Research through DESIGN through research -
a problem statement and a conceptual sketch
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This paper re-addresses the issue of a *lacking genuine design research paradigm*. It tries to sketch an operational model of such a paradigm, based upon a generic design process model, which is derived from basic notions of evolution and learning in different domains of knowing (and turns out to be not very different from existing ones). It does not abandon the scientific paradigm but concludes that the latter has to be embedded into / subordinated under a design paradigm.

Keywords: research through design, evolution, learning, knowing, fuzziness, …

0) Problem statement:
Guiding ideas in design research: for users and / or for design itself?
Design´s ultimate purpose may be the "quality of life". Modernist design claimed to meet people´s needs by means of 19th century scientific approaches, sometimes even using simplified and misinterpreted concepts of purpose-oriented *evolution*, leading to ideological positions as the notorious "form follows function" (Michl 2001-02). This "belief in science" still applied to main parts of the Design Methods Movement of the 1960s. And it still applies to major parts of the current "Design Research Movement" (DRM, my own term, W.J.), which started in the 1980s.
The DRM addresses two related questions: (1) internally, regarding the disciplinary status: *how can design become a respected academic field?,* and (2) externally, regarding design´s benefit for society: *how can design contribute to human-centred innovation?* The adoption of scientific standards immediately contributes to design´s academic respectability. Nonetheless, this strategy has a price, since it fails to

substantially contribute to tackling practical issues of social and economic innovation and human well-being. Two reasons are:

Firstly: the failure of de-contextualized scientific approaches to handle the systemic complexity of real world situations. For a kind of programmatic statement see Weaver´s initial concept of *organized complexity* (1948), for an account of the inherent problems in analysing / controlling / designing *social systems* see Luhmann (1984, 1997).

Secondly: the failure to deal with *future developments* of real-world systems. Design is involved in proposing the new, which, by definition, is *not predictable*. Early Futures Studies were still aimed at prediction, today there are projective and evolutionary approaches, which explore multiple futures and take the methods rather as learning devices than as forecasting tools. These failures demand us to reconfigure and conjoint the above two questions into one and ask:

How can design establish its own genuine research paradigm (independent from the sciences, the humanities and the arts) that is appropriate for dealing with purposeful change in ill-defined (therefore called "complex") real-world situations?

These issues are embedded in the ongoing debates about shifting modes of knowledge production in the sciences and in society at large. Nowotny et. al. (2001) claim that science enters the "agora" and explicate "Mode-2" knowledge production, which is contextualized and which must be "socially robust" rather than "true". Science is increasingly involved in projects of socio-cultural and technological change, and this can be interpreted as "science approaching designerly ways of knowledge production" (Jonas 2004). Knowing *how* becomes equally important as knowing *that* (Polanyi 1966).

Concepts such as "research through design" (Frayling 1993), or "project grounded research" (Findeli 1997), or, although semantics-focussed, "science for design" (Krippendorff 2005) offer promising starting points. But little has been done since to *operationalize* these concepts.

1) Evolution as the basic idea

A Darwinian view of natural and cultural processes of development (or desig*n) is deliberately adopted here, since t*here is not the least evidence that the development of

mankind and socio-cultural processes as a whole follow a kind of plan or design. The concept of evolution seems to be promising for the sake of theoretical supp*ort and methodological progress.* Evolution theory relieves us from assuming an Intelligent Artificer at some mysterious point of origin. Utter undesignedness, pure chaos was the starting point, no more conditions, no foundations are required. (Dennett 1995: 69):
"A designed thing, then, is either a living thing or a part of a living thing, or the artifact of a living thing, organized in any case in aid of this battle against disorder."
A good design theory, as a designed artefact, should be able to explain its own emergence. And so far, Darwinian thinking, in close combination with operational epistemology (von Foerster 1981), provides the only descriptive model, which satisfies this self-referential requirement. Any other explanation would be either a vicious circle or an infinite regress.
This is not to deny that designers / planners / people are able to intentionally design and manufacture a new teapot, a new aircraft, or a new constitution. But these designs are temporal interventions into evolutionary processes. *Design interventions are episodes in the process of evolution.* Most of the results disappear, a few are integrated into the further process. Failures as well as successes become part of the socio-cultural archive of mankind.
Variation - selection - re-stabilization form the basic pattern of development (Luhmann 1997, Jonas 2005).

