A Scenario for Design

Wolfgang Jonas

Dedicated to V.M.

1. Introduction

This paper illustrates a functional framework (a scenario) for the design process comprised of epistemological, theoretical, and methodological aspects, and introducing the concept of scenario as a guiding idea.

A scenario is a design in itself. So the criteria for the appropriateness of the construction have no correlation to some reality "out there," but comprehensiveness, coherence of the different chunks of knowledge, and beauty of the design, as well as adaptability and flexibility. "Designing designing" [1] does not claim truth, but universality. I like to call it "neorational" in the sense that it is a rationalism that has passed post-rationalism / modernism, and has evolved into "post-post-rationalism." It strives to bridge the gap between the "two cultures" of the humanities and the sciences. The starting point is science, using such concepts as autopoiesis, self-organization, and second-order cybernetics.

The scenario can be considered as an experimental stage set for design and planning practice, and a conceptual framework for disciplinary development.

2. Situation and Disciplinary Deficits

Design is developing from a craft and trade activity to a profession and, hopefully, towards an established academic discipline.[2, 3] Krippendorff [4] examines the question, "What makes a discipline?" in detail, and describes the deficits of design, mainly concentrating on the disciplinary discourse yet to come. Owen[5] calls design a "slow learner" with regard to the establishment of a knowledge base. Jonas [6, 7] describes the structure of these "learning pathologies," arguing that frequent crises in self-concept lead to the reactive adoption of stylish ideologies ("small theories" / "theory fashions") which focus on isolated aspects of the field. They postpone the crisis for a while. Theory fashions (functionalism, product semantics, eco design, and ethical design, for example), fiercely fighting each other, suddenly appear in close proximity.

On the other hand, there are the less spectacular, longer-term activities of theory-building that undergo considerable delays before showing any effect in practice. The last big effort of this kind, trying to enable design to deal with the increasing complexity of problem situations, took place in the 1960s, and ended in the early 1970s. There was little positive immediate effect. Some results were even

1 John Christopher Jones, "designing designing" in *Essays in Design* (Chichester: John Wiley & Sons, 1984, originally, 1978).

2 Richard Buchanan, "Myth and Maturity: Toward a New Order in the Decade of Design" in *Design Issues* 6:2 (Spring 1990): 70-80.

3 Richard Buchanan, "Education and Professional Practice in Design" in *Design Issues* 14:2 (Summer 1998).

4 Klaus Krippendorff, "Redesigning Design. An Invitation to a Responsible Future" in Vihma Tahkokallio, ed., *Design—Pleasure or Responsibility?* (Helsinki: UIAH, 1994), 138–162.

5 Charles Owen, "Design research: building the knowledge base" in *Design Studies* 19:1 (January 1998): 9–20.

6 Wolfgang Jonas, *Design—System—Theorie. Überlegungen zu einem sy-stem-theoreti-schen Modell von Design-theorie* (Essen: Verlag Die Blaue Eule, 1994), 50–68.

7 Wolfgang Jonas, "Viable Structures and Generative Tools—an approach towards 'designing designing' " "Contextual Design—Design in Contexts" (European Academy of Design, Stockholm, April 23–25, 1997).

negative, driving researchers including Alexander[8] and Jones[9] to retreat from the field. Nonetheless, long-term influences have been produced.

Working on the basis of short-term theories has had the side effect of fundamental work increasingly being neglected. The disciplinary infrastructures to do this autonomously waste away or even disappear completely. Unlike medicine, another academic discipline aiming at practice, the necessity of continuous theory work is not widely acknowledged. This is a vicious circle, driving design into the poor role of an auxiliary profession of economy or marketing, not really responsible for its contributions to culture. Theory, mostly about design, is left to those reflecting disciplines as philosophy or cultural sciences, which normally do not care much about design's fitness for its crucial, everyday function of shaping our way of living. Figure 1 illustrates this "shifting-the-burden" pattern[10] in systemic language.

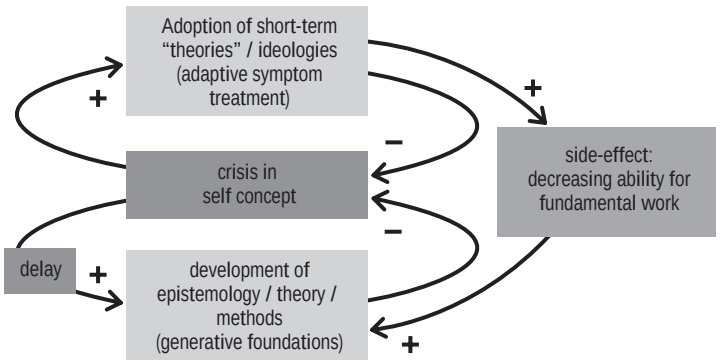


Figure 1
Creating generative foundations seems to be a necessary intervention for overcoming learning pathologies in design.

There still seems to be too little internal complexity to deal with increasing external complexity. The "critical mass" of coordinated efforts to produce reliable foundations has not yet been reached. This weakness of discourse and value system weakens design's ability to communicate with established disciplines such as economics or engineering on an equal basis. Other disciplines (including marketing) speak for design instead. Of course, there are a few individuals who are "Starck" enough to communicate according to their own rules, acting rather as a prima donna than as a partner.

3. What Is Special About Design?

The question is: How can design achieve autonomy? Design has not (yet?) reached the status of science, art, technology, and economics. Ongoing definitory attempts which revert to previously established areas include those of the Bauhaus, New Bauhaus, and Ulm schools. They might be useful, at best, as negations. Design is *not art* because it does not aim at individual expression, but instead to serve various stakeholders, even though there are all of those intuitive, creative, and individual components. Design is *not technology* because it deals

8 Christopher Alexander (interviewed by Max Jacobson), "The State of the Art in Design Methods" in *DMG Newsletter* 5:3 (1971): 3–7.

9 John Christopher Jones, "How My Thoughts About Design Methods Have Changed During the Years" in *Essays in Design* (Chichester: John Wiley & Sons, 1984, originally 1974).

