Gui Bonsiepe

Interface - An Approach to Design

In memoriam Jovita (1941-1998)

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The discomfort of design theory

theory as cheap commodity

design promotion

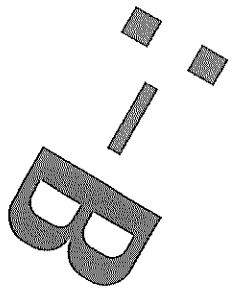
media-related philosophers

theory and voyeurism

praxis interwoven with theory

weakness of design discouse

operational and critical thinking



"Since practice is an irreducible theoretical moment, no practice takes place without presupposing itself as an example of some more or less powerful theory."[1]

In the universal commodity culture the only thing that counts is that which has a price as a commodity. Anything offered at no price is placed in the drawer reserved for the insignificant. This includes theory. It is produced free of charge, in the groves of the *academe*, where a surplus of time, however limited, still provides an occasion for such undertakings. Initially, theory is by necessity academic, although this should not be misread to mean divorced from practical life. Practical life is exposed to the pressures of contingency which hardly allow one to nurture theoretical activities. For a lean business, theoretical activities may transpire to be dead weight anyway. Like writing poems, theoretical deliberations do not contribute to growth in the GNP. In line with any strictly economic considerations, theory is pointless; and this is consequently how it is traded and treated. People remember theory at best when it concerns events inflated in the media. Then theory is called for as an entertainment provider or stop-gap. Once it has fulfilled its role as the entertaining after-dinner speaker, it is free to leave again – for the next event. That is one side of theory where no one asks for its use value or exchange value, but only for its show value. Yet there are other sides to theory. And I wish to address them here.

Only at a late date did design become a subject on which philosophy and science reflected. In the 1970s and 1980s, with the wave that popularized design and led to increased efforts to promote it, the discourse on design expanded. At the same time the predictable danger of a paternalistic relationship emerging between promoter and promoted was increased. Design developed into a theme fit for congresses and became an opportune, easily-presented media object. With the dynamics of this process, design became detached from any specific ability to design. In Germany, the concept "design" replaced the older term of *Gestaltung* (giving shape to) with its antiquated connotations, particularly as it had been impaired under fascism. Yet it is also doubtful whether the association of "design" and lifestyle is beneficial. Other competences became relevant, flanked and shored up by traditional values and norms that had nothing to do with the know-how of designing. Design opened up as a field of activity for academically accredited qualifications that were not tied to the design domain — with their own claims to hegemony and an interest in creating a new canon, an interest that increasingly influenced design policy and design discourse by asserting that design was too important to be left to the designers.

Given this openness and lack of conceptual clarity, the domain of design differs from other disciplines. Discussing theoretical physics requires specific specialist knowledge. This is not the case with the discourse on design. This is an advantage, as it enables unorthodox approaches. However, there is also the danger that the link to the materiality of design gets severed, promoting a bardism of design theory. Theory has not advanced any further, and probably will not get any further until it goes beyond the status of a pastime and is established as a full-fledged field in institutions of education. In order for this step to be taken, new curricula need to be devised that are tailored to the contemporary situation.

As early as the late 1960s, H. A. Simon's fundamental work on design theory positioned within a general theory of artifacts set the standards for deliberations from a precise scientific viewpoint.[2] Approaches from other worlds of discourse have a harder time of it. Reading these you often get the impression that design as an issue is more an annoying irritant than an object of sympathy. In fact, design encounters complacency and arrogance in the wake of a tradition which believes it can get a hold on objects merely by reflecting on them, in other words, purely theoretically in the worst sense. This has to do in part with a lack of familiarity with the object and with deep-seated reservations towards the artifacts (objects, signs) of everyday life and the technical and economic conditions under which they are produced.

Digitalization has brought forth a flood of writings and media-related philosophemes. IT scientists view these with reserve and they are not alone in doing so. It is as if the distance from concrete experience is directly proportional to the audacity of what are panegyric and at times apocalyptic texts. Multimedia and VR, and especially immateriality (not to mention its dialectic counterpart: corporeality / identity) seem at present to exert an irresistible attraction for unfounded speculations. This contrasts sharply with the sober, matter-of-fact overview that is contained in such publications as the collection of articles published by the National Research Council.[3] There, at least, you get a real view of virtual reality.