2) Variation - selection - re-stabilization as the basic pattern

The three separated processual components of evolution can be related to the constituent components of society, conceived as a communicative system (Luhmann 1997):
- *Variation* varies the *elements* of the systems, i.e. *communications*. Variation means deviating, unexpected, surprising communication. It may simply be questioning or rejecting expectations of meaning. Variation produces raw material and provides further communicative connections with wider varieties of meaning than before. In design: new artefacts, conceived as materialized communication.
- *Selection* relates to the *structures* of the system. Structures determine the creation and use of *expectations* that determine communication processes. Positive selection means

the choice of meaningful relations that promise a value for building or stabilizing structures. Selections serve as filters to control the diffusion of variations. Religion has been such a filter. Truth, money, power, as symbolically generalized media serve as filters in modern societies. In design: fashion, taste, etc.

- *Re-stabilization* refers to the state of the evolving *system* after a positive / negative selection. It has to take care of the *system-compatibility* of the selection. Even negative selections have to be re-stabilized, because they remain in the system's memory / archive. In design: the long-term viability of an artifact.

3) Designing as the essence of being human

The ability to design and to be conscious about this (i.e. to be retrospective and *projective*) seems to be the essential characteristic of being human, distinguishing us from the rest of the living world. The construction of the human position and ability of acting in relation to nature is one of the essential and unresolved challenges of modernity.

According to Latour (1998, Jonas 2000) Boyle‘s *Invention of the Laboratory* and the Scientific Community as factory for the production of facts concerning nature adds to the transcendence of naturalised nature the immanence (feasibility) of socialised nature. Hobbes‘s *Invention of Leviathan* as representative of the unpredictable mass of citizens, seduced by their passions, adds to the immanence (mundane chaos) of the social the transcendence of a scientifically substantiated eternal order. It is thus that the 3 *paradoxical constitutional guarantees of modernity* arise:

1. Even when we construct nature, it is as if we did not.

2. Even when we do not construct society, it is as if we did.

3. Nature and society must remain absolutely separate; the work of purification must therefore remain separate from the mediation work.

Design has to ignore this modern separation. The conception and realization of *projects* necessarily includes *natural and social* components. The intentional transfer of system states into preferred ones (or: state 1 → state 2) opens up the hybrid field for the "Sciences of the Artificial". Even Simon (1996: 139-167), as one of the protagonists of

rational cognitive process models of designing argues that design, seen as a socio-cultural phenomenon, follows evolutionary patterns and has no final goals. Management philosophy (Hayek 1967) has argued that the common separation of natural and artificial is insufficient. There are systems (table 1), which are the outcomes of human activities, but *not* the results of human purpose. And it is these hybrid systems, which are the subjects of management and design interventions; appropriate tools for these "semi-artificial" systems are still missing.

	Systems emerging WITHOUT human activity	**Systems as results of human activities**
Systems which are results of human design / planning	---	Artificial (mainly technological + simple social) systems → **"constructivist"**
Systems which are NOT results of human design / planning	Natural systems (solar system, crystals, organisms)	Complex social systems (family, economy, ethics, culture, …) → **"evolutionary"**

Table 1: The generation of systems by human design / activities (Hayek 1967, Malik 2000: 158).

4) Designing is part of the evolutionary pattern. It happens now, but tries to…

An important step towards an integration and more precise differentiation of the concepts of design and evolution consists of the argument, that *human designing comprises just the variation phase of socio-cultural evolution* as introduced above. Designing, as a sometimes highly rational endeavour (bringing a man to the moon may include certain trial&error components, but cannot be considered as trial&error overall) is embedded in an overall trial&error process.

