Research through Design

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Design Research

- Research for design
- Research into design
- Research through design

Archer, B. (1995). The Nature of Research. Co-design, January 1995, 6-13.

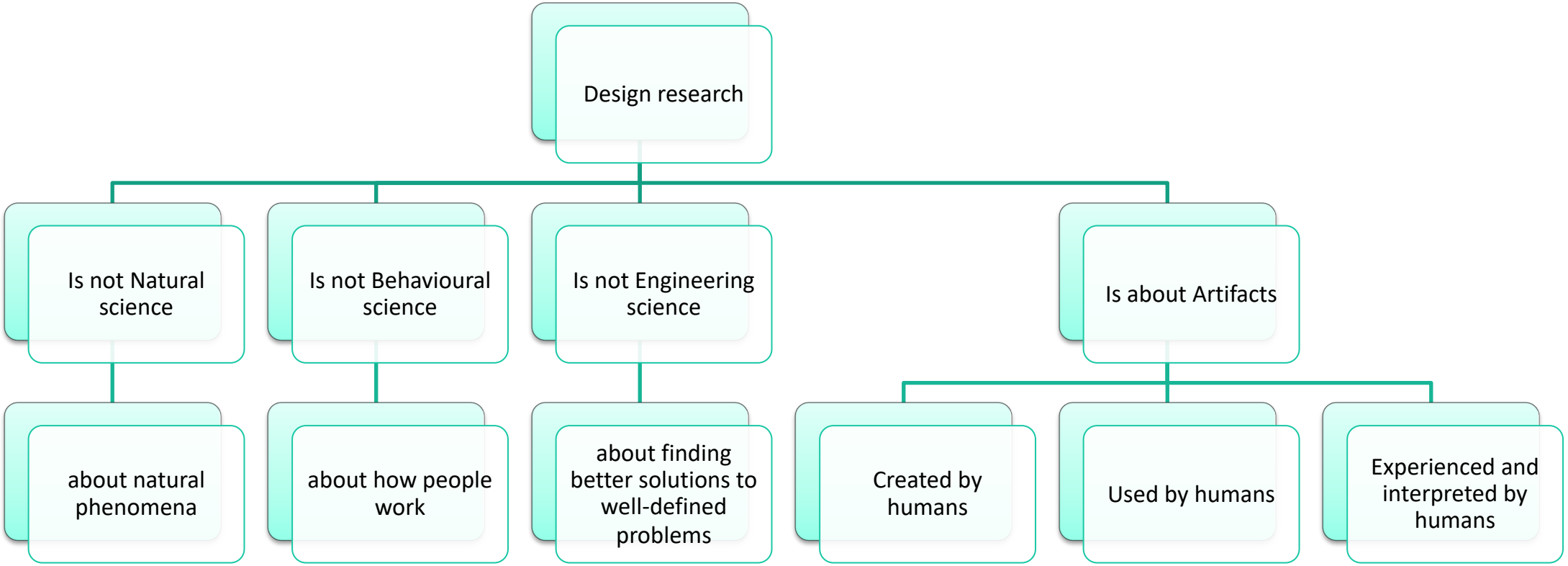
Design Research

- Research for design
- Research into design
- Research through design

- Research through design: study something while creating it.
- How do you do that?

Archer, B. (1995). The Nature of Research. Co-design, January 1995, 6-13.

Design Research



Sciences of the Artifical - Herbert Simon (1969)

- “Schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design”
- Strives for knowledge about artificial objects and phenomena designed to meet desired goals.

Wicked Problems – Rittel & Weber (1973)

- A response to Sciences of the Artificial
- Wicked problems are characterized by non-linearities and incompleteness.
- They have conflicting perspectives.
- They can’t be accurately modelled.
- Cannot be addressed using reductionist science and engineering.

Design

- Deals with conflicting perspectives.
- Can be perspectivally modelled.
- Is holistic an complementary to reductionist science and engineering.

Design Research and Design Practice

- Design research is not design practice, which informs product and service development.
- Design practice is a means to design research.
- Design practice shapes situated design.

Design Research Shapes Knowledge by Studying

- *Situated design* resulting in instantiations, methods, and constructs.
- Situated design can be abstracted to knowledge as *operational principles* resulting in methods, constructs, and models.
- Operational principles can be abstracted to *emergent theory about embedded phenomena* resulting in constructs, models, and better theories.

Purao, S. (2002). Design Research in the Technology of Information Systems: Truth or Dare, GSU Department of CIS Working Paper. Atlanta: Georgia State University.

