Prof. Peter Friedrich Stephan
Kunsthochschule für Medien Köln
Academy of Media Arts Cologne
Theory and Design of Hypermedia
http://www.hypermedia.khm.de

published in the german periodical »formdiskurs« no. 2, I/97, p. 108–119

Abstract
In the rapidly emerging information society, center-stage is being taken by research topics pertinent to design, like visualization, simulation, multimedia and virtual reality. The possibilities of the design disciplines to exercise influence relevant to society seems to be greater than ever before. The more complex and challenging the future tasks of technically implemented semiotic processes become, the more evident is the need for advanced research in the fields named above.
However, designers stick largely to their tradition of »implicit knowledge«, instead of joining international research teams in the areas of Computer Supported Cooperative Work (CSCW) and Human-Computer Interaction (HCI). There designers can contribute their unique blend of experimental practical approaches and systematic scientific research.

Designers in Cyberspace: Clueless

– Perspektives of design research

If we had an imaginistics, the way we have a logic,
then one would soon discover the art of discovery.
Novalis

1. Design in the Context of Current Research

In the rapidly emerging information society, center-stage is being taken by research topics which engender design-specific issues. I am thinking, among others, of Visualization, Simulation, Multimedia and Virtual Reality. The scope for the design disciplines to have an influence seems to be greater than ever before. The more abstract the world becomes, the more our forms of communication and production rely on technically implemented semiotic processes and the more we integrate »smart« machines into our everyday lives, the more important aesthetic, cognitive and creative aspects become.
However, if at all, designers are only marginally represented in the research world, be it in companies or in state institutions. To date, there have been but few attempts to establish design-specific research, but the overall swath of design disciplines tend not to recognize the possibility and necessity of conducting research themselves.
Thus, we are faced by a paradox. Precisely in a historical situation in which design as a profession has the opportunity to come good on its claim that it can influence things and help shape the artifacts and processes of central social importance it becomes clear that there is only a weak propensity to develop the qualifications and structures necessary for design to play such a role.
On the whole, design as a subject, once a synonym for modernity and progressiveness, is not able to relate to the dynamic processes shaping life today and is in danger of playing a marginal role in the future.

1.1 The formative power of the computer

The computerization of all walks of life unleashes a formative power truly comparable only with the historical phase of the industrial revolution. At that time design first established itself as a field; with the spread of digital technology, the overarching conditions have changed so radically that design must re-assess its assumptions and reformulate them. Otherwise, design could prove to be a phenomenon whose beginning, zenith, and nadir all coincided with industrial production. It is by no means certain that existing capacity can be adjusted to meet new conditions. Possibly, it would be more fitting to assume that a new discipline will emerge which will integrate existing abilities from various disciplines, among others skills associated with a domain hitherto known as design.

What to do?

The afore-mentioned new fields of research are interdisciplinary in thrust and will involve experts in the cognitive sciences, computer scientists, engineers, linguists, teachers and psychologists. Design know-how is also urgently required. If designers wish to establish their discipline in this context then the contribution they make will have to be such that others can adapt it. Design capacity must be articulated in concepts and by means of criteria that can be conveyed in established research environments. The integrity of design can only be upheld in this realm, otherwise characterized by engineering and IT, if the research work undertaken is independent and of a specialist nature.

1.2 A note on the notion »design research«

The notion of »design research« may seem somewhat pretentious, but it nevertheless seems apposite for a number of reasons:

1. It indicates the wish to establish the topic in the context of the natural sciences and the humanities, on the one hand, and of industrial research and development, on the other.
2. The notion addresses the given system of research institutions, research projects and research funding of which designers wish to be a part. Here, we evidently have to do with the political issue of who has the power to define research contents and discourse forms.
3. It has become customary to use the alternative concept »design study« for traditional development work ranging from scribbles to extensive elaborations, work that does not have to match up to the standards for research which must still be developed and expanded.

1.3 Design research must tackle the following tasks:

1. Communications

Forging a better broad link (to other fields) and a better in-depth link (processes of product development, workflow)

2. Reflection

A typology of historical design methods, self-knowledge of individual patterns

3. Substitution/Complementation

Replacement of traditional techniques by more efficient procedures, supplemented by new methods

4. New fields of design (ubiquitous computing)
From isolated hardware product to software-defined, process-oriented and networked action

5. Archiving
Follow-up projects are based on previous project work (dataflow)

6. Publications
Accumulation of knowledge in design by means of systematized publications (Internet, databases).

Taking part in established research work requires that design have the requisite educational structures: doctoral programs, participation in state research programs, contributions to industrial research and development efforts, foundation of institutes and the acquisition of third-party funding. Before such a hands-on approach to the problem can be discussed, we need to elaborate what the contents of design research should be. The following deliberations are not meant as the outline of a research program but as a sketch of the situation facing design in a digital world in order to stimulate within design a discourse on research.