10 Peter Senge, *The Fifth Discipline. The Art & Practice of the Learning Organization* (New York: Currency Doubleday, 1990).

with fuzzy, discursive criteria rather than objective criteria, even though design shares many functional objectives. Design is *not science* because it does not offer new explanatory models of reality, but changes reality more or less purposefully, and yet the experimental process of research resembles the design process. Obviously, design is something very special.

Glanville[11] uses the similarities in design and the research process to perform a complete "U-turn," arguing that design thinking should be the model for scientific research. Though very appealing, it really is not a solution since it shifts the burden of basic explanation to design, the weakest part of all. While design, in fact, is a cross-discipline and integrates various expert fields, it cannot be basic to everything else. Instead, it should be conceived as an expert discipline of a special kind: for integration, relation, and meaning. There have been numerous attempts to redefine design.

Table 1:
Two recent attempts to redefine designing

Reinterpretation Bonsiepe[12]	**Functional Definition** Jonas[13]
Design is a domain which can manifest itself in *every area of human knowledge and practice.*	
Design is oriented towards the *future.*	Design is *anticipative* (looking ahead, in different directions and time scales).
Design is related to *innovation.* The design act introduces something new into the world.	Design is *generative* (aiming at the synthesis of material or immaterial artifacts and patterns of behavior).
Design is tied to *body and space,* especially the retinal space.	
Design aims at *effective action.*	Design is *use-oriented* (taking quality of life as its criterion, without claiming to know what this is).
Design is fixed at *language* in the area of *assessments.*	Design *is illustrative* (creating wholes, contexts, narratives, aiming at agency and dissemination).
Design aims at the *interaction of user and artifact,* acting in the domain of the *interface.*	
	Design is *integrative* (neglecting disciplinary boundaries, moderating perspectives, and including its own).
	Design is *context sensitive* (being aware of and using social, cultural, technological interdependencies).

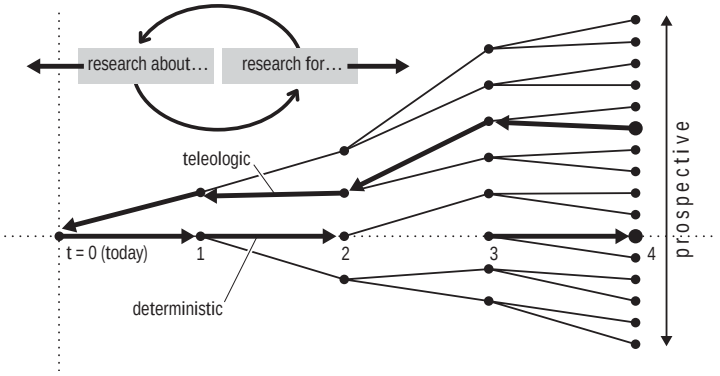
11 Ranulph Glanville, "Why Design Research?" in R. Jacques and A. Powell, *Design: Science: Method* (Guildford: Westbury House, 1980).

12 Gui Bonsiepe, *Interface. Design neu begreifen* (Mannheim: Bollmann, 1996).

13 Wolfgang Jonas, "Research for the Learning Design School," *The New Academy* (Barcelona, October 1997).

Theory-building has to consider that design, in aiming at "solutions," needs a theory for practice to deal with complex entities of different types (material, cognitive, and social) so that some kind of "systemic" concept seems inevitable. Design is future-oriented and, of course, serves people and social institutions. This is not to stress human-centered nature, there is nothing other than people to design for, with the possible exception of self-conscious machines. Yet it does emphasize that design, for the most part, is a matter of fuzzy, changing, cultural criteria as opposed to scientific criteria. There is ongoing negotiation between stakeholders of perspectives, with the goal of understanding each other's viewpoint. Design changes the world and, in turn, is changed by these changes.[14]

To derive the requirements for the framework, we should distinguish human operations by their orientation in time. They are either forward-oriented, aiming at purposeful action (called practice), or backward-oriented, aiming at reflection, interpretation, and causal reconstruction (called theory). A hypothetical abstract definition might describe design as a permanent sequence of decisions to reduce contingency at the individual, organizational, and social levels. The function of each decision is to define and, subsequently, to eliminate alternatives and absorb uncertainty in order to create novelty. In order to do this on a rational, meaningful basis, it is necessary to have feedback cycles established between theory and practice, and between the forward and the backward perspectives. This really is not new, but known as forecasting (deterministic), planning / backcasting (teleologic), scenario-building (prospective) or, more generally, learning (figure 2).



Fugure 2
Design as a bifurcation process of decision-making.

Any claim as to the priority of either the humanities or the sciences in this endeavor is counterproductive, since it tends to broaden the cultural gap.[15] We should not hesitate to include everything into a general framework which seems to be useful (from pragmatic philosophy to chaos theory).

14 Alain Findeli, "Theoretical, Methodological, and Ethical Foundations for a Renewal of Design Education and Research," *The New Academy* (Barcelona, October 1997).

15 Victor Margolin, "Design Research and Design Studies: Why We Need Both," a lecture given at the conference *"No Guru, No Method?"* (UIAH Helsinki, September 6, 1996).

This approach implicitly covers the issue of values and ethics in the Aristotelian sense as deriving from good practice, and not vice versa.[16] To focus on ethics would make design a religious project.[17]

4. Epistemological Consideration

Epistemology concerns the basic assumptions of our way to gain knowledge of the world we are living in. Normally, the epistemological basis either is taken for granted in a scientific field or more or less arbitrarily chosen, depending on the researcher's intellectual biography, as in design. Nevertheless, the choice shapes the complete building.

Design theory deals with an inherently context-dependent and temporal subject matter. Recognizing change as an essential feature should not be considered as an uncritical adaptation to contexts, but rather an essential condition of any dynamically stable theory. There are two major problems: self-reference (leading to circularity) and paradox (leading to nothing or everything). Like linguistics, psychoanalysis, and other disciplines, design research is a reflexive project. The most awkward characteristic of the subjects mentioned is that they examine themselves in their own terms. The observer is, at the same time, part of the observed field and observing from outside of it. The same is true for theory. Design theory is part of its subject; and creating a theory changes the subject.

