/doi/pdf/10.1145/2207676.2208538

Research Through Design as a Method for Interaction Design Research in HCI

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ABSTRACT
For years the HCI community has struggled to integrate design in research and practice. While design has gained a strong foothold in practice, it has had much less impact on the HCI research community. In this paper we propose a new model for interaction design research within HCI. Following a research through design approach, designers produce novel integrations of HCI research in an attempt to make the *right* thing: a product that transforms the world from its current state to a preferred state. This model allows interaction designers to make research contributions based on their strength in addressing under-constrained problems. To formalize this model, we provide a set of four lenses for evaluating the research contribution and a set of three examples to illustrate the benefits of this type of research.

Author Keywords
design, interaction design, interaction design research, HCI research, research through design, wicked problems, design theory, design method

ACM Classification Keywords
H5.2. User Interfaces: Theory and methods.

INTRODUCTION
In recent years we have both witnessed and participated in the struggle as several academic institutions have attempted to integrate design, with technology and behavioral science in support of HCI education and research. While there has been great excitement about the benefits integrating design can bring, we quickly realized that no agreed upon research model existed for interaction designers to make research contributions other than the development and evaluation of new design methods. Over the last two years we have undertaken a research project to (i) understand the nature of the relationship between interaction design and the HCI research community, and (ii) to discover and invent methods for interaction design researchers to more effectively participate in HCI research.

Through our inquiry we learned that many HCI researchers commonly view design as providing surface structure or decoration. In addition, we lack a unified vision of what design researchers can contribute to HCI research. This lack of a vision for interaction design research represents a lost opportunity for the HCI research community to benefit from the added perspective of design thinking in a collaborative research environment. The research community has much to gain from an added design perspective that takes a holistic approach to addressing under-constrained problems.

To address this situation, this paper makes two contributions: (i) a model of interaction design research designed to benefit the HCI research and practice communities, and (ii) a set of criteria for evaluating the quality of an interaction design research contribution. The model is based on Frayling's *research through design* [14], and it stresses how interaction designers can engage "wicked problems" [21]. What is unique to this approach to interaction design research is that it stresses design artifacts as outcomes that can transform the world from its current state to a preferred state. The artifacts produced in this type of research become design exemplars, providing an appropriate conduit for research findings to easily transfer to the HCI research and practice communities. While we in no way intend for this to be the only type of research contribution interaction designers can make, we view it as an important contribution in that it allows designers to employ their strongest skills in making a research contribution and in that it fits well within the current collaborative and interdisciplinary structure of HCI research.

Definitions
As we conducted this inquiry, we quickly realized that within both the HCI and design communities there is an inconsistent and confusing use of the following terms. Therefore, below we provide a set of definitions for these terms with respect to this paper.

Designer. Using such a generic term is a challenge at best. At CHI 2006's SIG: "The CHI Design Community", Bill Buxton sarcastically claimed that if everyone is a designer because they select their own clothes, then everyone is also a mathematician, because we all count our change. His comment captures what a loaded term "designer" is. Within

Research plans/proposals

Question template

1. Research goal, problem, and/or question?

2. Research gap: What is missing in previous knowledge (knowledge gap) or solutions to your problem?

3. Intended results and contribution? (Based on established contribution types)

4. Methods/approach?
   - What data, observations, or insights do you need for evaluating your results and contribution, and what method/approach will allow you to obtain those?

5. Significance? Why should anyone care, why does your work matter?
   - What makes your question interesting?
   - Why does your problem need to be solved?
   - What impact does your work have, if you reach your goals?
   - What value does your contribution provide over previous work?

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Writing a thesis on industry work? Articulate the gap and significance from the point of view of industry and your employer.

Heilmeier Catechism

- What are you trying to do? Articulate your objectives using absolutely no jargon.

- How is it done today, and what are the limits of current practice?

- What is new in your approach and why do you think it will be successful?