Design Research Outputs

- Theories grounded in studies of conceptual work.
- Adapted theories that discuss the applicability of conceptual perspectives from other disciplines.
- Manifestos that suggest approaches to design.
- Frameworks that suggest concrete approaches to design.
- Theories on design science that suggest normative standards for how research through design should be conducted.

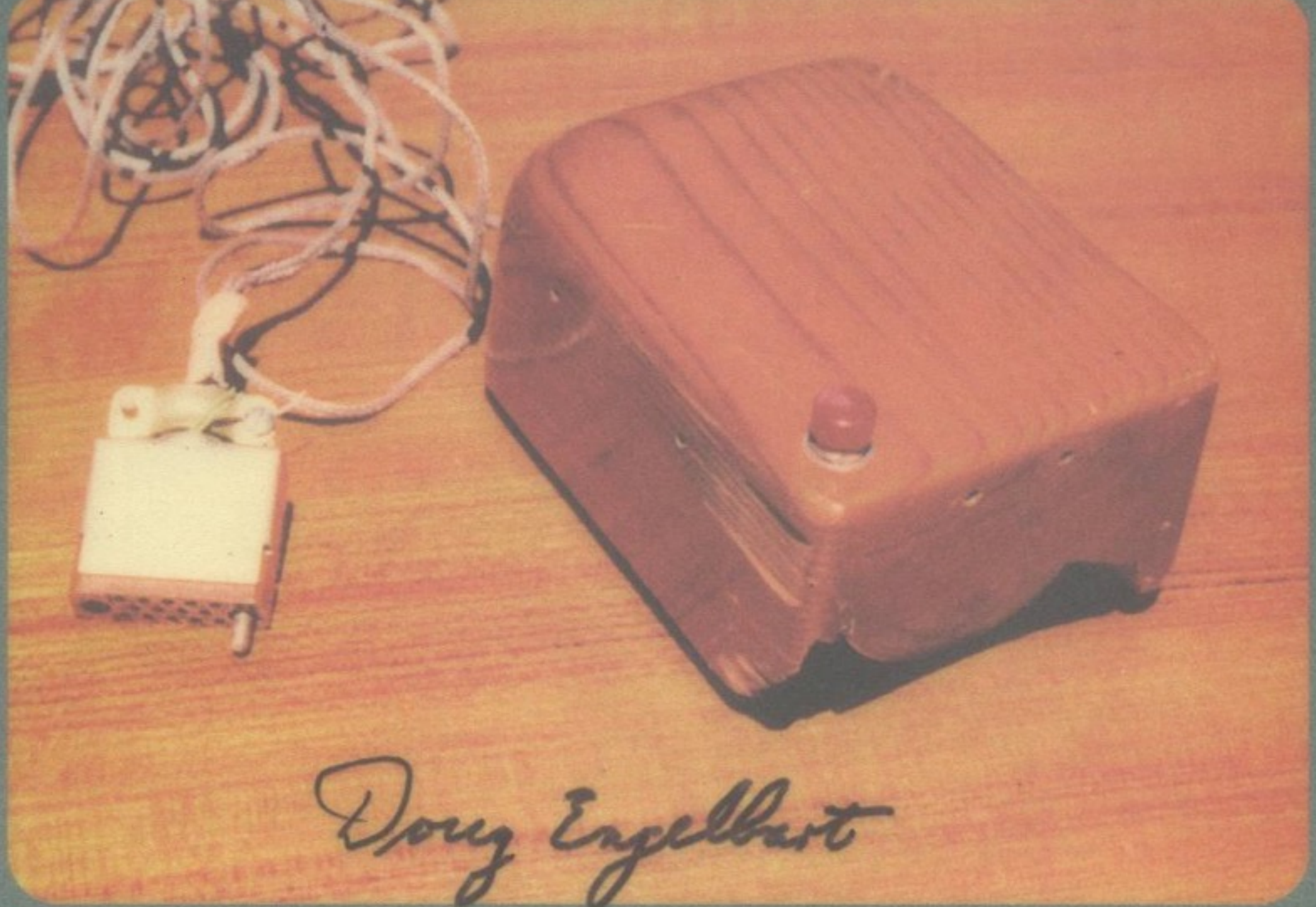
Gaver, W. (2012). What should we expect from research through design?. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12). ACM, New York, NY, USA, 937-946.

There Are Two Kinds of People in the World

- Design-oriented research
  - Uses design practice to produce knowledge
- Research-oriented design
  - Uses research practice to produce artifacts

Fällman, D. (2004) Design oriented-research versus Research-oriented Design, Workshop Paper, CHI 2004 Workshop on Design and HCI, Conference on Human Factors in Computing Systems, CHI 2004, April 24-29, Vienna, Austria

Artifacts as Carriers of Knowledge


Doug Engelbart

12294 Free Disk Pages

Help

Example ViewPoint Document

Close | Save | Reset | Save&Edit

XEROX
6085 Workstation

User-Interface Design

To make it easy to compose text and graphics, to do electronic filing, printing, and mailing all at the same workstation, requires a revolutionary user interface design.