Any comprehensive theory or model of design should be able to explain its own emergence and change.

In the classical scientific paradigm, this situation is extremely critical. The thing talked about is on one level, and the thing in terms of which it is talked about must be on another (meta) level. Gödel proved in 1931 that it is impossible to describe something both completely and consistently in its own terms. But some subjects, such as design, do and must talk about themselves in their own terms—that is, their metalevels are the same as their levels. This leads to the flaw that they have to be considered as incomplete and / or inconsistent in terms of the classical paradigm.

Is there any way out? Glanville[18] argues that self-reference is obvious even in "hard sciences" and, therefore, must be accepted as basic. The problem thus arising (see the "U-turn," above) is to redesign the whole of scientific knowledge to encompass not only the classical view (possibly modified), but also those things which currently are excluded. Are there, then, any levels at all? If self-referential (living) systems are basic, then levels cannot exist. Glanville's explanation is based on the observation of the way in which scientific knowledge actually is produced, and on remembering how it is that levels come into being:

> Science (and how often we do forget this in our oversimplifications) is a corpus of knowledge, and a corpus of knowledge requires agents to know it. It is not constituted of cold

16 Wolfgang Jonas, "Design und Ethik — brauchen wir eine Sondermoral für das Design?" 15. designwiss. Kollo–quium *Design und Ethik* (Hochschule für Kunst und Design Halle, 1995).

17 Ezio Manzini, "Prometheus of the Everyday. The Ecology of the Artificial and the Designer's Responsibility" in Buchanan and Margolin, eds., *Discovering Design* (Chicago: The University of Chicago Press, 1995), 219–243.

18 Glanville, "Why Design Research?"

> facts, but of working hypotheses. The corpus of knowledge does not, a priori, exist; it is constructed. The relationships in it have to be made through the act of relating, and they have to be expressed linguistically, and stabilized through shared interpretation in shared language.…

Glanville shows, in detail, that the sort of mechanisms that must be assumed for self-referential systems to be observable to others permit and require the making of such relationships and, thus, of levels. Without this assumption, there would be nothing left to talk about. This reinforces the concept of science as being a social endeavor. But it also provides the theoretical basis for the observer in any experiment—or the designer in any design—as being involved in a circular, feedback process in which the observer's description and the experimental arrangement's behavior interact and modify each other until they are in apparent agreement, allowing predictions to be made (inductively) without the need for any recourse to "truth."

This leads to the *autopoiesis theory* of living systems, and its further extension to mental and social systems. Maturana and Varela[19] argue that living organisms are autonomous, operationally closed, dissipative systems because they strive to maintain an identity by subordinating all changes to the maintenance of their own organization as a given set of relationships. They do so by engaging in circular operations. Thus, continuous patterns of interaction are established that are always self-referential, because a system cannot enter into interactions that are not specified in the pattern of relations that define its organization. The concept of operative closure already has been indicated by Schütz,[20] who clearly describes the unreconcilable gap between subjective meaning and alter's understanding:

> Intended meaning is essentially unapproachable, because it is constituted exclusively inside my own flow of consciousness.

For all these reasons, a constructivist approach seems to be appropriate. Luhmann[21] states:

> Constructivism is the consequence of some theoretical positions which focus on operational closure. This means that a system can only work within itself and not outside. A system can never operate in its environment…In cognitive science, this idea comes from brain research, as the brain is an operationally closed system. So, if we have to use our brains to make science, how can we get into the environment?

Luhmann's theory (see section 4) uses the concept of "observation," which is defined formally as an operation with a distinction in order

19 Humberto R. Maturana and Francisco Varela, *Der Baum der Erkenntnis. Die biologischen Wurzeln des menschlichen Erkennens* (Bern und München: Scherz, 1987).

20 Alfred Schütz, *Der sinnhafte Aufbau der sozialen Welt. Eine Einleitung in die verstehende Sozio-logie.* (Frankfurt: Suhrkamp, 1974, originally 1932), 140.

21 Ole Thyssen, "Some Basic Notions in the Systems Theory of Niklas Luhmann" and "Interview With Professor Niklas Luhmann, Oslo, April 2, 1995" in *Cybernetics & Human Knowing* 3:2 (1995): 3–22 and 23–26.

to indicate one side and not the other side of the distinction. The initial distinction is, more or less, arbitrary but influences the rest of the construction. The theory does not refer to ontology, but to the basic distinction system / environment. Any observation is based on the dualism of self-reference and external reference. Both types of reference imply each other, so that no materialism (only external reference) and no idealism (only internal reference) is possible. What is stable is not the objective world, but *eigenvalues*, functions and structures which are the product of "second-order observation." [22] A shared world is constructed and continually tested out of second-order observations.

To sum up: there is a "real world" which we cannot perceive as it "really" is. Constructivism provides a consistent and comprehensive way to account for that. Due to its foundation in autopoiesis theory, constructivism is a contribution to the naturalization of epistemology.

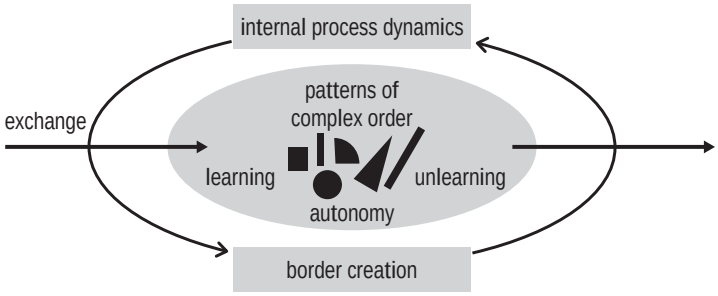


Figure 3
Dissipative systems (living, mental, and social) build internal complexity by autopoietic closure. This permits interaction with the environment, exertion of influence, evolution, and learning.