Although design activities desperately attempt to cover / include the selection- and re-stabilization phases in their considerations, they are necessarily de-coupled from these phases. There is no causal relation between variation - selection - re-stabilization. Bringing a man to the moon may turn out as the first step into the universe, or as a singular historical event of the second half of the 20th century. So state 2 should better be labelled state 2´, leaving 2 for the actual future state, which cannot be determined.

Design is about what is NOT (yet). This statement expresses the main epistemological problem the discipline has to face in order to arrive at an own paradigm. Although designing happens now, it tries - by means of various methodological approaches - to include future developments. In a more "philosophical" way this issue is addressed by Nelson & Stolterman (2003), who argue that design is an inquiry into three domains of knowing: the true, the ideal and the real, with incompatible ways of reasoning in each of them. I have proposed the process model of ANALYSIS - PROJECTION - SYNTHESIS, which can be considered as a more pragmatic and operationalized version of the true / the ideal / the real (Jonas 1996).

5) Designing / inquiry is a learning process in different domains of knowing

The basis of human / social learning processes, which are the epistemological core of design, can be considered as biological, grounded in the need of organisms to survive in an environment. The Kantian transcendental apriori should be replaced by the assumption of an evolutionary fit between the "objects" and the "subjects" of recognition. According to Riedl (2000) the learning model presents a spiral with structural similarity from the molecular to the cognitive and cultural level. This pattern works in the true (the natural world) as well as in the ideal (the world of value-based exploration) and in the real (the world of acting and making).

Another supporter of this argument of *naturalized epistemology* is John Dewey (1986): processes of circular action, driven by intentionality, are the essential core of knowledge generation. Thinking depends on real world situations that have to be met, initiated by the necessity to choose appropriate means with regard to expected consequences. The projected active improvement of an unsatisfactory, problematic situation is the primary motivation for thinking, designing, and, finally - in a refined, purified, quantitative manner - for scientific research and knowledge production. Knowing is a way of acting and "truth" is exchanged by "warranted assertibility".

Schön´s (1983) epistemology of "reflective practice" can be regarded as the designerly description of these concepts. The well-known circular design process models of the Institute of Design (research → analysis → synthesis → realization) seem to be adoptions of Kolb´s (1984) "learning cycles".

6) Operationalization: A generic model of designing / a map for research

If we combine the macro model of ANALYSIS - PROJECTION - SYNTHSIS (domains of knowing) and the micro model of research → analysis → synthesis → realization (the learning phases) we get a hypercyclic *generic design process model* (Hugentobler, Jonas, Rahe 2004). If we switch the mode from concept to operation, then we can interpret the scheme as a toolbox of 3 rows and 4 colums.

		Steps of the iterative **micro process** of learning / designing			
		research	**analysis**	**synthesis**	**realization**
Domains of design inquiry, steps / components of the iterative **macro process** of designing	**ANALYSIS** "the true" how it is today	How to get data on the situation as it IS? → data on what IS	How to make sense of this data? → knowledge on what IS	How to understand the situation as a whole? → worldviews	How to present the situation as IS? → consent on the situation
	PROJECTION "the ideal" how it could be	How to get data on future changes? → future-related data	How to interpret these data? → information about futures	How to get consistent images of possible futures? → scenarios	How to present the future scenarios? → consent on problems / goals
	SYNTHESIS "the real" how it is tomorrow	How to get data on the situation as it SHALL BE → problem data	How to evaluate these data? → problem, list of requirements	How to design solutions of the problem? → design solutions	How to present the solutions? → decisions about "go / no go"
	COMMUNICATION "the driver"	How to establish the process and move it forward? How to enable positive team dynamics? How to find balance between action/reflection? How to build hot teams? How to enable equal participation? → focused and efficient teamwork			

Table 2: The toolbox, categories of design methods / tools: questions and outcomes.

