Design Research
- what is a PhD thesis -

Matthias Rauterberg
Eindhoven University of Technology
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Thinker versus Tinker

“There is nothing so practical as a good theory.”

"Don't worry about what anybody else is going to do… The best way to predict the future is to invent it. Really smart people with reasonable funding can do just about anything that doesn't violate too many of Newton's Laws!"

(1971)

Ludwig BOLTZMANN(1884-1906)

Alan C. KAY(1940-)
Daniel KAHNEMAN
Map of Bounded Rationality: A Perspective on Intuitive Judgement and Choice.
Nobel Prize Lecture, 8 December 2002
Analysis & Synthesis, Deduction & Induction

**Analysis** (reduction): Separating of any material or abstract entity into its constituent elements.

**Synthesis**: Combining of the constituent elements or separate material or abstract entities into a single or unified entity.

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**Deduction**: A form of inference; if the premises are true, the conclusion must be true, i.e., deduction preserves the truth (equivalent to analysis).

**Scientific induction**: a form of inference in which the conclusion, though supported by the premises, does not follow from them necessarily, i.e., induction does not necessarily preserve the truth (equivalent to synthesis).
<table>
<thead>
<tr>
<th><strong>“Other reasoning patterns”</strong></th>
<th><strong>Deduction</strong></th>
<th>what + how &gt; <em>(result)</em></th>
<th>Known: what is observed + how it works &gt; makes predictions of results possible</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>especially traditional science</strong></td>
<td><strong>Induction</strong></td>
<td>what + <em>(how)</em> &gt; observation</td>
<td>Known: what is observed + unknown: how does it work? &gt; known: changes observed &gt; leads to theorising, hypothesising; explaining observations</td>
</tr>
<tr>
<td><strong>&gt; analytic thought</strong></td>
<td><strong>Design thinking</strong></td>
<td><strong>Abduction 1</strong></td>
<td><em>(what)</em> + how &gt; value</td>
</tr>
<tr>
<td><strong>designers</strong></td>
<td></td>
<td><strong>Abduction 2</strong></td>
<td><em>(what)</em> + <em>(how)</em> &gt; value</td>
</tr>
<tr>
<td><strong>&gt; creative thought</strong></td>
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Kees DORST  
Deduction-Induction-Abduction
Positivistic sciences

• An assumption of linear causality; there are no effects without causes and no causes without effects. \[Causality\]

• A single, tangible reality "out there" that can be broken apart into pieces capable of being studied independently. \[Reductionism\]

• The separation of the observer from the observed. \[Objectivity\]
  – So that the results of an inquiry are essentially free from beliefs, interpretations, etc.

• What is true at one time and place will also be true at another time and place. \[Universality\]
<table>
<thead>
<tr>
<th></th>
<th>Science</th>
<th>Design</th>
</tr>
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<tbody>
<tr>
<td><strong>Causality</strong></td>
<td>1-2 C</td>
<td>4 Causes</td>
</tr>
<tr>
<td><strong>Reductionism</strong></td>
<td>yes</td>
<td>no, holistic</td>
</tr>
<tr>
<td><strong>Objectivity</strong></td>
<td>yes</td>
<td>no, subjective</td>
</tr>
<tr>
<td><strong>Universality</strong></td>
<td>yes</td>
<td>no, contextual</td>
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</table>
Scientific methods

Nomothetic research (in natural sciences and engineering): the aim is to find general causal laws to explain phenomena, theories are usually axiomatic (deductive) systems or sets of models.

Constructive research (in engineering and design): the solution of the problem is not only shown to exist but it is also constructed.

Idiographic (ideographic) research trying to provide all possible explanations of a particular case, for example in history.
Scientific methods (cont’d)

**Action research** (in design sciences): the problem is solved by certain actions whose consequences are evaluated and new actions are specified (iterative improvement, trial and error).

**Case study** (in design sciences): an in-depth, longitudinal examination of a single instance or event, which is called a case.

**Questionnaire study** (in social sciences): a series of questions are used for the purpose of gathering information, which is usually analyzed statistically.
“But life is short, and truth works far and lives long…” Schopenhauer

<table>
<thead>
<tr>
<th>Epistemological Method</th>
<th>Real Being</th>
<th>Formal Being</th>
<th>Ideal Being</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Observation of Reality</td>
<td>Formal proof</td>
<td>Belief based on intuition</td>
</tr>
<tr>
<td>Inference Concept</td>
<td>Inductive logic</td>
<td>Deductive logic</td>
<td>Value system</td>
</tr>
<tr>
<td>Academic Paradigm</td>
<td>Natural Sciences</td>
<td>Mathematics</td>
<td>Humane Sciences</td>
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</tbody>
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“Time Saving Truth from Falsehood and Envy” François Lemoyne, 1737
“Thank you for your attention…”

“Traditional scientific method has always been at the very best 20-20 hindsight. It’s good for seeing where you’ve been. It’s good for testing the truth of what you think you know, **but** it can’t tell you where you ought to go.”

Robert Pirsig, 1974
“Zen and the art of motorcycle maintenance”
References

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