5. Systems Theory as Core and General Framework

The theory has to be comprehensive, highly abstract, and flexible in structure in order to integrate numerous subject theories on different levels of resolution. And it has to be adaptable to change, while keeping its basic character.

Every observation is a unity of a distinction and an indication.[23] Cognitive operations begin following the imperative: Make a distinction! This section started with a contingent (i.e., neither necessary nor impossible) decision to be stabilized through the coherence of the total approach: the adoption of sociological systems theory for theory-building and methodology, and the choice of the distinction system / environment as a starting point. The guiding idea is that design, if it intends to act generatively, has to become an autonomous system itself (theory). Other fields, if seen as subjects of intervention (methodology), have to be considered as autonomous systems.

5.1. Outline of Systems Theory

The reception of social systems theory in design seems to end with Parsons, whose structural functionalism, concerned with the problem of conserving existing structures, is rightly considered too rigid and static.[24] The further differentiation of systems theory is widely

22 Heinz Von Foerster, *Sicht und Einsicht: Versuche zu einer operativen Erkenntnistheorie* (Vieweg: Braunschweig, 1985) - originally *Observing Systems* (Seaside, CA, 1981)

23 George Spencer Brown, *Laws of Form* (London: George Allen & Unwin, 1968).

24 Victor Margolin, "Design Research and Design Studies: Why We Need Both."

neglected. One of its origins lies in first-order cybernetics,[25] dealing with observing an objective reality and the problem of control. Here, many designers still stop listening and turn away with horror. But there also is second-order cybernetics (developed at the Biological Computing Lab at the University of Illinois, Urbana, by von Foerster et al., and at the Palo Alto Mental Research Institute by Bateson, et al.), dealing with the problem of negotiation and argumentation, and the construction of a reality by observing observations. Whereas, first-order cybernetics deals with observed systems, considered open, and with the observer defining the system's purpose; second-order cybernetics deals with observing closed systems with the observer defining "his or her own purpose."

Luhmann's theory of social systems[26] is the most advanced model of modern society. He extends the autopoiesis concept of living systems to the description of mental and social systems since about 1980. Living systems act in the medium life, mental systems in consciousness, and social systems in communication. Both mental and social systems operate with language and meaning. Communication cannot take place without presupposing consciousness, and vice versa.

The theory asks for the function of systems. The purpose of system formation is, generally speaking, the creation of separated regions which allow the system to record and process the complexity of the world. Systems establish a difference between inside and outside, acting as a sense-making, symbolically mediated interface between delivered and processable complexity. Thus, a system defines, for itself, the boundary which allows it to create its own identity according to internally produced and processed rules, and to maintain it against an external reality.

No analysis of consciousness will ever reveal anything about communication and vice versa, just as no analysis of mental processes will reveal anything about brain processes, which are the domain of living systems. Autopoietic systems act in operative closure; mental and social systems being totally distinct. The construct of person is the structural coupling of mental and social systems, allowing both references to communication and consciousness.

Boundaries increase the level of "stabilizable improbability" (organized complexity), limiting meaning to the internally meaningful. Every kind of environment is perceived only with respect to the own difference schema. The kind of relationships possible with its environment depends on the mode of operation, which is determined by the system's internal structure. External control of autopoietic systems is impossible, except at the price of destroying their autopoietic quality and identity.

Functional subsystems are the products of ongoing differentiation. They increase their operational efficiency by using generalized media and codes (e.g., the economy operates in the medium money, science in the medium truth, politics in power, etc.). Sub-

25 Norbert Wiener, *Cybernetics or Control and Communication in the Animal and the Machine*, 1948.

26 Niklas Luhmann, *Social Systems* (Stanford: Stanford University Press, 1995)—originally *So-ziale Systeme. Grundriß einer allgemeinen Theorie* (Frankfurt: Suhrkamp, 1984).

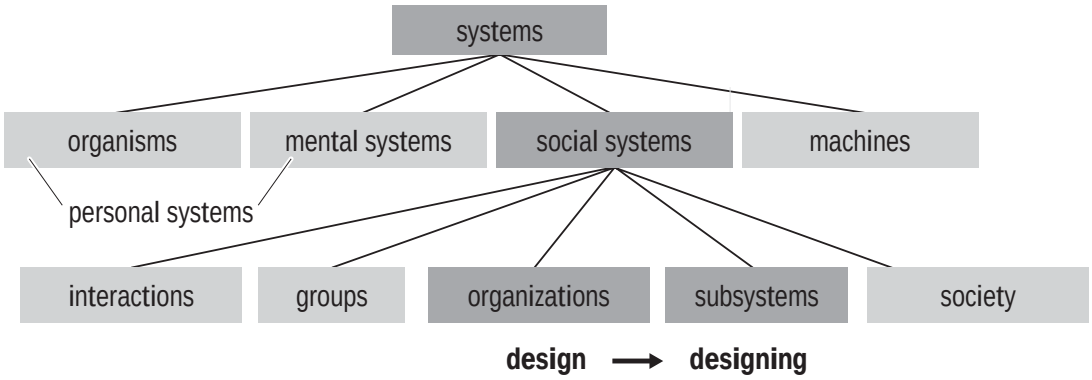


Figure 4
System classification.[27] Design can be conceived as a social system interacting with other social systems.

systems are closed and create their own domains, allowing only certain operations. Though creating a shared orientation via their codes, they are not based on consensus but, rather, stabilize around conflict. Conflicts are productive, and allow for change and learning. Thus, no vantage point exists to observe society as a whole, and it is impossible to talk about what is rational for society or what will benefit society as a whole.

Jonas[28] elaborates on the concept for design by introducing three contextual and/or historical phases—satisfaction, creation, and reflection of need—three process steps (expanding the "problem-solving" process—see section 6), five process levels (from creative to cultural processes), and four reality levels (vision, structure, patterns, and events/objects). The hypothetical social subsystem designing (on the level of science, economy, etc,—see figure 4) is introduced as a flexible, project-oriented and, thus, temporary framework that integrates engineers, designers, economists, social scientists, and futurologists, depending on the specific task at hand.