Bit-map display - Each of the pixels on the 19" screen is mapped to a bit in memory; thus, arbitrarily complex images can be displayed. The 6085 displays all fonts and graphics as they will be printed. In addition, familiar office objects such as documents, folders, file drawers and in-baskets are portrayed as recognizable images.

The mouse - A unique pointing device that allows the user to quickly select any text, graphic or office object on the display.

See and Point

All functions are visible to the user on the keyboard or on the screen. The user does filing and retrieval by selecting them with the mouse and touching the MOVE, COPY, DELETE or PROPERTIES command keys. Text and graphics are edited with the same keys.

Shorter Production Times

Experience at Xerox with prototype work stations has shown shorter production times and thus lower costs, as a function of the percentage of use of the workstations. The following equation can be used to express this:

Year	Non 6085	6085
1978	85.2	15.8
1980	61.1	39.9
1982	45	55
1984	30	70
1986	10	90
1988	5	95

Table 1: Percentages of use of methods.

Activity under the old and the n

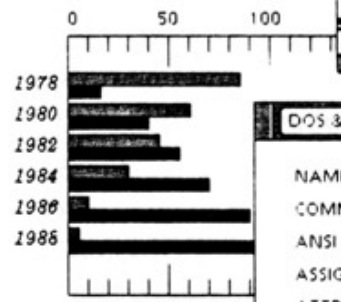


Figure 1: Data from Table 1 drive

$$X(n) = \sum_{i=1}^{n} \int_{a}^{b} \frac{A + FF_{n}^{i}}{\text{denominator} +}$$

Workstation usage percentages
Table 1 and illustrated in Figur
6085 users are likely to do mo
composition and layout, contro
process including printing and di

Text and Graphics

To replace typesetting, the 6085 offers a choice of type fonts and sizes, from 6 point to 36 point:

Here is a sentence of 8-point text.
Here is a sentence of 10-point text.
Here is a sentence of 12-point text.
18-point text.
24-point text.
36-point text.

Brother Dominic

DOS & Lotus data:

Close | Redisplay

NAME	EXTENSION	SIZE	DAT
COMMAND	COM	22677	15-N
ANSI	SYS	2556	18-S
ASSIGN	COM	864	28-N
ATTRIB	EXE	15091	14-N
BACKUP	COM	17024	28-A
CHKDSK	COM	9435	24-O
CHMOD	COM	6528	27-A
COMP	COM	3018	10-S
DEBUG	EXE	15364	15-N

9:27:24
10-29-86
N.H.
Local
Kevin J.
Outbaske
Mail Merge
Mail from Ken
Brother Domini c
Calendar
Calc
Loader
Blank User Dictionar
Empty Dictionar y
Blank Record File
Blank Docum ent
2.0
Beechnut
Monthly Profit
Blank Folder
C Tools
Blank Illustrator
Blank Canvas
Emulator
Converter
Blank Shared Book
Blank Book
Emulated Rigid Disk
Virtual Floppy
Exampl e ViewPo
Remote Files
Drawers in Japan
Swaps
DOS & Lotus
4427 Blank Referenc e
Mackey
OSBU
Xerox
Tape Drive
Floppy Drive
Wasteb asket
Directory

Annotation of Process Documentation for Design Rationale

- Annotations about design choices reveal designers alternatives and criteria
- Annotations articulate theories embedded in design artifacts about e.g.:
  - Technical aspects: How should it be implemented?
  - Ethical aspects: What values should a design serve?
  - Practical aspects: How should those values be achieved in use?
  - Aesthetical aspects: What form and appearence is appropriate for the context?
  - Social aspects: What will the people who use this be like?

Gaver, W. (2012). What should we expect from research through design?. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12). ACM, New York, NY, USA, 937-946.

Arvola, M. (2010). Interaction Design Qualities: Theory and Practice. In Proceedings of the 6th Nordic Conference on Human-Computer Interaction (NordiCHI 2010), pp. 595-598. Reykjavik, Iceland, October 16 - 20, 2010. New York, NY: ACM Press.

A simple form balances bright colours for the kitchen. The vertical arrangement of reservoir, filter and pot clarifies operation. An elegant coffeemaker: simple, usable and aesthetically pleasing. Rams redesigned the unit, dissatisfied with the need for two heating elements.