Theory as contemplative behaviour (and there is something of the voyeur about it) turns the object of contemplation into precisely that: an object. It objectifies it and renders it accessible, thus claiming power over it. What Walter Benjamin said of polemics, namely that they treat an object as lovingly as a cannibal prepares an infant, is also true of objectifying theory. It voraciously consumes actual design. Theoretical discourse is also a discourse of power, a discourse of appropriation. Thus, theory gets caught up in a permanent compulsion to legitimate itself. It emerges in the duality of contemplation and action. Theory presupposes the materiality of what it is theorizing. It consumes its object in order to exist. Initially praxis has priority over theory. In other words, theory leads a parasitic existence

and - in a misleading view - always arrives too late. Nevertheless it affects all design praxis. Conversely, design action all too easily degrades theory to the status of legitimator for a particular form of praxis (in other words, a window-dresser).

John Dewey proposed a way out of this dilemma: renouncing the position of spectatorial vision for knowledge and accepting an open participatory conception of knowledge.[4] This is not a fake reconciliation that simply papers over the cracks and differences. Theory and praxis *are* different. We would misunderstand both if we were to attempt to render one in a way that functions as an image of the other. In other words, theory needs to avoid the danger of abstractness and head for the so-called lower levels of praxis. And it must do this against the background of the insight that praxis cannot be accessed in a purely discursive manner. A single project - be it a plausibly designed book page, an intelligent metaphor for navigation, or a precisely positioned handle on a medical apparatus - transposed into reality outweighs barrages of verbose speculations thanks to its declarative strength, its pure facticity.

Praxis, in turn, must not isolate itself in contingency. Precisely action which wants praxis and only praxis and sets itself as the imperial standard, succumbs to blind opinionating. This is all the more the case when praxis claims not to do this and has a fit when it hears the word theory. Anyone who barks against theory unconsciously falls victim to it. Anyone who thinks that theory is some leisure-time occupation for the intellectual elite, without any relevance for praxis, puts himself on the side-track of history called "No Future". Any request that theory should be simple, following the motto 'for the rest of us', is likely to take on board a populist prejudice. Theory is as differentiated as the praxis on which it reflects. This is a decidedly complex matter. Were it not to be, then theory would be unnecessary.

Praxis is justified in keeping things at a distance where theory is concerned, if theory raises the suspicion of being directive and denouncing all praxis as narrow-minded. Praxis under the aegis of theory – that would be an off-putting scene, just as theory would be if it were only to follow in

the wake of praxis. Theory would be over-taxed if it were expected to provide concrete instructions for action, as if theory could be a tool-box of methodological procedures for design. Conversely, theory would be presumptuous if it were to pose as the regulative agency of praxis and succumb to the temptation of wishing to influence praxis *directly*. Such an undertaking would only entangle theory in contradictions between intentionality and operational know-how.

Indifference and aversion are not justified vis-à-vis theory as a domain in which hermeneutic questions are raised. In theory there is also a tradition of the non-despotic gaze – which perceives opaque areas, discovers complexity and reflects on contradictions instead of sneaking comfortably off-stage.

But then why do we need theory, let alone design theory? Why not protect praxis from all theoretical considerations? From what experiences is theory drawn? Is it somehow a substitute activity for design? Is the prejudice justified that "he conducts theory who cannot himself design" ? Must theory be rooted in design practice in order to deserve to be taken seriously? Does design need a theory specific to it? What can one hope to get from it?

We cannot expect there to be clear single answers to these questions. The answers will differ according to interests and career intentions. However much the meaning and purpose of theory may be doubted, there is at least one firm argument in favour of design theory. All practice is embedded in discourse, a domain of linguistic distinctions that form an indispensable part of praxis. Universes of discourse vary in terms of degree of differentiation and stringency. Compared with other realms, design discourse stands out neither through differentiation nor through stringency. One can only speculate as to the causes of this deficient discourse on design. I guess that it stems from the preponderance of the skill-oriented phase in training, as this fosters a basic anti-intellectual stance. Skill-oriented training is gradually being dissolved in institutions of design education. Otherwise designers will not emancipate themselves, but instead vegetate in the shadows, which sharply contradicts the cultural and economic importance

of design as a central domain of Modernity. Let me emphasize that skills are a necessary, but by no means sufficient, condition for design work. Anyone involved in typography cannot survive without being skilled in operating QuarkXpress or Pagemaker. But anyone seeking only to be perfect with the software will be a mere operator or, as the saying goes, a pixel monkey on a rendering ranch.

