User Interfaces

EECS 3461 – Sections A & B
Fall 2021

R-Interaction-V
Third Paradigm HCI

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Dependencies

This resource pack assumes that you are already familiar with:

- R-Humans-II (and all previous)
- R-Design-VI (and all previous)
- R-Interaction-II (and all previous)

Key Questions

1. design contexts?
2. What is a market vs a commons?
3. What is a proprietary vs a non-proprietary interactive system?
4. The StoryGraph vs Goodreads case study
5. How do ideas spread? How do technologies get adopted?

Topics

In this module, we will explore types of interactive systems where the 'interface' seems to melt away

1. What is 'Dangling String' and why is it relevant?
2. What is the idea of the disappearing interface?
3. What are the design dimensions of ambient systems?

1.

First Paradigm [Harrison, 2007]

- The early days of computing (e.g., 1965-1980, prior to personal computing) saw interaction as a form of **man-machine coupling**
  - an amalgam of engineering and human factors, inspired by industrial engineering and ergonomics
- questions to be answered: what are the problems in the coupling? how can we developing pragmatic solutions to them?
- goal of design:
  - optimize the fit between humans and machines, deal with the concrete problems that arise in interaction and that cause disruption

Second Paradigm [Harrison, 2012]

- Next comes a revolution that that human minds are like information processors, and that interaction can be modeled as information exchange between humans and computers
  - the paradigm places "rationality and rational analysis [as] the most important mode of operation for human activity" (Flyvbjerg, 2001, p. 23)
- questions to be answered:
  - 'how does information get in', 'what transformations does it undergo', 'how does it go out again,' 'how can it be communicated efficiently'
- premise:
  - human information processing is deeply analogous to computational signal processing
  - the primary interaction task is enabling communication between the machine and the person

User Interfaces, Interaction Design

- recall our earlier class material, when we discussed the primary fields upon which User Interfaces and Interaction Design are based: Design and HCI
- also recall that HCI had its start in the 1980's, with a foundation in cognitive psychology
- cognitive psychology is a field strongly associated with the scientific method

Historical Reflection

- human as an 'information processor' was a dominant metaphor
- dominant metaphors evolve and change over time
- the 'person as an information processor' is just one of many different metaphors which have been used historically
- Other metaphors?

Historical Reflection

- history shows that we use metaphors for conceptualizing human performance, for explaining how people think/do
- Prior metaphors include
  - hydraulic metaphors
    - the 4 humors (Hippocratic medicine), keeping balance, reservoirs
  - mechanical metaphors
    - e.g., clocks, steam engines
  - electricity, circuitry
    - e.g., chemical processes generate action potential, arose once galvanometers measured electrical current in biological specimens
  - telegraphic/telephone
    - nerves as a telephone network
  - many others

Analysis of the Metaphor

- we will now discuss some of the content of the following paper:
  - Harrison, Steve & Sengers, Phoebe & Tatar, Deborah. (2011). Making epistemological trouble: Third-paradigm HCI as successor science. Interacting with Computers. 23. 385-392. 10.1016/j.intcom.2011.03.005.
- the paper investigates some of the shortcomings of the metaphor of users as information processors

Harrison et al (2011)

- Harrison, Steve & Sengers, Phoebe & Tatar, Deborah. (2011). Making epistemological trouble: Third-paradigm HCI as successor science. Interacting with Computers. 23. 385-392. 10.1016/j.intcom.2011.03.005.

- theoretical/critical analyses paper
  - Steve Harrison
    Department of Computer Science and (by courtesy) Art and Art History, Virginia Tech
  - Phoebe Sengers
    Information Science and Science & Technology Studies, Cornell University
  - Deborah Tatar
    Department of Computer Science and (by courtesy) Psychology, Virginia Tech

1.

New challenging areas

1. workplace studies
2. ubiquitous and pervasive computing
3. non-task-oriented computing, such as ambient interfaces and experience-centered design
4. works that seeks to de-marginalize emotion

Workplace Studies

- workplace studies are intended to inform system design in computer supported cooperative work settings
- these studies take into account the complex actions and interactions in workplace settings (including both formal and informal work practices)
- ACM hosts a yearly conference called Computer-Supported Collaborative Work (CSCW)

Workplace Studies

- workplace studies focus on the social situation of interaction and the implications for the design of interactive systems
- workplace studies take as central that social, situated actions explain the meaning of interaction
- this view is hard to reconcile with the views that arise from the information-processing metaphor, which holds:
  - social interaction can be formalized as the exchange of information
  - other social factors are not accounted for