Modular design and exposed mounts afford reconfiguration. Surfaces are simple and a grid structure is used. Beyond user tailorability, note details such as built in bookends. The unit is designed as a system with each unit individually detailed.

Not only is it clear how to use this radio, but its mixed materials brings technology into domestic space. Controls are clustered according to different groups of functions. The slate grey fascia fades into the environment. The radio's details support its functions and aesthetics - note the bevel where grey faceplate meets wooden enclosure.

Good design makes a product understandable
'at best, it is self explanatory'

Good design makes a product useful
'not only functional, but also psychological and aesthetic'

Good design is unobtrusive
'both neutral and restrained'

Good design is thorough, down to the last detail
'nothing must be arbitrary or left to chance'

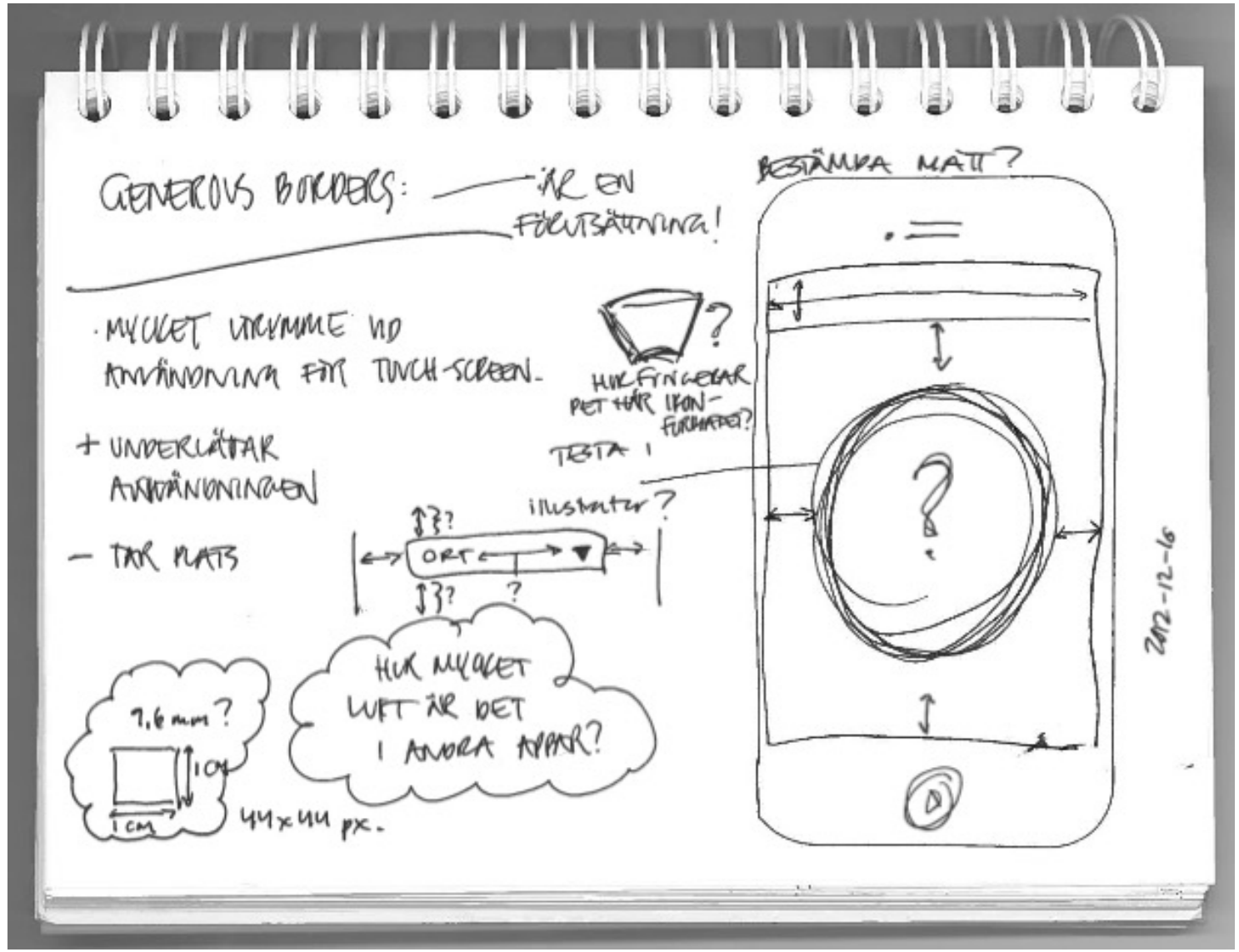
A subtle combination of a modern frame and traditional upholstery. The frame is an exoskeleton for the soft cushions. Beveled armrests are comfortable

This prototype portable TV offered new affordances to an emerging medium. Controls are few and logically arranged. A simple form and brushed metallic finish fits most environments. . Though never produced, the unit was compact, ergonomic and robust.