Theory can be characterized as the domain in which distinctions are made that contribute to praxis having a reflected understanding of itself. Put in a nutshell: theory renders that explicit which is already implicit in praxis as theory. This is why theory is irksome: it casts into question things taken for granted.

In his book *Che cos' è un intellectuale?*[5] Tomás Maldonado introduced a subtle distinction between *pensiero operante* and *pensiero discorrente*. As he admits, it entails all the weaknesses and risks of categorial dualities. Based on this distinction, we can put forward the following interpretation: design praxis as *pensiero operante* acts in the domain of social production and communication. Design theory as *pensiero discorrente* (thinking against the grain) acts in the domain of social discourse and thus, in the final instance, in politics, where the central question is: in what sort of a society do its members wish to live? Let me stress that this emphatic concept of politics in design theory has nothing to do with notions of professional politics or party politics, and even less with the simplistic geometry of opposing positions between left and right.

Theory is living in language and therefore has a contentious relationship to visuality. This is so, in spite of the fact that epistemology has, since the beginning of classical philosophy, always been permeated with visual metaphors – a fact that has been termed the "imperialism of an ocular-centric philosophy". If theory privileges language and declares it the only form of cognition, an anti-visual bias becomes evident. Since the visual turn in the natural sciences, the visual domain has been recognized as a domain that helps constitute cognition. This undermines language's claim to absolute predominance as a primordial basis of knowledge, thus attacking a powerful, institutionally ensconced tradition of discursivity.

Often accused of being inarticulate, designers' statements are assessed in keeping with the standards of discursivity, and rightly so. If you cast a glance at the other side of what is mainly a digital dump - e.g. a lot of learning software and web sites - you will find a shameful reversal of this situation: there you have an acute lack of visual articulation. One can only hope that a New University will overcome the division between discursivity and visuality.

If Flaubert were to compile a dictionary of commonplaces today, then the following entry would be fitting under the heading of "images": *Images: ... always preceded by 'beautiful, colourful ...'. Looks good at the beginning of a lecture, especially if the topic is visual. Serves as an excuse for visual illiteracy and thus aesthetic incompetence.*

Design theory could be used for investigating the links between visuality and discursivity. Then words would be brought to images, and images to words.

A new approach to design education would then probably emerge. This would bring the 80-year-old skill-oriented design training to an end (although I do not intend to belittle those approaches that have created landmarks). To date, all design education has a preliminary character. This will remain the case until, step by step, in the unspectacular detailed everyday work of design and design education, the conditions are created from which we can move on from the pre-history of design into the real history of design. Following a retro interlude, design education (and this includes research and theory formation) could begin under the auspices of radical modernity of the 21st century.

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1 Spivak, Gayatri C., *The Post-Colonial critic.* New York/London: Routledge 1990, p. 2

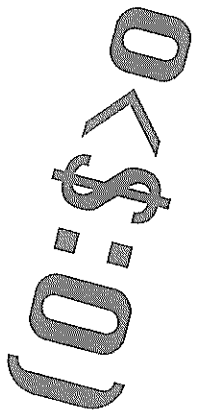
2 Simon, H. A.: *The Sciences of the Artificial.* Cambridge: MIT Press 1981

3 Durlach, Nataniel, I./Mavor, Anne S. (eds.), *Virtual reality – Scientific and Technological Challenges.* Washington: National Academy Press 1995.

4 Levin, David Michael (ed.), *Modernity and the Hegemony of Vision.* Berkeley: University of California Press 1993. p.10

5 Maldonado, Tomás, *Che cos' è un intellectuale?* Milano: Feltrinelli 1996.

Design: from material to digital and back



changes in design discourse

cosmetics, surface, appearance, deception

an ontological diagram of design

interface as the central category of design

re-assessing design

appropriate technology

design in the periphery

design as a constitutive category

the basic elements of design

effective action

the specific character of design innovation

technology and industrial design

physical efficiency and socio-cultural efficiency

the structural affinity between language and design

In the course of the last four decades the term 'design' has undergone a number of changes, which are reflected in changes in the central issues of design discourse. To put it simply, one can describe the change as follows: in the fifties the focus was on productivity, rationalization and standardization. Industrial production, exemplified by Henry Ford, was the model for distinguishing design from the fine and the applied arts on the one hand, and on the other hand, to give it credibility in industry as a new discipline. This debate grew more important in Europe during the reconstruction period after the Second World War. There was great demand for goods, and this could be met by mass production, which enabled consumer goods to be offered on the market at affordable prices. The times had not yet come when design mainly meant product differentiation.