Ubiquitous, Pervasive, Ambient Computing

- core concepts:
  - computing is made to appear anytime and everywhere
  - computing is ambient and environment-baed (the environment is sensitive and responsive to people)
  - computing that is not demanding of attention; interaction occurs in the periphery of attention; can be perceived at a glance
- these interrelated concepts are taken up in the interrelated design domains of:
  - ubiquitous computing
  - pervasive computing
  - ambient computing
  - calm technology

Ubiquitous, Pervasive, Ambient Computing

- design approaches connected to these concepts are derived from disciplines such as ethnography, design, and the arts
- the concepts are based on the idea that use context is, in the end, fundamentally unspecifiable and dynamic
- these ideas are hard to reconcile with the views that arise from the information-processing metaphor, which holds that:
  - information flow between machine and context (including the user) can be identified and optimized
  - context can be modelled as yet another source of information, this information can be flowed to digital systems

Non-task-oriented computing

- non-task-oriented computing aims to create meaningful user experiences
  - ambient/ubiquitous/pervasive computing
  - traditional platforms – desktop, mobile, VR, AR
- does not aim to support specific tasks or goals
- the idea is that there is value in the experience itself
- this idea is hard to reconcile with the views that arise from the information-processing metaphor, which holds that:
  - problems can be formalized in terms of motivations, goals, tasks, and operations
  - attributes such as effectiveness and efficiency are important

Affective Computing

- Affective computing is concerned recognizing, interpreting, processing, and simulating human affects
- Affective computing includes both:
  - the study of phenomena of emotion and affect
  - the application of this knowledge towards the development of systems and devices that demonstrate emotional intelligence and/or afford experiences of empathy and other phenomena of emotion
- there are two approaches:
  - i) emotion can be modelled as information flow,
  - ii) emotion is co-constructed in action and cannot be modelled as information flow
    - this latter approach is not compatible with the information-processing metaphor

New challenging areas

- in these design domains, the following issues are important:
  - social factors in interaction
  - unspecifiable and dynamic use contexts
  - meaning in user experience
  - co-constructed emotion
- these issues raise shortcomings of the information-processing metaphor
- in task-based computing, these issues of were marginal
- now the issues are now becoming central

1.

What to do?

- come up with a new metaphor, one that is better than the human-as-information-processor metaphor?
- something even more radical?

Centrality

- what has been 'central' in the field of HCI?
  - Answer: usability
  - And… whatever is not central gets considered ‘on the margins’
- we discussed previously how frameworks of *user experience* arose to address what *usability* was not addressing

Marginality

- what was marginal in the field of HCI in the 1980's?
  - emotions and computing
  - social factors
  - context
  - colonialism in computing
  - gendering, racialization
  - who gets to participate in building systems and who gets excluded
  - computing for personal pleasure, for fun, for aesthetic
  - evaluation based on discussion, impressions, emotion

Improvement?

- So here we have an argument that the information-processing metaphor works ok for central phenomena, but starts to "fray at the edges"
- … and what was formerly "at the edges" is now becoming more and more central
- It seems natural to ask:
  - *So what metaphor should we use instead?*
  - *Which metaphor is the "better" version of the information-processing metaphor?*

- Harrison et al argue that there is no "better" metaphor without first examining the underpinnings of knowledge
- let's go back to science and its particular **epistemological framework**

1.