Contrasting materials differentiate the handle from the cutting head. The simple form has few details and little branding. The device is ergonomic and simple to maintain. The S3's balance of functionality and aesthetics keeps it desirable to aficionados.

The unusual form ensures portability. Obvious vents indicate function. Rams balances form with colour. Packable and usable, with multiple rest positions.

Sketch design for an annotated portfolio of Dieter Rams' designs for Braun and Vitsoe.


GENEROUS BORDERS: — ÄR EN FÖRUTSÄTTNING!
· MYCKET UTRYMME NÄR ANVÄNDNING FÖR TUCH-SCREEN.
+ UNDERLÄTTAR ANVÄNDNINGEN
– TAR PLATS
HUR FINGRAR DET HÄR IKON-FORMATET?
TESTA I
illustrator?
ORT
?
7,6 mm?
1 cm
HUR MYCKET LUFT ÄR DET I ANDRA APPAR?
44x44 px.
BESTÄMDA MÅTT?
?
2012-12-16

Evaluating Design Research 1

- Process
  - Scientific rigor applied to methods
  - Motivation for selection of methods
  - Enough detail to make it possible to reproduce the process (no black boxes)
- Invention
  - Significant invention
  - Novel integration of subject matters to specific situation (literature review!)
  - Articulation of what is novel
- Relevance
  - Why should others care?
- Extensibility
  - How can others use the resulting outcomes in practice and research?

Zimmerman, J., Forlizzi, J., and Evenson, S. 2007. Research through design as a method for interaction design research in HCI. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (San Jose, California, USA, April 28 - May 03, 2007). CHI '07. ACM, New York, NY, 493-502.

Evaluating Design Research 2

- Contestable
  - Is the contribution inventive and novel for the academic community in question?
- Defensible
  - Is the contribution grounded empirically, analytically, and theoretically?Is the research process and the reasoning rigorous and criticizable?
- Substantive
  - Is the contribution relevant to the community in question? Does it contribute to the goals of the community, for example, better design?

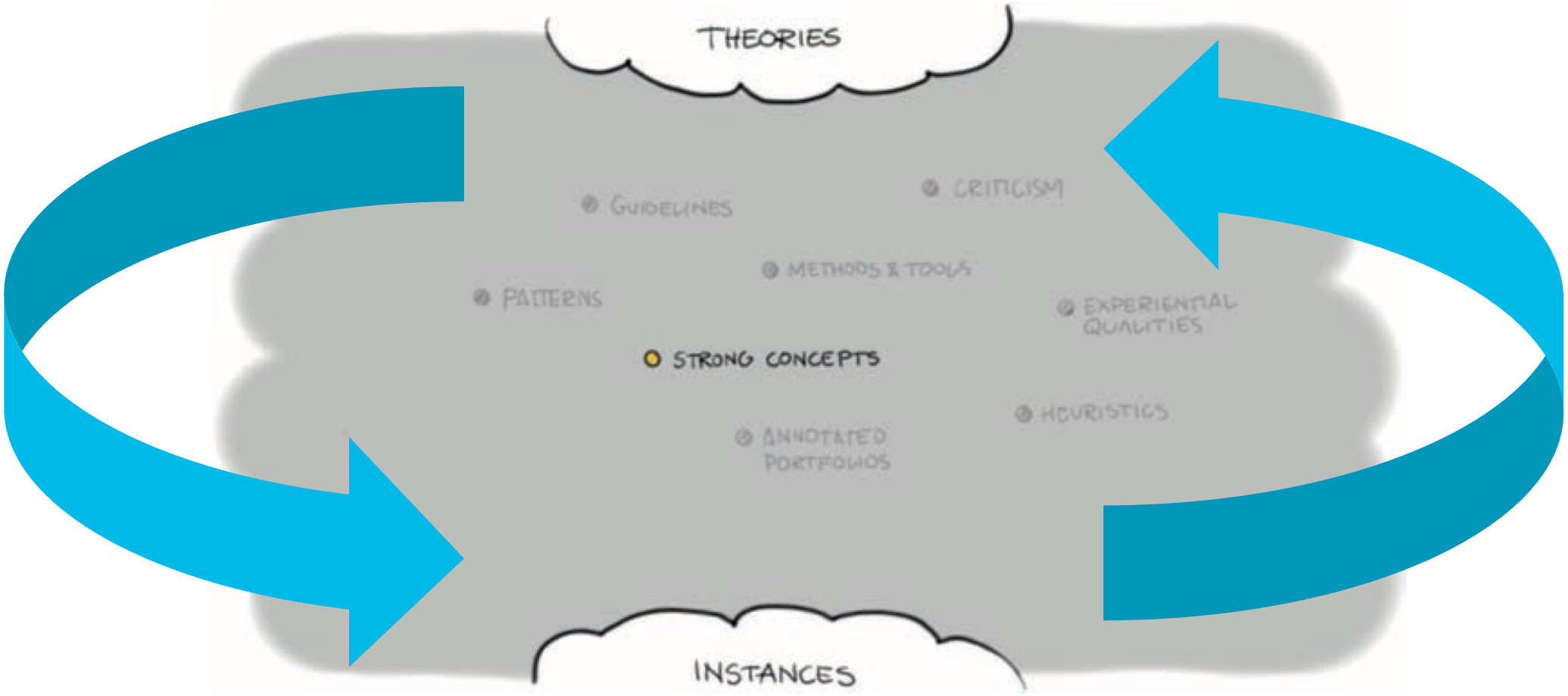
Höök, K. & Löwgren, J. (2012). Strong concepts: Intermediate-level knowledge in interaction design research. ACM Trans. Comput.-Hum. Interact. 19, 3, Article 23 (October 2012), 18 pages.