- Who cares? If you are successful, what difference will it make?

https://www.darpa.mil/work-with-us/heilmeier-catechism

Why does someone need to care?

- Ideally, one should be able to pursue new knowledge for its own sake, without worrying about the sales pitch

- In practice, we're almost always competing for funding, media attention, getting papers accepted…

- The research plan or paper with more **clearly articulated and significant contribution** tends to win

Academy of Finland research plan template

Fill in the sections of the plan where applicable, according to the practices of your own discipline. Please use the headings provided.

1 Aim and objectives

1.1 Significance of research project in relation to current knowledge, research based starting points:

- How the project and the methods used are linked to previous international and/or national research (state of the art)
- Research premise, aims and objectives

1.2 Research questions and/or hypotheses:

1.3 Expected research results and their anticipated scientific impact, potential for scientific breakthroughs and for promoting scientific renewal:

- Research impact within the scientific community
- Project's novelty or added value for science

1.4 Special objective of call (applies to Academy Programmes and other thematic calls):

- Justifications for how the project will address the call objectives and questions.

Research & Master's Theses

Research & Master's thesis

An Aalto ARTS thesis can focus on either art/design or research.

"Emphasis may be put on criteria most relevant for that particular thesis: if the student defines his or her work as theoretical or applied research, the criterion **Quality of the artistic component** may be ignored. In such cases, weight is put on the criterion **Discussion of the topic, conclusions and interpretation**"

https://mycourses.aalto.fi/pluginfile.php/1504906/mod_resource/content/2/Aalto%20ARTS%20Master%20Thesis%20Guide%202020%20v.2.pdf

Almost all the grading criteria apply to both thesis types

- Definition of topic & goals

- Command of the topic and use of sources

- Choice of methods/techniques, ability to draw conclusions, independently, linking the topic to broader context

- Description and analysis of the process

- Quality of writing and illustration

- Demonstrating professional knowledge and skills

- Only for artistic thesis: Quality of the artistic component

https://into.aalto.fi/display/enartma/Completing+your+master%27s+thesis

Developing a thesis plan

- Iterate on your thesis topic until you can answer the research plan template questions
- You won't know the results, but you should have some assumptions or hypotheses of how things will work out
- Write your answers down as an extended abstract or 1-pager, roughly corresponding to the abstract and intro of a research paper.
- Iterate on this until both you and the supervisor/advisor feel it's safe to proceed.

If (and when) you need to change your plan, revise the abstract.

Ideally, the abstract crystallizes the thesis vision, guides the thesis process, and allows your thesis supervisor to quickly remind themselves what the thesis is about (they will forget if they supervise multiple students)

Extended abstract / 1-pager

- Research goal and/or question?

- Research gap?

- Results and contribution?

- Research method/approach?

- Significance?

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Why bother with a meta-scientific paper at a technical conference? Because the stakes are high. Philosophies of science are at worst an impotent topic worthy of hallway conversations. But if the critics are right, our field is seriously crippled, from the project level to the larger arenas of research *Realpolitik*. Lacking a coherent view of what HCI is, and what *good* research in HCI is, how can we communicate results to others, assess research, co-ordinate efforts, or compete? In addition, as we show, philosophical views offer thinking tools that can aid in generating ideas and generally enhance the quality of research.

The contribution here lies in describing HCI as *problem-solving*. An overview is given in Figure 1. The view originates from Larry Laudan's philosophy of science [28]. Laudan describes scientific progress in terms of two foundational concepts: *research problem* and *solution*. Laudan's 'problem' is not what we mean by the term in ordinary language. It is defined via inabilities and absences occurring in descriptions; knowledge; or, as often in HCI, constructive solutions. For example, a research problem may involve lack of understanding of how colour schemes on a web page affect the aesthetic experience of its use. More generally, Laudan's research problem subsumes what we traditionally understand in HCI as a 'design problem' but also problems to do with theory and empirical research.