2. How can design research constitute itself?

2.1 Initial position of designers

The issue of using computers for design tasks has been addressed quite early.[1] However these efforts remained singular and didn´t catch on in the design community. So it wasn't until the late eighties that the use of digital technology has caused a fundamental revolution in designers' working conditions and compelled them to adapt fast. Everyday practice in the designing professions is increasingly defined by the utilization of electronic tools as these have enhanced efficiency in a new way.

The pressure to adapt by constantly acquiring a knowledge of how to use new hardware and software systems appears to place such a strain on designers that they have great difficulty in seeing the broader perspective. As computer users they are caught in the upward spiral of technology, which they in no part control. Designers cannot clearly see the background to technological developments, and technology's potential and perspectives.

Since digital technology is still in its infancy, the goal cannot be to bring ourselves up-to-date with one enormous effort. Only research specific to design will be able to help us gain a deeper insight into the driving forces behind these developments and tap them on behalf of design. Only the active design of our own instruments and the areas in which we work to meet the goals we set ourselves can put us designers back in a knowledgeable position commensurate with the scope of our work and the message we wish to convey with it.

To date, computer technology has predominantly been used in the domain of design to substitute for already known working processes. It is still very early days when it comes to unleashing the original potential of digital technology to support the processes which are generally and imprecisely termed design. We possess drawing programs and construction software, we can work on images and sounds and integrate them into synaesthetic structures. However, design systems as such that reflect and support design activity (which is so hard to define) are still only rudimentarily available and present a genuine task for design-specific research.

---

[1] see: Karl Gerstner 1963: Programme entwerfen, Martin Krampen 1970: Computer und Gestaltung – Ein Überblick, Frieder Nake 1970: Können Computer in die Grundlehre eingreifen?

2.2 Design as Science?

The ambitious wish to set up independent research presumes that themes and procedures that do not yet exist will be adapted accordingly. In other words, I do not want to advocate that design needs to be rendered scientific. That discussion is almost as old as design itself and need not be repeated here.[2] Instead, I am assuming that design is neither science, nor technology, nor art, but cuts across these established fields of discourse and practice.

Designers claim to have two fathers: one heavenly (spiritual, artistic) father and an earthly (material, scientific) father. Their mother is ***techne*** and she stands for concrete work. Designers can only show whether this double parentage has given designers the stuff with which to be modern heroes by handling the tension that thus arises, focusing on it and using it productively. This can then form the starting point for developing design research.

2.3 Thinking with a model

Design is less a noun and much rather a verb. Design is primarily »doing«. What do designers do? They design. What does ist mean »to design«?

Any description of this activity will certainly involve the components of »innovation« and »pragmatism«. Anything that has no novelty value therefore does not count as design work; nor does anything which does not stem from a wish to be practical, in other words does not recognize certain fundamental conditions and function under these conditions. Design is essentially based on signs and just as signs can only arise if we agree on their contents, design, too, can only be described in terms of the situation and context on which it depends.

According to Otl Aicher design is »thinking with the object«. Here, the object becomes a model and has a twofold function. On the one hand, it is a medium of representation in that it follows a given original by transposing select characteristics of the latter. On the other, it enables certain assumptions to be brought to bear. Whether the assumptions are valid or not can be decided when using the model and the evaluation leads in a cyclical process to the modification of the model.

The model thus has a specific character that distinguishes it from other forms of transposition, such as metaphors or allegory. Unlike the latter, which make use of depiction, the illumination of comparison or illustration, the model has a productive function. What the model offers does not exist a priori but is first generated by virtue of the fact that it is encapsulated by the model. The presentation thus resembles production. Production and understanding, thought and design supplement and foster one another in the process in which the model is formed. Design processes are characterized by intellectual and concrete models being brought up against each other and this leading to their changing.

Similar descriptions are to be found today in the theory of science. Especially Rheinberger, whose conceptual frame we shall adopt in what follows, characterizes the process of scientific research as a process of design that takes place by means of an »epistemic thing« through which knowledge is generated:

---

[2] See Bonsiepe, Gui: „Arabesken der Rationalität," in: ulm, journal of the Hochschule für Gestaltung, No. 19/20 (August, 1970). Bonsiepe cites a statement dating from 1910 by the architect Lethaby as the earliest instance of someone calling for more science in design. Also see Pohl, Wolfgang: „Design auf dem Wege zu einer Wissenschaft?", form, No. 60/IV (1972) and van den Boom, Holger: Fünf Gedankengänge – Unterwegs zu einer Designwissenschaft, (Weimar, 1994)

> „One could say experimentally that the 'epistemic thing' is to scientific activity what the 'sculpture' is to sculpting or 'the picture' is to painting, or the 'poem' is to poetry. It is the 'scientifically real' generated by scientific activity."[3]

In the following the possible consequences for design as a new research discipline shall be discussed.