In addition to this central issue of design, growing interest became apparent in design methodology, reaching a peak in 1964 with the publication of Christopher Alexander's book *Notes on the Synthesis of Form*, which has become a classic.

The third issue in design discourse is the relation between design and the sciences, both the natural and the social sciences, and the humanities. At a very late stage design entered the management and marketing discourse, a process not yet concluded.

In engineering driven companies and in Latin American companies generally, design remained a fringe phenomenon, because it went beyond the traditional criteria of company management, planning and engineering. This is also true for companies that operated in economies of 'real existing socialism'.

Any attempt to see design from the standpoint of engineering encounters difficulties, and it generally ends in the - hardly surprising - verdict that design is only a cosmetic exercise, in which a few decorations are merely added to the blueprints produced by product development departments. This narrow view is still found in many software companies, where the contribution made by the designer is generally reduced to the idea of screen design and adding visual effects or 'souping up'.

If industrial production is seen within the categories of engineering, the designer is bound to appear as a make-up specialist, albeit one with the generally enviable ability to sketch and visualize. But design is not drawing. Design is also thinking, and thus a cognitive process. It is important to stress this, since the general public tends to closely associate design with the ability to draw.

The topic of cosmetic intervention has a long tradition in design discourse. In the fifties Max Bill was objecting to what he called the view of the designer as hairdresser. There can be no doubt about the negative connotations of such phraseology. The implication is that design is superficial, of minor importance, and that it need not be taken seriously. With differing nuances this attitude has survived in a tendency to see the aesthetic aspects - appearance and form - as the primary elements of design. The whole subject is then elevated to the level of an artistic and creative process shrouded in an atmosphere of mystery. When one does not know what to do, one can always hide behind the smoke screen of individual creativity.

Designers should not be astonished to see their activities interpreted in such a reductionist fashion. However, they could argue that their maligned design contributions are actually of central importance to very many people. The survival of entire firms is dependent on these supposedly 'cosmetic' exercises.

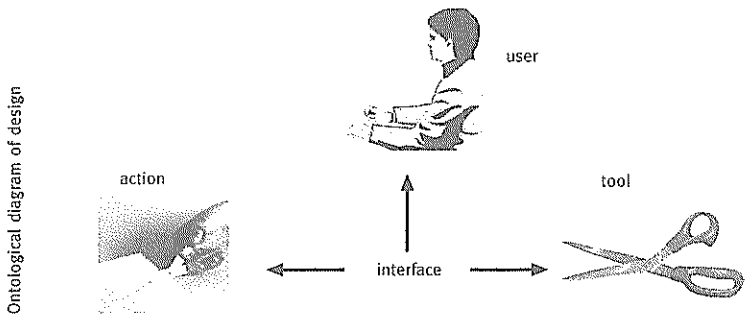
Instead of the view that the designer creates wrappings for the technical structures evolved by engineers, a more differentiated approach may be helpful - it is the ontological design diagram.

This diagram consists of three domains which, as will be shown, are linked by a central category.

Firstly we have a user or social agent who wants to realize an action effectively;
Secondly we have a task which the user wishes to perform, e.g. cutting bread, putting on lipstick, listening to rock music, drinking a beer or performing a root canal operation;
Thirdly we have a tool or artefact which the active agent needs in order to perform this task effectively - a bread knife, a lipstick, a walkman, a beer glass, a high precision drill rotating at 20,000 rpm.

It must now be asked how these three heterogeneous areas - a body; a purposeful action; an artefact, or information in an act of communication - are connected. They are linked by the interface. It should be emphasized that the interface is not a material object, it is the dimension for interaction between the body, tool and purposeful action. This is not only true of material artefacts but also for semiotic artefacts, for instance, information in communicative action. This is the essential domain of design. This position is not meant to dismiss design as immaterial, and certainly not to dispel its materiality. On the contrary, the interface goes beyond the duality of material/immaterial, it covers what they have in common. It covers the design of a spanner just as it covers medical software for the purposes of diagnosing skin disease.