What Makes a Design Unique and Not Merely Novel?

- The application of an established generic model to a new problem or in a new domain
- A design that combines elements from multiple established generic models
- The addition of a new element to a known generic model manifested in a design
- A combination of a new generic model and a design that defines a new design space such that the design demonstrates the potential scope of the new space.

Wiberg, M., & Stolterman. E. (2014). What makes a prototype novel?: a knowledge contribution concern for interaction design research. In Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational (NordiCHI '14), pp. 531-540. New York: ACM.

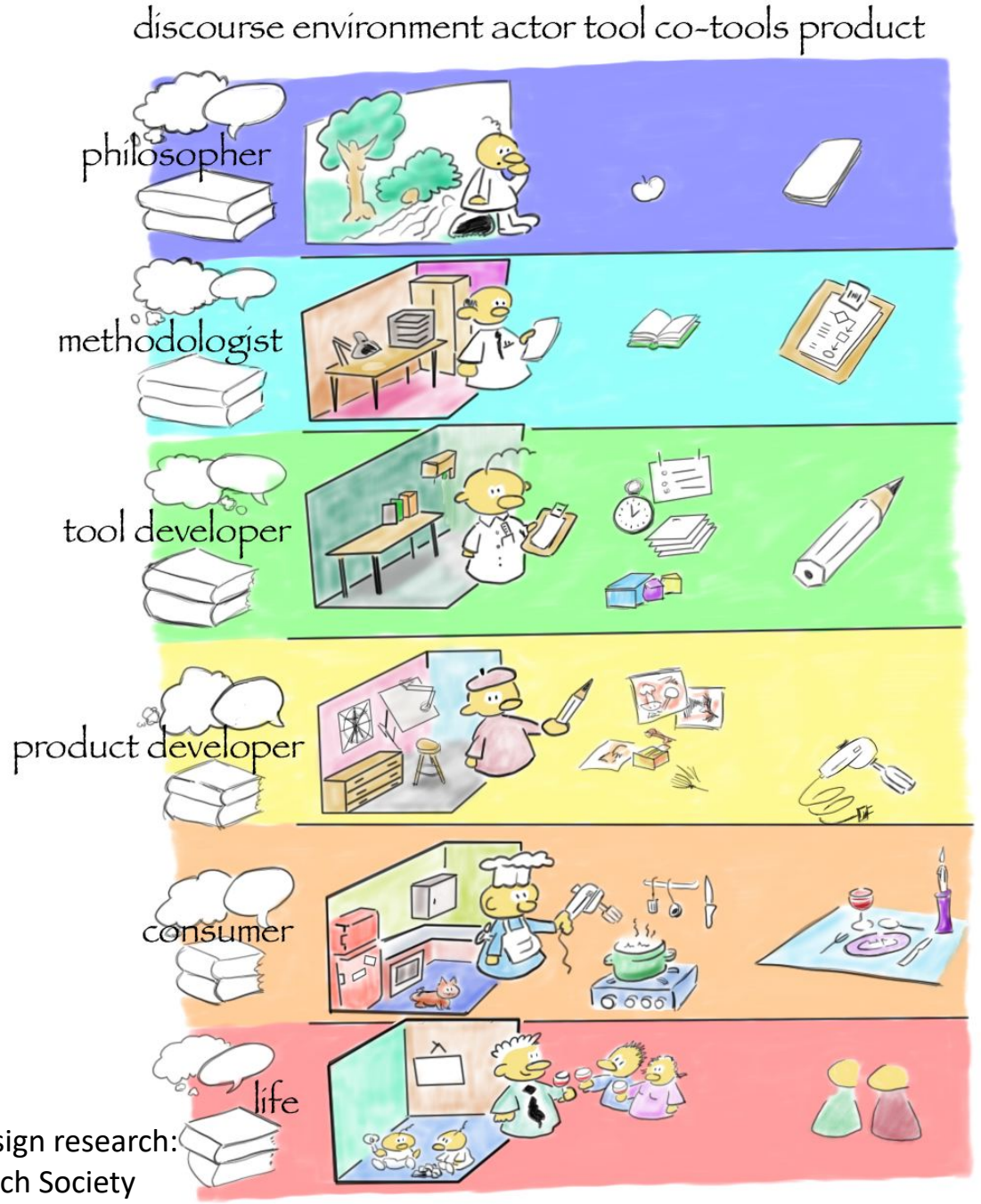
RtD often gives intermediate-level knowledge