Underpinnings of knowledge

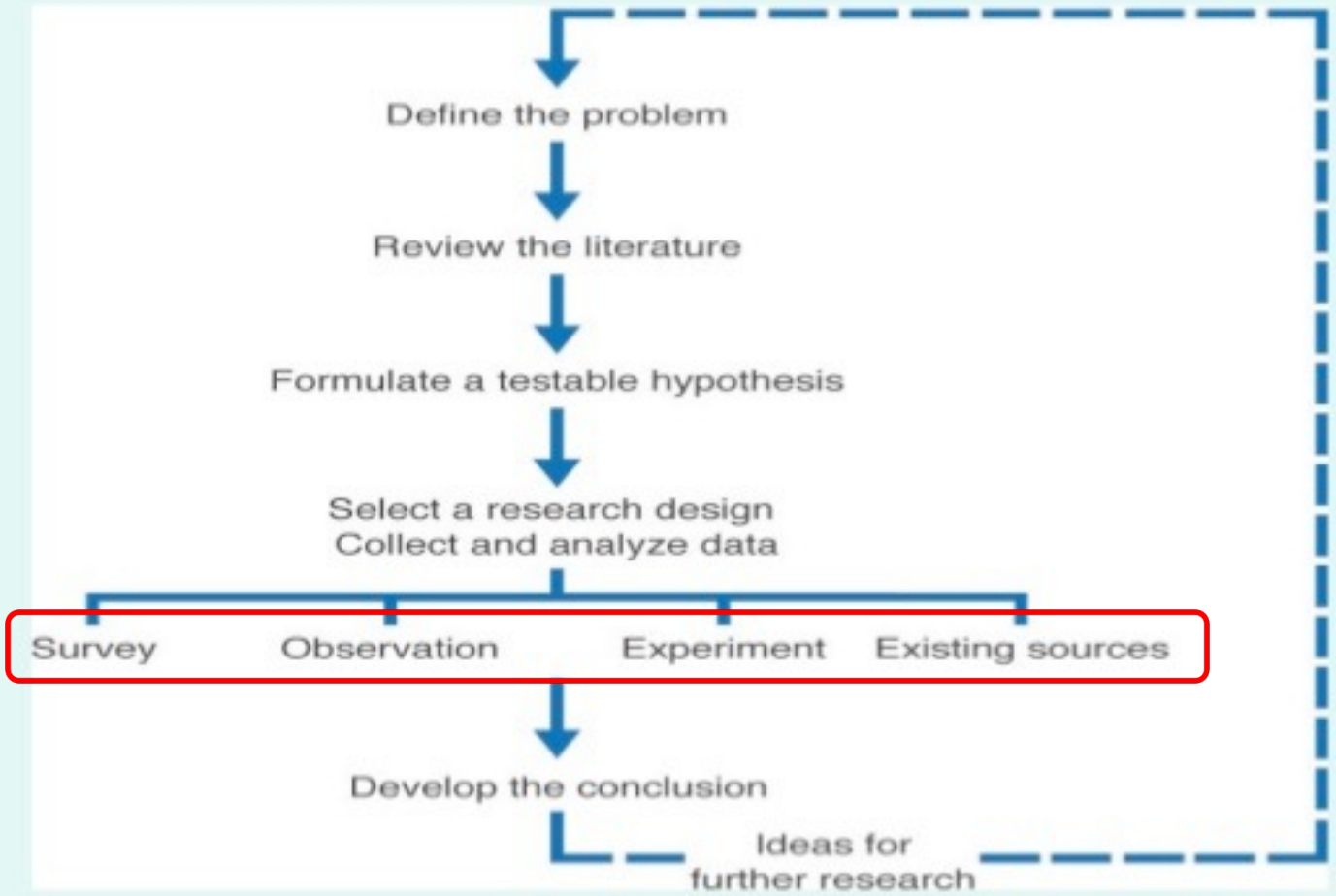
Recap

- recall back in R-Knowledge-I
- beliefs are a starting point
- beliefs remain beliefs until they pass a test to be *legitimated* as knowledge
- “An epistemology is a theory of knowledge. It answers questions about who can be a "knower” […]; what tests beliefs must pass in order to be legitimated as knowledge? […], what kinds of things can be known (can "subjective truths" count as knowledge?), and so forth.” [Harding, 1987]

Scientific method

- the scientific method is a body of techniques for acquiring new knowledge
- science has a particular **epistemological framework**