5.2 Related Paradigm Shifts

From adaptation to generation

One of the crucial questions in a theory of open systems, from evolution to organization or education, has been: How does a system adapt optimally to its environment? In a theory of closed systems, we ask: How does a closed system constitute and reconstruct itself in an overly complex, chaotic environment? Adaptation is not central, but rather the conditions of the possibility of establishing a complex order.

Meaning as a formal process concept

Meaning (*Sinn*) does not refer to a certain aspect of reality, but describes the formal order of human experience and action as a continuous process of selection, following internal criteria and based on the difference of the actual vs. the possible. The present core of actuality is unstable because it permanently needs new indications of possibilities. Meaning is a surplus of relationships to

27 Niklas Luhmann, *Social Systems*.

28 Jonas, "Viable Structures and Generative Tools—An Approach Towards 'Designing Designing,'"

further possibilities of experience and action, so that what is in the center of attention is surrounded by a horizon of assumptions and references. The "automobility" of processing meaning, which sustains itself through self-referentially enabling its own reproduction, is autopoiesis par excellence.

From aggregation to emergent qualities

Social entities constitute realms of their own, emergent orders, irreducible to the characteristics of biological and mental systems. It is the *form of processing meaning* which makes the difference: mental systems are processing meaning in the form of thoughts and imagination, whereas social systems process meaning in the form of symbolically mediated communication. Communication is necessary for their formation and continued existence. The connectivity of communication is meaning in social systems.

From people to communication

One of the irritating consequences is that social systems consist of the processing of communication, not of human beings. There is no place and no need for the individual in the theory (there are simply too many of them). Man is a very diffuse idea, depending on who is observing and how. No supersystem encompasses living, mental, and social systems. In this perspective, the "members" belong to the environment because they are never, in total, part of a system but only in some respects, with certain roles, motives, and attentions. Only a radical depersonalization of social systems enables us to understand their peculiarity and autonomy in a way that prevents them from being regarded as a mere collection of biological and psychic moments. "Intersubjectivity" does not solve this problem, because the neurobiologically founded assumption of the autopoietic quality of mental processes leads to the conclusion that every person possesses his or her own intersubjectivity.

From purpose to the function of purpose

The concept of intentional action has to be qualified in the systems context. Speaking of the "true" purpose of product development apparently is meaningless in the economic context. The point here, whether design likes it or not, is the magnitude of the flow of goods and capital. Thus, the key question is the function of purposes on whatever level. Purposes reduce the complexity inside the acting system and increase performance. They provide the neutralization of values needed to minimize irrelevant side effects; they serve for the operationalization, (i.e., the formulation of clear instructions); and they justify the means. Purpose also is a means of drawing borders, establishing identity and, thus, system formation. Purposes do not denote the "nature" of an action (there is nothing of that kind); rather, they have important auxiliary functions.

From action theory to systems theory

It therefore is necessary to transfer the concept of action from action theory to systems theory. The relationship of action and system can be broken down into various components mainly through the boundaries of action systems which, on different levels of generalization, produce different rationalities, features, and problems. *The level of individual action is sociologically irrelevant*. Even Schütz questions the seemingly clear and distinct category of action:[29]

> So it is left to the observer, be it a partner in social life or a sociologist, to fix high-handedly the start and end-point of alter's acting the meaning of which is to be explored. The objective course does not offer any criteria for the distinction of a "unified action."

From means and ends to continuance/viability

Systems theory starts from the permanent problem of system continuance. The basis of this is not single purposes or simple chains of purposes and means, but "purpose programs." They transform permanent, insoluble problems into sequences of soluble problems. At the end of this multistage reduction are concrete design problems leading to design solutions. Purpose programs formulate and formalize the conditions on which a subsystem may handle the means of the supersystem's like own purposes and, therefore, become indifferent to effects that nonetheless may be relevant in the whole system. For example: "gute form" or "quality of life," as self-defined purposes of the subsystem (design team or school), are contingent on the supersystem (firm or economy) with its purpose program of securing continuance. Changing contextual conditions (satisfaction, creation, and reflection of need) produce crises and hectic reformulations of design purposes. These conflicts are more fruitless the less autonomous the subsystem is.

Design thus should make an effort to transform its simple, sometimes naive, contingent purposes, mainly of a reactive character, into generative purpose programs, including specific modes of interaction, codes, and values relative to the general context. More disciplinary autonomy might initiate a design evolution from a fuzzy subsystem towards a clear and distinct cosystem of economy.

6. Scenario-based Methodology

Methodology integrates and puts into operation the product development process. It has to be abstract and flexible enough to cover projects in firms, educational projects of any size, public development projects, and policy-making projects. And it has to leave room for individual approaches.

By emphasizing systemic description, providing intervention strategies, and methodological openness and interactivity, it takes account of the stakeholders´ involvement in the process, and performs the intermediate step from first- to second-generation methods.

29 Schütz, *Der sinnhafte Aufbau der sozialen Welt. Eine Einleitung in die verstehende Sozio-logie*, 82.

Though (or because) the methodology is directed at people, the concept of the individual as the center of design production and reception has to be abandoned. To illustrate, when designing an object (e.g., an ATM), we do *not* have to take into account the "whole person" (whatever that might be). But we do have to take care of the communicative/interactive needs of persons related to this specific situation, as far as these are recognizable. What is the whole person? Those who can observe it from the outside, cannot observe it from the inside, and those who can observe it from the inside, cannot observe it from the outside.

Everything else is, in my view, a misconceived and idealistic/romantic concept of "wholeness" which does not work. This means: don't care for individual people (they are inaccessible anyway). Instead, care for their communicative patterns of behavior. This should not be considered as antihumanistic, but as methodological.

6.1 A Process Framework for Reflective Involvement

Figure 5 shows the outline of a broadened concept of the design process covering such requirements as universality, future-orientation, reducing contingency, and providing feedback.