Höök, K. & Löwgren, J. (2012). Strong concepts: Intermediate-level knowledge in interaction design research. ACM Trans. Comput.-Hum. Interact. 19, 3, Article 23 (October 2012), 18 pages.

Levels in Design Research

- Thinking questions, developing frameworks and models, designing tools, designing products, using products, and living life.
- As a methodologist developing frameworks and models, your research method is **not** your product design method.



Stappers, P. J. & Sleeswijk Visser, F.(2014). Meta-levels in design research: Resolving some confusions. In Proceedings of Design Research Society (DRS) 2014, Umeå, June 16-19 2014.

Design research can be like interpretative field studies, but

- in RtD argues researchers engage in design in order to develop new understandings:
  - blurs the line between the roles of researcher and designer
  - Theories of design must continuously be put to the test in practice to ascertain their value for research and for practice (Dalsgaard, 2014)

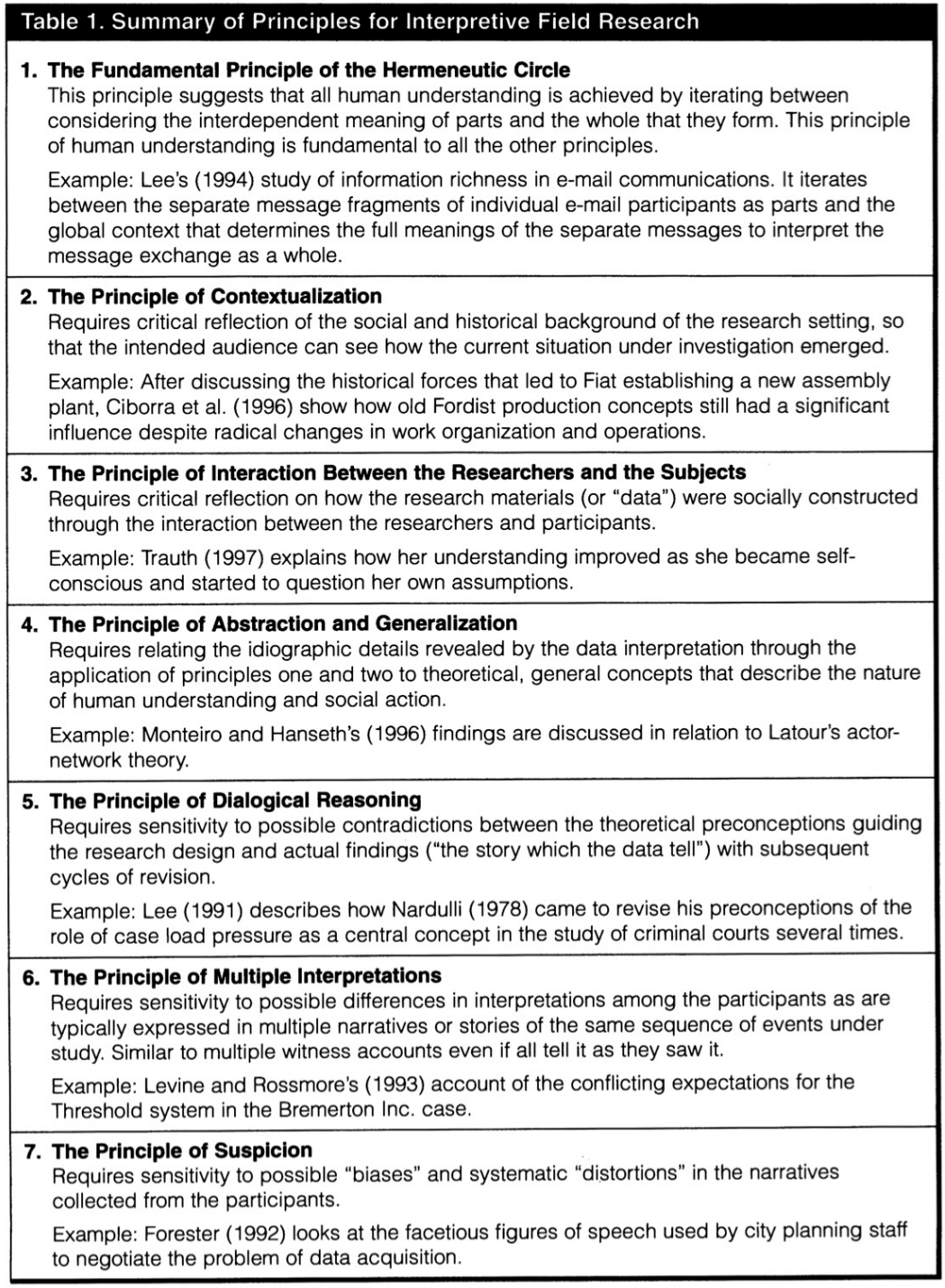


Table 1. Summary of Principles for Interpretive Field Research

1. **The Fundamental Principle of the Hermeneutic Circle**
   This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.

   Example: Lee's (1994) study of information richness in e-mail communications. It iterates between the separate message fragments of individual e-mail participants as parts and the global context that determines the full meanings of the separate messages to interpret the message exchange as a whole.

2. **The Principle of Contextualization**
   Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.

   Example: After discussing the historical forces that led to Fiat establishing a new assembly plant, Ciborra et al. (1996) show how old Fordist production concepts still had a significant influence despite radical changes in work organization and operations.

3. **The Principle of Interaction Between the Researchers and the Subjects**
   Requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants.

   Example: Trauth (1997) explains how her understanding improved as she became self-conscious and started to question her own assumptions.

4. **The Principle of Abstraction and Generalization**
   Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.

   Example: Monteiro and Hanseth's (1996) findings are discussed in relation to Latour's actor-network theory.

5. **The Principle of Dialogical Reasoning**
   Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tell") with subsequent cycles of revision.

   Example: Lee (1991) describes how Nardulli (1978) came to revise his preconceptions of the role of case load pressure as a central concept in the study of criminal courts several times.

6. **The Principle of Multiple Interpretations**
   Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.