Most of our argumentation builds on a concept put forth by Laudan that links problems with solutions: *problem-solving capacity*. For Laudan, a solution is something special, too. In the above-mentioned case of aesthetic perception of web pages, possible solutions range from descriptions of self-reports to models of aesthetic impressions. These solutions change the status of the inabilities and absences but in different ways. Laudan qualifies this in terms of *improvements to problem-solving capacity*. This is counter to some traditional notions of progress [28, p. 14]:

In appraising the merits of theories, it is more important to ask whether they constitute adequate solutions to significant problems than it is to ask whether they are 'true',

Extended abstract / 1-pager

- Research goal and/or question?

- Research gap?

- Results and contribution?

- Research method/approach?

- Significance?

HCI Research as Problem-Solving

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ABSTRACT
This essay contributes a meta-scientific account of human–computer interaction (HCI) research as problem-solving. We build on the philosophy of Larry Laudan, who develops *problem* and *solution* as the foundational concepts of science. We argue that most HCI research is about three main types of problem: empirical, conceptual, and constructive. We elaborate upon Laudan's concept of *problem-solving capacity* as a universal criterion for determining the progress of solutions (outcomes): Instead of asking whether research is 'valid' or follows the 'right' approach, it urges us to ask how its solutions advance our capacity to solve important problems in human use of computers. This offers a rich, generative, and 'discipline-free' view of HCI and resolves some existing debates about what HCI is or should be. It may also help unify efforts across nominally disparate traditions in empirical research, theory, design, and engineering.

Author Keywords
Human–computer interaction; Problem-solving; Scientific progress; Research problem; Larry Laudan

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION
The spark for writing this essay comes from feelings of confusion, and even embarrassment, arising in describing our field to students and other researchers. What is human–computer interaction (HCI) as a field? As numerous ideas and disciplines contribute to HCI, its unique character is elusive. Although HCI is in intellectual debt to many other fields, few would agree that it reduces to them. It has its own subject of enquiry, which is *not* part of the natural or social sciences. It does not belong to engineering, computer science, or design either. So what is it?

The essay has a grand ambition: to develop a conceptually coherent account of the '95% of HCI research'. We know of no other paper offering an attempt to address the field as a whole. We are motivated first and foremost by the intel-

lectual enigma pertaining to what HCI *is*: There is no accepted account that would tell how HCI's numerous approaches contribute to pursuit of shared objectives. In contrast, HCI has been criticised for lack of 'motor themes, mainstream topics, and schools of thought' [25] and for being fragmented 'across topics, theories, methods, and people' [38]. Consequently, some have called for 'a hard science' [36], others for 'strong concepts' [19] or an 'inter-discipline' [3]. These are serious concerns with serious implications for the field.

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Exercise: Experimental games as research

- Assume that you have developed SuperHot and want to write it up as a thesis

- How would you define the goal, research gap, results & contribution, method, and significance?

- Goal: Reimagining FPS games

- Research gap: FPS games are one of the most popular genres, but the FPS games of recent years mostly follow well-established conventions and mechanics, without much innovation.

- Result & contribution: A novel game mechanic "Time only moves when you move" and a game that explores and demonstrates the opportunities and challenges of the mechanic. Contribution type: artefact (or "invention" if using Zimmerman's RtD terminology)

- Method/approach: RtD. Iterative prototyping and testing, reaching goals evaluated based on player feedback

- Significance:
  - Game mechanics innovations are a key driver of game evolution—to avoid stagnation of the field, innovating new mechanics is important.
  - Players value new mechanics, as experiencing and exploring something new is a core psychological motivation for games
  - SuperHot's success gives empirical evidence for significance