2.4 The »epistemic thing«

The natural sciences have long since used models as »epistemic things«, for example the globe, molecular models, or the DNA double helix. Today, these models hardly exist any longer as an objective arrangement and are instead created and manipulated as electronic data in computers: visualization and simulation provide information on the assumptions behind the manipulations.
If we postulate that the »epistemic thing« in scientific work is the equivalent of the model in design, then we can conclude that the two approximate each other in the joint medium of computer models. Today, the designer designs by using electronic models, just as the scientist explores using electronic models.
Design and research are purposive activities that are paradoxical in that they plan environments that enable the occurrence of »surprises«. Design and research processes consist of a heterogeneous mixture of procedures. Such a heterogeneous method has proved to be best for tackling the ill-defined tasks facing designers and researchers. It is less a question of solving them and more one of manipulating / modeling, in other words of shifting things from one state into another, and the product is an »informational surplus value«[4]. This process yields an innovative potential precisely because the experiment is ill-defined as are the procedures of »bricolage« associated with it.

2.5 Bricolage

The notion of »bricolage« was introduced by Lévi-Strauss who used the term to describe an activity which functions in the technical domain the way mythical thought functions in the intellectual domain, bringing forth a »first science «. »Bricolage« stands for the use of means which are »abstruse compared with those of the expert«. The person doing »bricolage« has a »limited choice of instruments and materials which are, moreover, heterogeneous « and works using »the remnants of earlier constructions or deconstructions«. These »can only be defined by their character as tools«; they are, therefore, »only half defined by their purpose«. Lévi-Strauss calls the process a »non-predetermined movement«.[5]

---

[3] Rheinberger, Hans-Jörg: Experiment - Differenz - Schrift, (Marburg, 1992). Rheinberger's expression »the scientifically real « refers explicitly to Gaston Bachelard's »The new scientific mind«.

[4] The term was coined by Rainer Kuhlen. See Kuhlen, Rainer: Hypertext. Ein nicht-lineares Medium zwischen Buch und Wissensbank, (Heidelberg, 1991)

[5] See Lévi-Strauss, Claude: The Savage Mind, (Weidenfeld, London, 1966)

2.6 Experimental systems

There are various parallels here between research and design systems and we shall in what follows term both generally as »experimental systems«. Experimental systems are intended to create the basic conditions for entry into the not-yet-known. To this end, they have to be as flexible as possible in order to enable »events that cannot be planned« to happen. At the same time, they need to be as stable as is necessary in order not just to register noise, but to provide results we can the interpret. The configuration of the experimental system determines the number and the type of questions that can be asked there.
The traditional definition of the »scope of the problem« is not commensurate to experimental systems. Such an approach rests, or so the hypothesis put forward by Allen Newell would have it, on the assumption that all those parameters can be completely represented (formally described) which could be part of the potential solution. The object is to devise optimal solutions by means of a heuristic search, theories of utility and statistical decisions theory, as these best meet the prior defined needs. Description and solution coincide here:

> „… to solve a problem simply means to describe it such that the solution becomes transparent."[6]

This formal approach makes it easier to tackle the task with machinery and it turns up good results for some well-defined tasks. However, if the tasks addressed become more complex, the possibility of describing them exhaustively becomes increasingly difficult. Instead of speaking of the „scope of the problem" I propose that we use the more comprehensive notion of „the scope of possibilities", for this term covers not only representations of the problem, but also how it comes about, i.e. the communicative and pragmatic dimension. It is a dynamic approach, to the extent that it first arises through use.
The procedures based on this hypothesized „scope of the problem" could be used as an „experimental sub-routine"[7]. This shift in perspective away from outwardly-controlled, purportedly objective problems in favor of anticipation and realization of actions integrates objective and subjective components into the experimental system. Optimal solutions, to keep the terminology consistent, can at most be pin-pointed for a specific situation, in a temporally and locally limited form and cannot be treated as absolutes; indeed, they refer only to the observer monitoring them.
Computers dissolve the hard-edged distinctions between spheres of reflection and production for as semiotic machines they integrate both worlds into the electronic model. The cognitive design field – the scope of possibilities – is the product of multimedia technology linked to knowledge-based systems. The computer as a dynamic, interactive medium not only permits us to grasp the substance of knowledge. It also enables us to generate real experiential knowledge. In the world of these media, symbolic actions have an effect and are therefore operative in nature.