   Example: Levine and Rossmore's (1993) account of the conflicting expectations for the Threshold system in the Bremerton Inc. case.

7. **The Principle of Suspicion**
   Requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants.

   Example: Forester (1992) looks at the facetious figures of speech used by city planning staff to negotiate the problem of data acquisition.

Klein, H. K., & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. MIS quarterly, 67-93.

Criteria for Undergraduate Theses in Design
(in varying degrees)

- Familiarity with basic concepts in scientific methods
- A pragmatic worldview: Truth is what *works* in this real world situation from multiple perspectives (aesthetically, practically, technically, ethically etc.)
- Clear contribution potential: What makes this particular situation interesting and worthwhile studying?
  - Not necessarily what the client asks for
- Field work – sketch and prototype – user test: an established approach (emphasis may be on some parts)
  - One research question per phase
- Qualitative or mixed methods research
- Process description and motivation of central design decisions (grounded in documentation in e.g. idea log, annotated sketchbook, diary)
- Problem discovery by field work and sketching and not only prototyping and testing of solutions
- Empirical validation of design results in e.g. user tests
- Lessons learned applicable to others and other design situations (discussion on generalizability/transferability).
- Core design idea articulated and related to other designs, and novel features highlighted

Further Criteria for Master Theses in Design
(in varying degrees)

- Possibly other worldviews:
  - Advocacy/participatory, as in action research
  - Critical, focusing on power structures and social critique
  - Social constructivist, focusing on meaning construed between designer/researcher and other stakeholders
  - Less likely post-positivist, focusing on testing the probable truth of hypotheses in experimental setups
- Analytical and theoretical validation of design results
- A higher degree of analysis of the process documentation (e.g. content analysis)
- Novel or even new core design ideas related to the ”idea history” of other designs, and contributing to, developing, or challenging earlier ideas

Read Jonas Löwgren's two texts on design theses

- https://www.ida.liu.se/~729G40/info/tips.sv.shtml
- A few examples of good design theses of different kinds:
  - http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-161023
  - http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-174074
  - http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-3667
  - http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-8717

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