Scientific Approach



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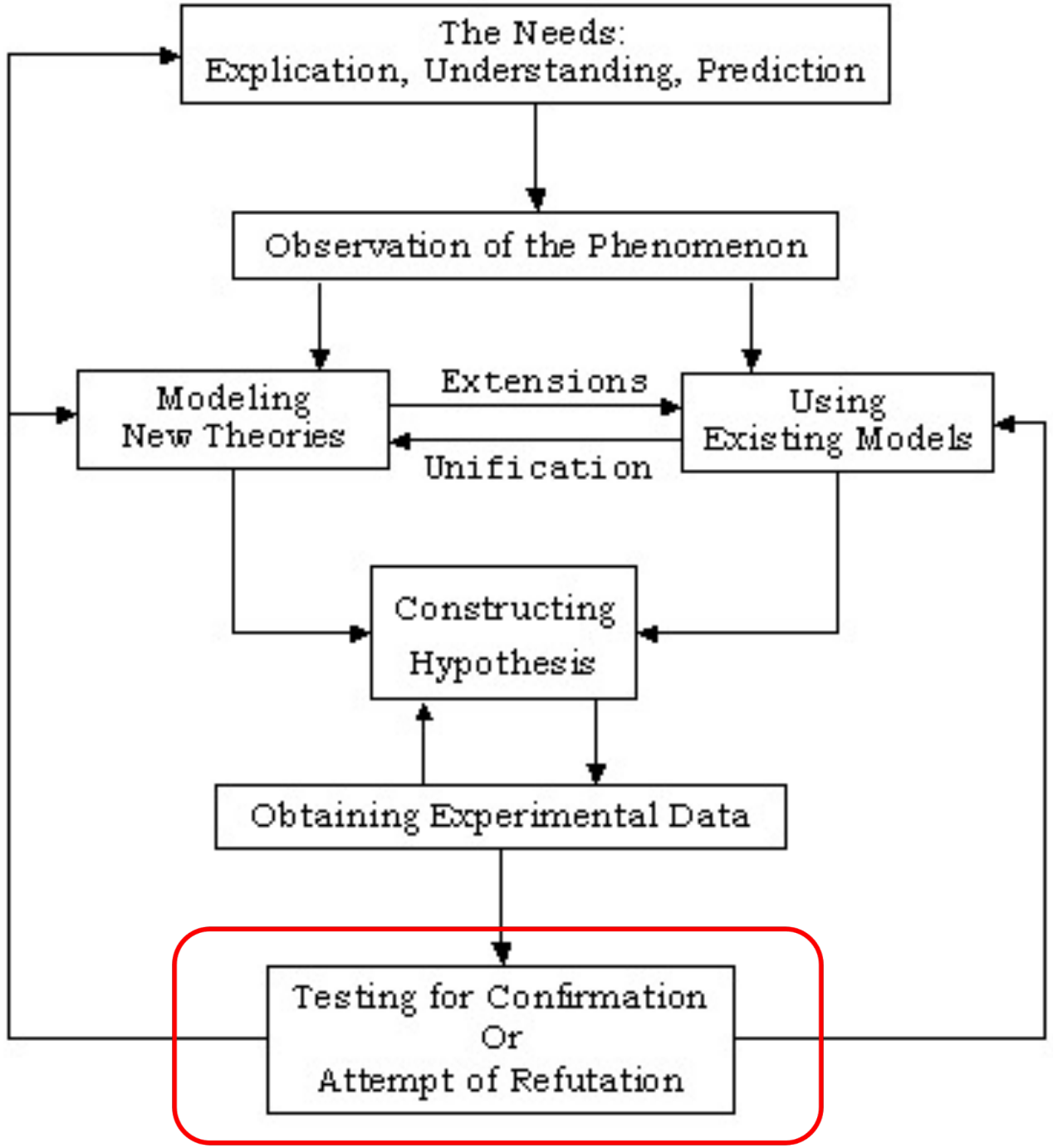

The General Scientific Approach

hypothesis construction:
embedded within (prevalent, new) models and theories

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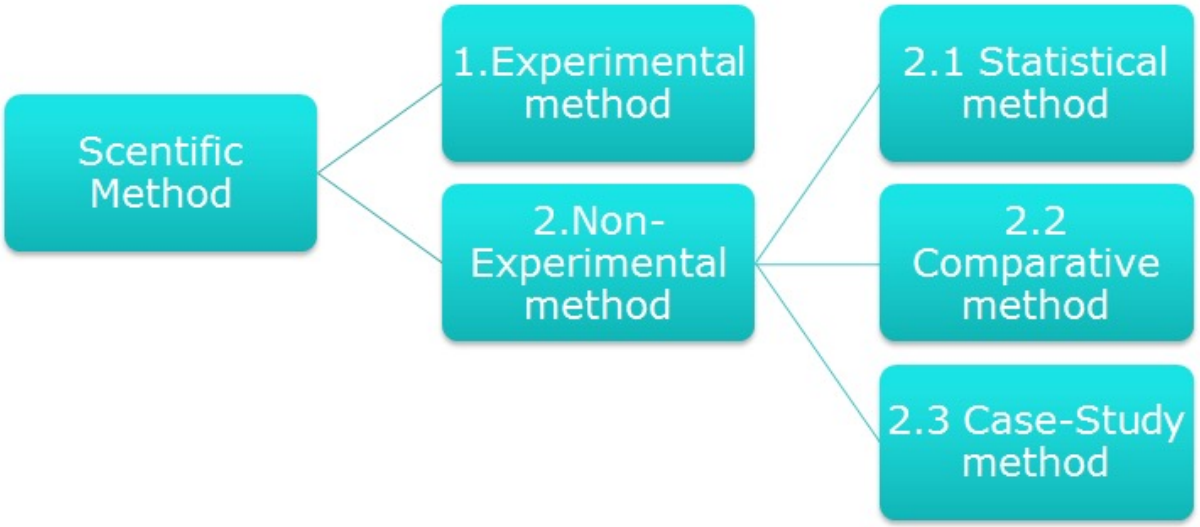
Scientific Research