---

[6] This approach was the basis for the development of »GPS - General Problem Solver« by Newell and Simon 1972. See Simon, Herbert A.: The Sciences of the Artificial (Cambridge, London, 1981)

[7] The term is Rheinberger's

2.7 Theory formation as design project

If we assume that knowledge is not passively received but must be generated, then there is a creative and constructive side to each cognitive process. Here, creating models as the inner representation and external arrangement of cognition is of central importance. Taking known components (proven techniques, apparatuses, formula, materials), an arbitrary object is then composed in line with hypothetical rules. The task of the object is to provide insights into the suitability of such rules.
I am understanding theory formation here as a cognitive phenomenon that emerges and stands in a mutually generative relation with design activity. It is not something external to design production; instead, in the form of modeling it is a direct part of design practice. In addition to its descriptive function, theory can fulfill a performative function specifically in the context of electronic design systems (meta-models created using a programming language). Design models are »implemented theories« and they show that they are productive by generating a hyperreality[8]. This tears through the dividing line between theory and practice, making it possible to regard theory itself as a design task. This outlook is commensurate with the state of the electronic media today, which has developed hypertexts and hypermedia, in other words forms that can no longer be reduced to some linear statement.[9] Such research calls for the integration of theoretical reflection, design competence and technical knowledge. The designer would seem to be predestined to achieve precisely this.

3. Utopia is here

Great designers such as Charles Eames, Otl Aicher and Buckminster Fuller were researchers, following the standard of Leonardo. Together with innovative entrepreneurs they could achieve uncommon solutions and break new grounds. Today individuals can still reach a lot. Decentralised technology empowers the individual, but only on the basis of existing systems. Once these are questioned, a strategy is needed: teams, money and politics come in. Through dynamic changes however, structures tend to be destabilized. We should take advantage of this in order to make the structures dance. Superstudio's radical design and archigram's utopian designs show us how this was done earlier. In those days designers anticipated in metaphorical ways, but today the challenge is to make creative use of the phantastic possibilities which are here and wait to be developed.
What is called for today is for the profession to remember its Enlightenment tradition. The interest back then focused not on the singular product suitable as a museum exhibit, but rather on a thing to be used, ensuring the quality of the scope for human action. Today, the scope for action and our abilities are determined by software-based products that are still in their infancy. Here, designers have a good chance to establish their

---

[8] The expression stems from Baudrillard and is interpreted by Bolz as follows: „Baudrillard calls this strange reality which originates in the anticipation and circularity of models and can therefore no longer be distinguished meaningfully from the imaginary 'hyperreality'. When faced with it, the reality principle, which is otherwise in force in all acts of mere sham, is sent flying. (…) The hyperreality of simulation absorbs the real and robs all questions as to true and false, reality and illusion, of their object." [Bolz, Norbert: „Die Logik der Simulation," in: Engelbert, Arthur (ed.): Kunst im Schaltkreis, Variation - Serie - Simulation, notes on the conference of Oct. 21, 1989, (Berlin, Hochschule der Künste Berlin, FB 6), pp. 113-119]

[9] See Landow, George P.: The Convergence of Contemporary Critical Theory and Technology, (Baltimore, 1992)

credentials as researchers and therefore achieve a new level of recognition and extend the reach of their influence.
The development of educational facilities for design, ranging from applied art colleges via polytechnics to independent departments in the art academies and universities corresponds to the gradual enracination of the discipline in a teaching context. Today, as a further stage down this path, we need to establish theory and research specific to the field. In the final instance, only thus can we ensure that teaching is of a quality commensurate with the importance of design-specific opportunities and challenges in the digital world.

Biographical Note

Prof. Peter Friedrich Stephan, born 1959, lives in Berlin and Cologne. He studied design, music, marketing and business and social communications in Berlin, Hamburg and New York and. Scince 1983 he works as an author, designer, musician, producer, and consultant for multimedia productions. Besides his work in corporate communications he is also active in the fields of experimental design and theory. He was a research fellow and guest lecturer before becoming professor for „Theory and Design of Hypermedia“ in 1997 at the Academy of Media Arts in Cologne. His research work focusses on the newly established field of „knowledge design“. As a consultant for online companies his occupations are E-recruiting and online events. Latest publication: „Events and E-Commerce – Customer Care and Branding on the Internet“ (Berlin: Springer Publishing, 2nd edition in preparation).