Minimum viable game thesis

- Develop a game (or part of it, e.g., UI, art, level design) & write it up
- Intro and abstract: answer the template questions
- Background chapter: Discuss previous games and research related to your work. Goals:
    1. Elaborate on the knowledge gap you fill or the uncharted territory you explore
    2. Give your readers the tools/background needed to understand your work
    3. For thesis grading, demonstrate academic citing practice and knowledge of literature.
- Design and implementation: Describe your design process and rationale
- Evaluation: Did you reach your design goals? What went right? What went wrong? What would you do differently? If possible, argue based on data such as player observations and interviews.
- Conclusion: Reiterate everything compactly, focusing on what it all means and the main takeaways for the reader

Minimum viable game thesis and grading criteria

Aalto Thesis Grading Criterion	How to satisfy
Definition of topic & goals	Explain your design goals, why they were selected, and why are they worthwhile pursuing. A good thesis explores something new (a mechanic, a theme or theoretical grounding…) and argues convincingly why it is new and significant.
Command of the topic and use of sources, linking the topic to broader context	Explain your game, relating it to other games and academic theories, studies, and books/papers. If you don't know what would be relevant to cite, talk to your thesis supervisor/advisor.
Choice of methods/techniques, ability to draw conclusions	Make sure to test your game in a way that allows you to conclude whether you reached your design goals or not. The goals define the methods needed, e.g., what questions you should ask your test players or how you should instruct them.
Description and analysis of the process	Make sure to document your process. Take note of design decisions and their rationale.
Quality of writing and illustration	Use careful proofreading, Grammarly, ChatGPT etc. to ensure correct academic writing. If using AI tools, remember to check the result for errors.
Demonstrating professional knowledge and skills	Scope your game correctly: Something that is not too trivial but still something you can pull off with high quality, in a reasonable time.

Using academic sources

- Answering the questions and discussing your game and player feedback is relatively straightforward
- Finding a fitting academic framework and sources to cite is often harder
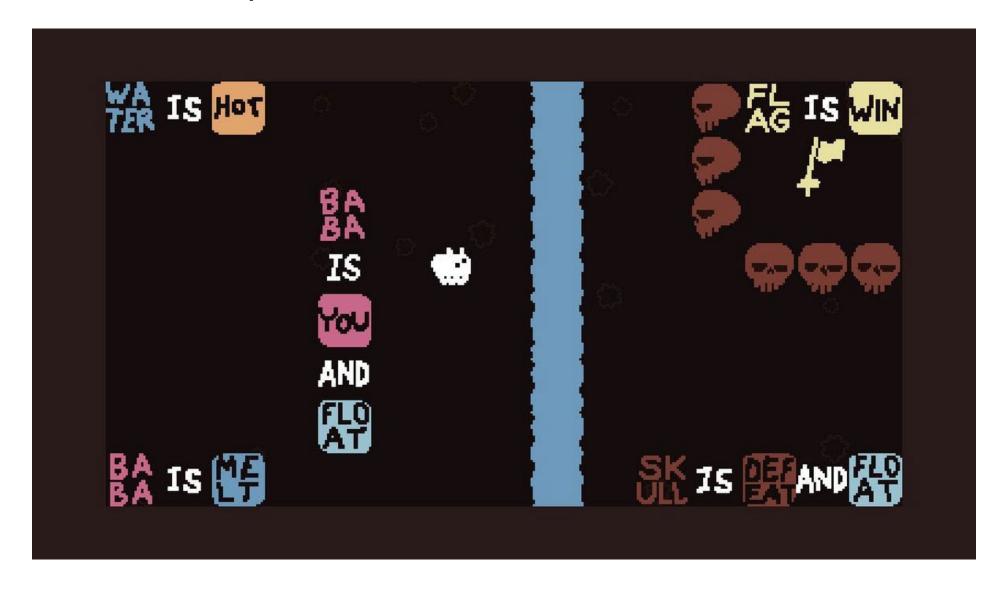- Let's practice…

Case: SuperHot

Case: SuperHot

- Intro: Cite basic sources on contribution types and Research Through Design.

- Background: Find and discuss academic papers on experimental games, FPS mechanics, and time manipulation (bullet time etc). Define and cite the games that inspired this game or share properties with it.