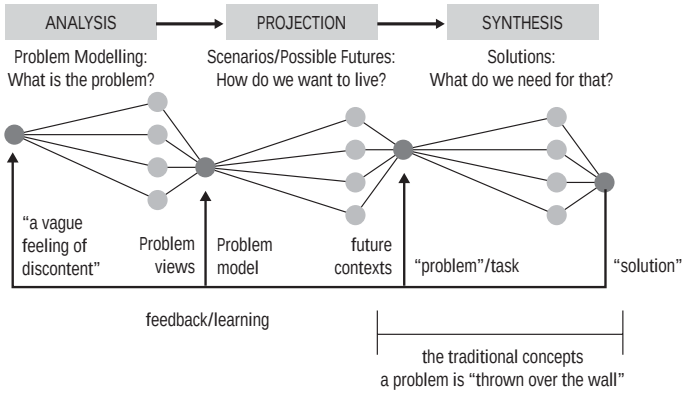


Figure 5
Broadened concept of design (designing).

SYNTHESIS is the phase in the design process which, traditionally, is the focus of interest. An apparently clear and distinct "problem" is given/"thrown over the wall," and has to be solved. This step should not be neglected or disregarded (a common misunderstanding, sometimes fear, of traditional product designers concerned with this approach), but it is not the main interest here. In times of accelerated technological and social change, and globalized economies with saturated markets, the two preceding steps become increasingly important. It is not at all trivial to find an answer to the question: What is the problem? (ANALYSIS). And it is just as challenging to ask: How might the future environments look in which our solutions have to prove their worth? (PROJECTION). It becomes a design problem to define the design problem (see the concept of "problem design" [30]).

30 Wolfgang Jonas, "Design as Problem-solving? Or: Here Is the Solution—What Was the Problem?" in *Design Studies* 14:2 (April 1993).

6.2 Scenario-building as a Central Concept

Scenarios are images of possible, probable, or preferable futures or futures to be avoided, and sometimes comprise the steps to achieve them. Early scenarios (except Utopias such as Bacon's *New Atlantis* or More's *Utopia* are, for example, those of Kahn.[31] Coming from the military field and public policymaking, they entered business planning (e.g., the Shell scenarios by Wack[32]). The concept comprises a broad range from global models to user scenarios as already widely used (e.g., in HCI design). Scenario building is a central concept in design, shifting the focus from the object to the process of communication and interaction, and covering all phases of the design process:

ANALYSIS: analytical scenarios
(e.g., sensitivity modeling)
PROJECTION: context scenarios
(possible futures, dealing with uncertainty)
SYNTHESIS: user scenarios
(e.g., human-computer interaction).

Hasdogan[33] worked on user-oriented scenarios in design. The approach presented here combines analytical scenarios (for sensitivity modeling, see Simon[34] and Vester[35]), contextual scenarios (see Schwartz[36] and van der Heijden[37]), and user scenarios; and explores their usefulness in design projects.

Scenario-building is the process of reflected involvement. It invites open communication and participation in creating new information and knowledge. It can be performed only by participating persons / stakeholders / authors that influence and themselves are influenced in the process.

The following introduces the example of a context scenario which, in the concrete project, was related to analytic and to user scenarios.

Possible futures are determined by those external forces (variables) which have a "high impact" on the system and, at the same time, display "high uncertainty" in their future behavior. They can be de-

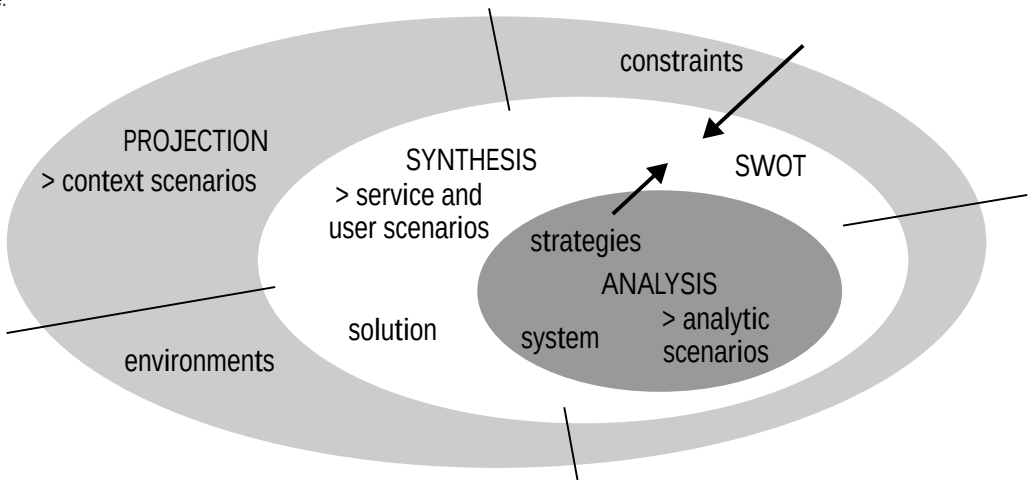


Figure 6
Design solution space between system and context. Design acting as an interface discipline.

31 Herman Kahn, *The Year 2000: A Framework for Speculation on the Next Thirty-Three Years* (New York: MacMillian,1967).

32 Pierre Wack, "Scenarios: Uncharted Waters Ahead" and "Scenarios: Shooting the Rapids" in *Harvard Business Review* (Sept./Oct. 1985): 73–89, and (Nov./Dec. 1985): 139–150.

33 Gülay Hasdogan, "The Role of User Models in Product Design for Assessment of User Needs," *Design Studies* 17:1 (January 1996): 19–33.

34 Herbert A. Simon,*The Sciences of the Artificial* (Cambridge: MIT Press, 1996).

35 Frederic Vester, *Sensitivitätsmodell Prof. Vester. Ein computerunterstütztes Planungsin-strumen-tarium zur Erfassung und Bewertung komplexer Systeme* (München: Studiengruppe für Biologie und Umwelt GmbH, 1993).