The interface is the central domain on which the designer focuses attention. The design of the interface determines the scope for action by the user of products. The interface reveals the character of objects as tools and the information contained in data. It makes objects into products, it makes data into comprehensible information and - to use Heidegger's terminology - it makes ready-to-hand *(Zuhandenheit)* as opposed to present-at-hand *(Vorhandenheit)*.



Three examples will show what the interface achieves: a thumb-tack, a pair of scissors and a travel information kiosk.

The human body consists of a soft mass which is enclosed in a sensitive membrane that can easily be penetrated. To use a thumb tack we need a smooth surface provided by the head of the thumb-tack. Without that interface using thumb-tacks would not only be painful, it would be simply impossible.

An object only meets the criteria for being called scissors if it has two cutting edges. They are called the effective parts of the tool. But before the two cutting edges can become the artefact 'scissors' they need a handle in order to link the two active parts to the human body. Only when the handle is attached is the object a pair of scissors. The interface creates the tool.

The third example is from digital technology, which is where the term 'interface' originates, and it makes the essential function of the interface and its design very clear. The digital data stored (on a hard disk or a CD-ROM) are coded in the form of 0 and 1 sequences and have to be translated into the visual domain and communicated to the user. This includes the way commands like 'search' and 'find' are fed in, as well as the design of the menu, positioning on the screen, highlighting with colour, choice of font. All these components constitute the interface, without which the data and actions would be inaccessible. As we know, the first generation of computer programmes that worked with cryptic commands were so difficult to use that the term 'user-friendly' was invented to describe the obvious fact that a digital product also has to be usable. Otherwise it is a mere thing or non-thing - it is merely present-at-hand *(Vorhandenheit)* without being ready-to-hand *(Zuhandenheit)*.

Without interface there are no tools. This fact makes interface a core concept providing a stronger argument for design than the culturally oriented interpretation that sees design as primarily concerned with aesthetics.

Let us return to our simplified account of the predominant themes in design discourse: the radical criticism of consumer society and alienation

in the sixties gave rise to hopes of an alternative design, a new product culture and the possibilities for design in the planned economies that, for lack of a more appropriate term, are now characterized by the derogatory term 'real existing socialism'.[1] It seemed plausible that a society organized by different criteria could also create a different material culture, a world of consumption but without addiction to consumption.

The political processes since the end of the eighties appear to have put an end to that idea. The product culture of the planned economies has been wiped out by the wave of commodities produced in market economies. Although design was promoted by government institutions, difficulties were encountered when integrating design into industry. Possibly this was due to the predominance of quantitative criteria in production. However, it may also be the result of a planning discourse where design and innovation remained foreign activities that would disturb the normal flow of production.

In the seventies the subject of appropriate technology entered the debate. Moreover, for the first time the Euro-American concept of 'good form' came under fire. Arguing on the basis of 'dependency theory' Third World countries insisted on the development of their own design. Once the socio-economic difference between central and peripheral countries was recognized and accepted, this in turn provoked doubts about the validity of a universal definition of design originated in the West.

It was not only the difference in GNP which grouped countries into two classes. To a greater extent it was the debilitating effect of industrialization, which is evident in the gap between a minority oriented to consumption patterns of the central countries and the marginalized majority, vegetating at bare subsistence level. These wide gulfs in the peripheral societies inevitably give any debate on design in the periphery a political bent.

It is hard for the central countries to understand this. In the periphery the problems of design are primarily political, and only secondly are they technical and/or professional. This predominance of political factors can give the impression that the discussion on design in the periphery is

politicized or - even worse - bound to an ideology. By contrast, the seemingly unpolitical and sublimely impartial attitude found in the central countries is bound to appear naive or cynical. It is a contradiction on the one hand to proclaim the end of ideology and on the other to indulge in the mass pilgrimage to the temple of the American (consumer) Dream.