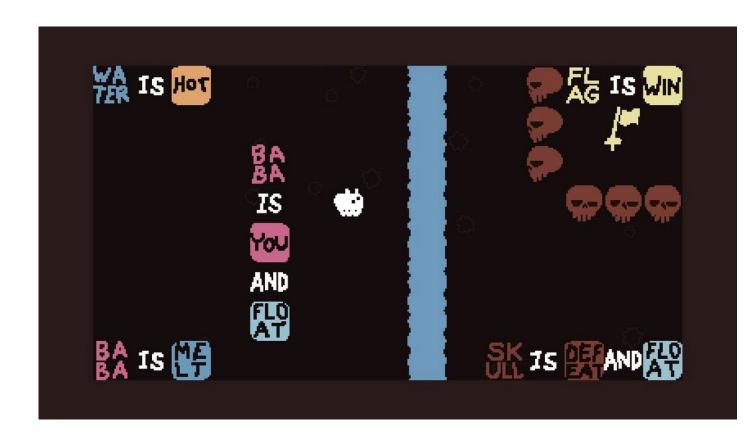- Optionally: Find and discuss what film studies say about time manipulation.

Case: Baba is you

Case: Baba is you

- Again: Cite basic sources on contribution types and Research Through Design.

- Background: Emergence, puzzle design, programming games, the history and tradition of games that the game continues (Sokoban etc)

Game theses and thesis-career fit

Career goal	A viable thesis
Just want to graduate and get a job in the industry (not necessarily in that order)	A minimum viable thesis describing and reflecting on a game you made (or part of it, e.g., art, UI). Ideally, your work should be polished and publicly released (mobile app stores, itch.io, Steam early access...). Industry recruiters value portfolio and published games over academic theses. Or, if you can get a job already before the thesis, that is also an option. You may be able to write up what you do for the company or develop a thesis on the side.
Games as art, indie studio (co-)founder	Public speaking and pitching for investments and grants is a big part of the job => you need to be able to excite the audience and demonstrate insightful thinking. Here, an experimental and ambitious thesis game helps, e.g., exploring a new mechanic or design approach. Ideally, the game should be showcased at GDC Experimental Gameplay Workshop or other curated festivals or competitions.
Game analytics, Games user research	Research & data -focused thesis that demonstrates a deep understanding of players. Can be based or own or existing games. Main problem: what research question to ask, what data to collect, and how to analyze it?
Doctoral studies	Research thesis that is publishable as an international peer-reviewed paper in conferences such as CHI, CHI PLAY, FDG, Digra. To get into a PhD program, one may nowadays need a published paper, because many applicants have them and they are a key positive indicator for PhD supervisors who screen applicants.

Summary

- It is important to:
  - Identify your research contribution
  - Understand how the contribution should be evaluated
- When starting a thesis or research project, prepare an extended abstract or 1-pager that answers the template: Goal and/or question, research gap, results & contribution, method/approach, significance
- The answers do not have to be in that particular order—writing a fluent and engaging narrative is also important. We will study some examples in the exercises…

Exercises and Homework

Exercise: Read and Analyze

- Instructions, materials, and report template: https://urly.fi/30Hk

Homework: Preparing to write your (hypothetical) thesis 1-pager

- Next week, we will dedicate some time to writing a first draft of the 1-pager in class, with me available for help

- To prepare:
  - Think of a possible thesis topic
  - Read the Wobbrock & Kientz contribution types paper to identify how you can frame your work as a research contribution, and how you should evaluate it. https://faculty.washington.edu/wobbrock/pubs/interactions-16.pdf
  - If you don't find a matching type, you can also try reading the problem solving and Research through Design papers and framing your work accordingly

  Research as problem solving: https://dl.acm.org/doi/pdf/10.1145/2858036.2858283

  Research through Design: https://dl.acm.org/doi/pdf/10.1145/1240624.1240704