36 Peter Schwartz, *The Art of the Long View* (New York: Currency Doubleday, 1991).

37 Kees Van der Heijden, *Scenarios: The Art of Strategic Conversation* (Chichester: John Wiley & Sons, 1996).

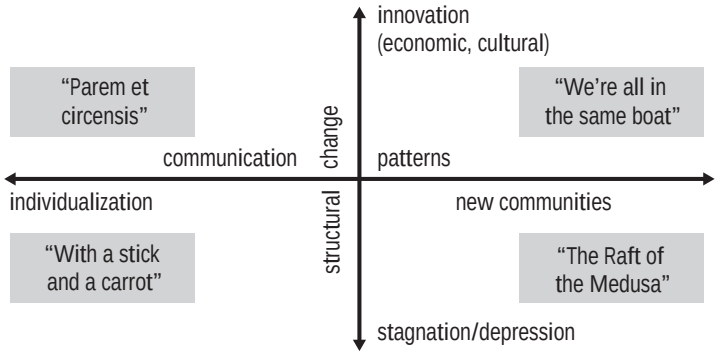


Figure 7
"Quattro stagioni": Frame of four scenarios derived from two variables, with two extreme states each.

termined intuitively or discursively (e.g., by consulting experts in the field or stakeholders involved in the process—see Schwartz[38]). It also may be possible to use the findings from cross-impact analysis and sensitivity modeling, especially the highly active (independent) and highly critical variables, for that purpose.[39, 40]

"Quattro stagioni" is an approach, following Schwartz[41], for the creation of four extreme contexts using those two variables with highest impact and highest uncertainty. Because of the uncertainty, it is possible to identify two extreme states of each variable (flip-flop). The combination of two extreme states of two variables each results in a frame of four scenarios. For example, the variables "communication patterns" (individualization—new communities) and "structural change" (stagnation—innovation) provide the scenario frame of figure 7.

Fleshing out the four quadrants with characters and events yields four stage sets, contexts, or testbeds for subsequent design activities. Figure 8 shows the above-defined frame illustrated with strong metaphoric images. The choice of concise titles and strong images is of utmost importance to the communicative function of the scenarios for their recognizability and for their function as focal point for design considerations, as well as for organizational learning. The four, related narratives are not given here.

Solutions emerge in the field of tension between the system (analytical scenario) and its environment (context scenario), as shown in figure 6. On this level, service and user scenarios play an important role in developing solution concepts. Solutions have to take into account the strengths and weaknesses of the system, and the opportunities and threats of the contexts (SWOT analysis).

The matrix of decision options (figure 9) is a tool to systematically test solution variants before the background of the different scenarios. How does the scenario act on the solution? What happens if the solution has to survive in this context? Viewing the options in one row will result in the robust options, (i.e., those that are useful in all possible contexts). Considering the options in one column will lead to the range of competencies which will support optimum viability in one, specific scenario.

38 Schwartz, *The Art of the Long View* .

39 Van der Heijden, *Scenarios: The Art of Strategic Conversation*.

40 Michel Godet, *From Anticipation to Action. A Handbook of Strategic Perspective* (Paris: UNESCO Publishing, 1994, originally, 1991).

41 Schwartz, *The Art of the Long View*.

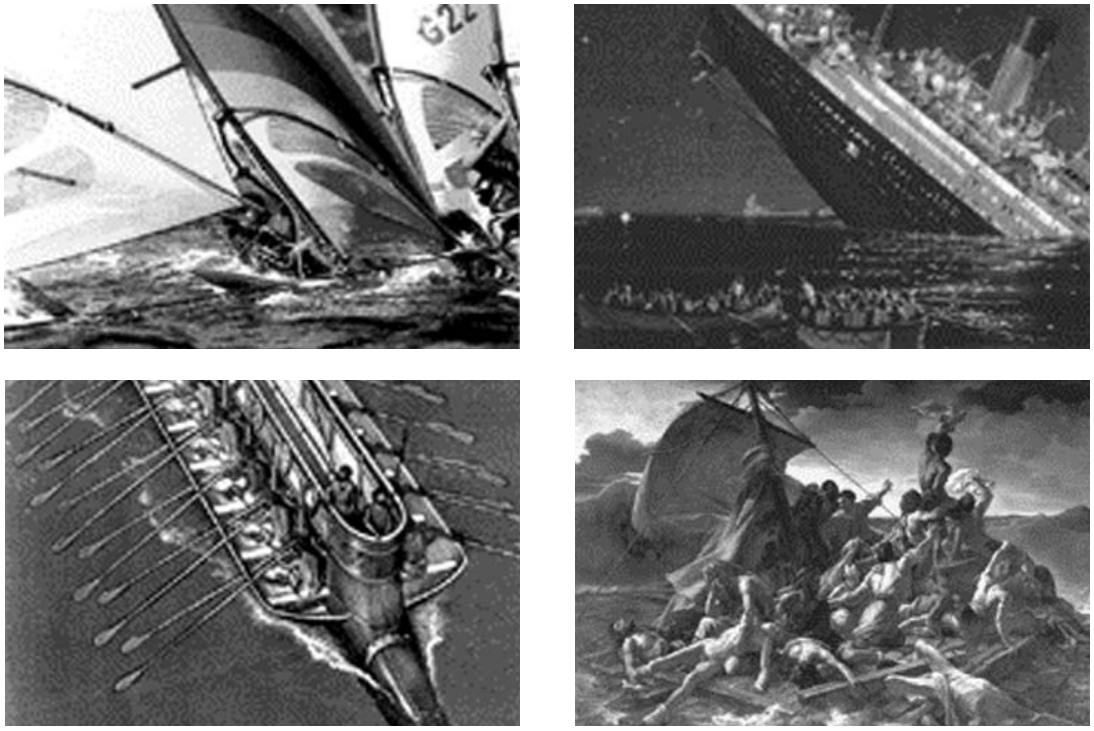


Figure 8
"Quattro stagioni": Scenario frame filled with strong metaphoric images.