Each of the 12 compartments that represent the complete process contains methods and tools for the respective process steps: For example, the ANALYSIS/synthesis compartment provides methods about "How to understand the situation as a whole? → worldviews", which can be, for example, systemic modelling techniques. If we assume 10 methods per compartment and 12 process steps, then we arrive at 10^{12} different paths

/ processes. Each path is a legitimate roadmap of the design process, transferring state 1 → state 2´. The scheme is open for various "flavours" of design research: technological, cultural, user-centred, semantic, systemic, … and it is just one possible model of a process, the validity of which has to be debated elsewhere.

The model allows individualized sequences / design processes. *The distinction of design and research becomes fuzzy.* The more one limits the inquiry to single domains of knowing or even to single process steps, the more it becomes possible and important to match the standards of scientific research. On the other hand, processes covering several boxes or even the whole process necessarily have to creatively deal with knowledge gaps (Jonas 2004).

The field of HCI, as an increasingly design-related activity, is facing similar problems. Fallman (2005) tries to clarify the role of design in HCI research and argues that *"it makes more sense to regard HCI as a* design discipline *rather than as a more traditional academic research discipline."* This is remarkable, and even a bit bizarre, as the design discipline on the other hand, is on the same road, but heading into the opposite direction, towards an academic / scientific research discipline. Fallman distinguishes design and research in HCI as 2 poles of a continuum and coins the terms of "research-oriented design" and "design-oriented research", which can immediately be related to the present concepts of "research through design" and "design through research" (table 3).

	Design ←	**→ Research**
Fallman (for HCI)	**Research-oriented Design** Design is driven by research within a larger design process Aiming at the real, by means of judgment and intuition, judged by the Client	**Design-oriented Research** Research is driven by design within a larger research process Aiming at the true, by means of Analysis and logic, judged by academic peers
Jonas (for design)	**Research through design** Covering the whole situation / process building design as an institution for human-centred innovation and supporting design as a discipline	**Design through research** Focussing on isolated questions producing knowledge for / about (?) design

Table 3: Design and research in HCI and design, according to Fallman (2005) and Jonas.

7) Research through DESIGN through research:

Re-contextualizing the scientific paradigm

Research within the "DRM-mindset" assumes that the "swampy lowlands" of uncertainty and unpredictability (Schön 1983) will be subsequently replaced by well-grounded knowledge. But exclusively scientific research is unable to fully recognize the implications of acting in a space of imagination and projection, where design criteria only become apparent after the outcome has been designed. Therefore the "knowledge base position" needs to be complemented by the "unknowledge base position" (Jonas, Chow, Verhaag 2005) or by the competencies to deal with not-knowing (Willke 2002). It is not science as a method, but science as a guiding paradigm for design, which is being called into question. Examining design as processes in the course of socio-techno-cultural evolution will reveal more clearly what is impossible and will enable us to identify the stable islands of reliable knowledge. This view adopts the circular and reflective "trial & error" models of generative world appropriation, as put forward by Dewey (1986), von Foerster (1981), Glanville (1982), Schön (1983), Swann (2002) and many others. Furthermore the hierarchical separation of basic / applied / clinical research does not make sense in this conception of design. Basic research for real needs has to be closely related to real-world situations. I.e. basic research, in order to be basic, has to be embedded / applied in clinical situations.

The idea of research through design is based upon a generic structure of learning / designing, which has been derived from practice. Every design process (more or less) follows this structure, making use of the various (scientific) methods provided for each of the steps. The inherent fuzziness of the process model is able to bridge the causality gaps occurring between the different scientific contributions. The proposed paradigm of design research means that it is the generic design process and not the scientific process that guides design research. Other than Fallman, who just distinguishes the two approaches, I suggest a clear design-orientation:

The Scientific Paradigm has to be embedded into the Design Paradigm:

- research is guided through design process logic, and

- design is supported / driven by phases of scientific research and inquiry.

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