Scientific research permits choice from a certain “tool box” of methods for investigation



The Science Stance

- in science, there are specific tests for beliefs…

1. we start with a belief, and — *"belief: the earth is flat"*
2. then apply tests to the belief, and — *"use curvature test in an experiment"*
3. if the belief passes the tests, then the belief gets legitimated as knowledge — *"belief does not pass test, earth must not be flat"*

this is an oversimplification, but the point is that there is a specific test for whether the belief gets legitimated as knowledge

this knowledge is assumed to be objective

Generating Knowledge: Science Stance

- knowledge generation consists of:
  - the development of a *falsifiable hypothesis*
  - the collection of data (using different methods), most often quantitative
  - methods such as: experiments, statistical methods, comparative methods, and case-study methods
  - the analysis of the data with respect to predictions generated by hypothesis; use statistical procedures to affirm or refute the hypothesis
- **assumes that the researcher is impartial and a disinterested outside observer**
- assumes that context should eliminated (via controls)
- the findings are evaluated using standards such as **reproducibility**, **reliability** and **validity**

“Science-as-we-know-it” and Successor Science

- philosophers of science identify two versions of science: "science-as-we-know-it” and successor science
- Science ("science-as-we-know-it")
  - makes use of scientific method; has associated ideals and mechanisms
  - claims of universal objectivity

Successor Science

- Successor science
  - a version of science with significant shifts in thinking about the nature of knowledge and about how we come have knowledge
  - deconstructs ‘universal’ claims to show how they actually embody specific gendered, class, or racial agendas
  - hold that bias is not simply the result of error or poor practice but is directly tied to the values and norms of the scientific method
  - not meant to be an 'unbiased' version of science-as-we-know-it, instead a variant of it
  - universal knowledge claims are suspect, since totalizing claims would imply taking one person’s point of view as more valuable or more central than others’, and therefore sidelining those in less powerful positions.
- this perspective is formalized in the notion of ‘‘standpoint epistemology,’’ i.e. the idea that all knowledge arises from and is related to specific social, cultural, and historical circumstances

WTF? Is this saying that we should get rid of science?

- No, this is not the point

- Is it possible to engage in scientific practice without universal knowledge claims?
- Yes, if you adopt a different metaphor…

Science & Metaphors for ‘Seeing’

- metaphor #1:
  - science is based on a metaphor of transparent vision
  - assumes transparent access to 'natural reality'
  - truth consists of mental representations that are directly tied to and validated by natural reality

Science & Metaphors for 'Seeing'

- metaphor #2:
  - science is based on a metaphor of vision that is not transparent
  - the world is viewed through a particular lens that 'colours' what is seen
  - this is the metaphor for 'situated knowledge', which comes from particular points of view and is generated through particular mechanisms
  - 'truth' is constructed of via interpretation
    - requires knowing not only what you can see in artefacts, but also knowing the mechanisms through which they are produced

Harraway (1988)

- these ideas come from a remarkable and highly influential essay by feminist philosopher of science, Donna Haraway (Haraway, 1988).
- The core idea was to rethink objectivity for successor science by changing the metaphor of vision which underlies it.

Standpoint Epistemology

- any knowledge-maker has points of view that are situated (in their previous experiences, in the ideological framework, in their values, etc)
- those who are 'scientific knowledge-makers' have points of view and those views are situated;
- standpoint epistemology:
  - acknowledges the social dimension of scientific knowledge
  - acknowledges that knowledge arises from and is related to specific social, cultural, and historical circumstances
  - recognizes that there are claims of 'universally-valid', but the perspective of these claims is contingent on cultural and social factors

Harrison et al

- taking situated knowledges seriously has two concrete implications for how we report HCI research

Harrison et al

- Implication #1

- research papers should articulate to the extent possible the intellectual and political commitments that the authors bring to a particular project, in order to allow readers to better evaluate the knowledge which it generates.

Harrison et al

- Implication #2
- since the mechanisms by which knowledge is produced are crucial for its evaluation, research papers should not only mention what methods were used but also articulate how and why methods are applied.
- Practitioners in the field should not use 'black-box' methods (i.e., recipes that can be applied without understanding), since we need to know how knowledge was generated in order to be able to weigh it.