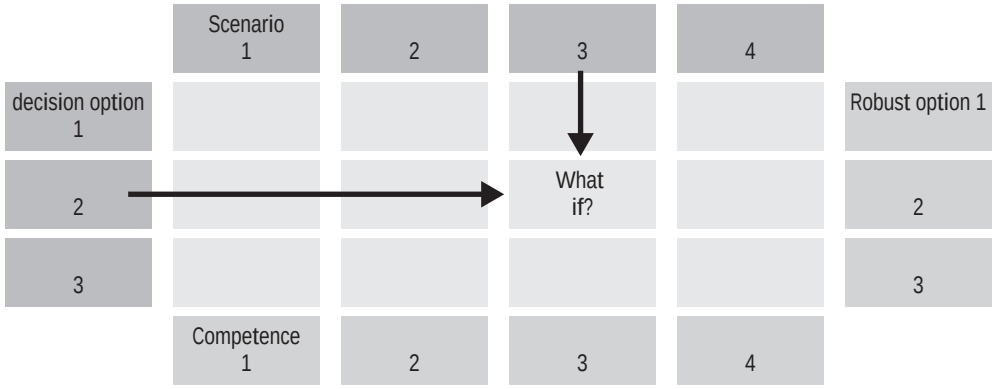


Figure 9
Matrix of decision options.

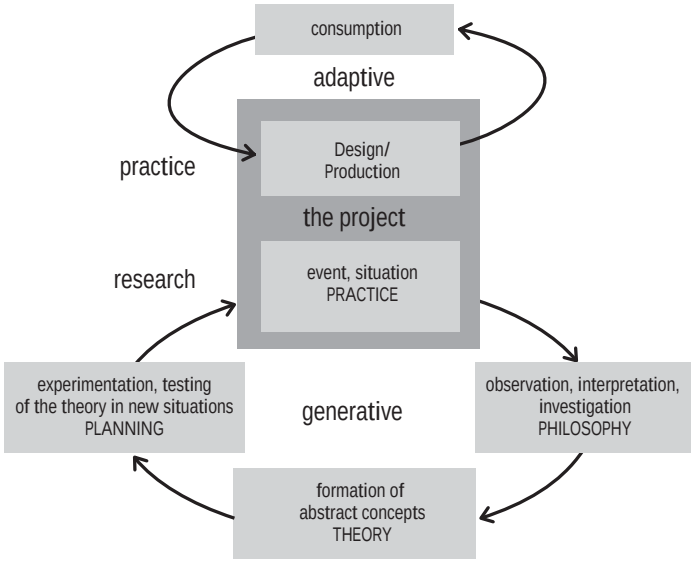


Figure 10
Double-loop learning in design.[44]

7 Research Fields and Disciplinary Perspectives

Design research has to be strengthened in order to stabilize the delicate dynamic balance between autonomy and context-dependency (figure 3). Otherwise, we perpetuate the well-known practice of frequent "paradigm-shifts," starting from scratch every ten years or so, and claiming to finally have found out how it "really" is. If it is true that the process of intervention into complex autopoietic systems will be the design product of the future (see Krippendorff[42] and Willke[43]), then research has to focus on the *process of design*. Apparently, a circle of double-loop learning has to be established for that purpose.

This can best be accomplished by research *for* design, i.e., by researchers involved in the process, and in the disciplinary learning cycle in education and practice. Research *about* design, which is mainly backward-oriented (figure 2), delivers essential contributions but can, in principle, at least, be done by anybody as distant as possible from the discipline (e.g., an art historian studying medieval architecture).

The project, as a more or less arbitrarily cut out piece of the continuous flow of time, delivers the experimental setting or framework for research. The form of a workshop might be a further refinement. A research program has to crystallize around the concept of project and projection activity as the main features of designing. Design research is project-oriented research, making the design process a subject of design. Research, as an inherent component of education, creates a strong link between theory and practice. The project, as subject matter, is the link.

It turns out that there is a strong interrelation between the process of design practice and the process of design research; sometimes the two are hard to distinguish. And there is a further problem: neither practitioners nor most theoreticians like this con-

42 Krippendorff, "Redesigning Design. An Invitation to a Responsible Future."

43 Helmut Willke, *Systemtheorie II: Interventionstheorie. Grundzüge einer Theorie der Intervention in komplexe Systeme* (Stuttgart and Jena: Gustav Fischer Verlag, 1994)

44 Jonas, "Research for the Learning Design School."

nection. Practitioners want instant-to-apply recipes (if at all), while theoreticians prefer to stay in their protected niches because practice could spoil the purity of their preferred approaches. But this combined effort is necessary in order to become a discipline. And it is the only way providing the advance of education before practice.

Hasdogan[45] points out that *scenario building* is the core activity in the design process. It can provide a thematic core for design research, because it:

- Deals with involvement (understanding understanding),
- Is a communicative process (organizational development),
- Is projective (linking design to futures studies),
- Is transdisciplinary (developing a language of autonomy—exchange), and,
- Generative (creating wholes which produce "solutions").

Design might become a respected autonomous partner in a hypercyclic network of future-shaping disciplines. Designing (figure 4) might emerge as a functional subsystem of society, with its own language/code to allow increased internal complexity, and with its own disciplinary ethics, concerned with the quality of the decision-making process instead of individual ethics.

The general perspective can be described as the establishment of design thinking as the guiding paradigm, not only in product development, but also as a central concept in the process of decision making in social life (organization, firm, and community). So "design as one of the most important and least recognized arts of human culture" [46] evolves towards a respected discipline which is not concerned with the necessary, but with the contingent, and the artificial.[47] Maybe, there now is a critical mass of researchers and practitioners to push things forward.

Perhaps in the very distant future, we could achieve Glanville's point, where design thinking is the paradigmatic model for scientific research, as opposed to the present practice, where design tries hard but vainly to be scientific according to well-established standards.

45 Hasdogan, "The Role of User Models in Product Design for User Needs."

46 Buchanan, "Education and Professional Practice in Design."

47 Vester, *Sensitivitätsmodell Prof. Vester. Ein computerunterstütztes Planungsinstrumen-tarium zur Erfassung und Bewertung komplexer Systeme*.