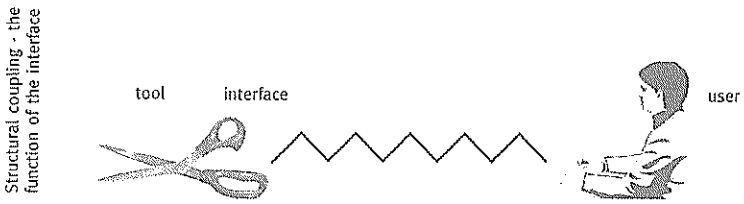
Peripheral countries' attitudes concerning design in the central countries have sometimes been ambivalent. The technical quality of design in the central countries was undeniable, and it often served as reference or model - acknowledged or unacknowledged - for the design that was aspired to. But the lack of technical know-how about processes and finish could easily mean that the design actually produced was second-rate, particularly in its formal and aesthetic aspects. Attempts were made to compensate for this weakness, which was vaguely perceived, with a passionate search for a design identity - and this was occasionally combined with a nostalgic orientation to the formal codes of natives who had survived the massacres during colonialization. One may ask: why not simply do design, instead of wasting time searching for an identity? The undertones of nationalism in the Third World can easily provoke the laconic and ironic verdict that nationalism is the last option left to the poor. But this negative assessment overlooks the link between identity and dignity. The search for identity is motivated by the wish for autonomy, and this means being able to have a say in determining one's own future.

In the eighties criticism of rationalism and functionalism, or, to be more precise, criticism of a caricature of functionalism, revived in various guises. The time of personal gestures had arrived again. The question of the social relevance of design was doomed, and discussions on style and form again predominated in the design scene. Design objects acquired the status of cult objects. A neo-craft of small series production evolved, especially in furniture and lamps, with prices comparable to those on the art market. The slogan was that design should first and foremost be 'fun'. The customer was not paying for design but for a lifestyle signalled by the exhibition of design trophies.

Now, in the nineties, environmental compatibility and design management are the main focus of design discourse. The talk is no longer of development generally, but of sustainable development, which readdresses the seventies theme of appropriate technology, including its plea for development suitable to the needs of different countries, and taking into account technical and financial resources available locally. Today we talk about self-sustaining growth, and this can be interpreted as a recommendation: the periphery should attempt to cope on its own, while the central countries focus on their own concerns, as long as the debtor countries pay the interest punctually on the loans given during the failed accumulation process. It failed because industrialization was conceived and implemented without the dynamic factor of innovation.

To judge from the design publications and media coverage, the subject is now being shoved into the limelight. Never before has it been possible to incorporate design as a decisive factor in discussions on the efficiency of firms and national economies. But this also reveals the contradiction between the widespread use of the term 'design' and the lack of theoretical grounding. Today design is a phenomenon that has not been researched theoretically, despite its omnipresence in our everyday lives and in our economies.

What is the explanation for this lack of theoretical research? Without attempting to give a definitive answer, one can assume that there is a mutual relation between the shallowness of design discourse and the lack of a stringent theory. So far, design has been an area without a proper foundation, where talk is 'small talk'.



A reinterpretation of design which looks beyond the 'good form' frame of reference and its inherent socio-pedagogical aims, may help to open a new perspective. This interpretation also looks beyond the concept of 'lifestyle', where design functions as the supplier of interchangeable items in a scenario for disoriented acquisition potential. The reinterpretation is presented here in the form of seven theses on design:

Thesis 1: Design is a domain that can be manifest in any field of human knowledge and practice.
Thesis 2: Design is oriented to the future.
Thesis 3: Design is related to innovation. The act of design gives birth to something new.
Thesis 4: Design involves body and space, in particular the retinal domain.
Thesis 5: Design aims to facilitate effective action.
Thesis 6: Design is located linguistically in the field of assessments.
Thesis 7: Design is concerned with the interaction between the user and the artefact - be it an object of daily use or software. The domain of design is the domain of the interface.

The first characteristic of design as a domain of human action takes it out of the narrow frame of disciplines with which the term 'design' is generally associated, that is, industrial design, graphic design, fashion and interior design. There is a risk of falling into the trap of vague generalizations like 'everything is design'. Not everything is design, and not everyone is a designer. The term 'design' does refer to a potential to which everyone has access and which is manifest in everyday life in the invention of new social practices. Everyone *can become* a designer in his special field, but the field that is the object of design activity always has to be identified. An entrepreneur or a manager organizing a company in a new way is designing, though he probably does not realize this. A systems engineer who works out a process to reduce the misdirection of luggage at an airport is designing. A genetic engineer who develops a new variant of corn that is resistant to external influences is designing. The inherent components of design are

not solely concerned with material products, they also cover services. Design is a basic activity whose capillary ramifications penetrate every human activity. No occupation or profession can claim a monopoly on it.

The future is where design belongs. Design is only possible where confidence and hope are united. Where there is resignation, that is, no belief in future prospects, there is no design.

The terms 'innovation' and 'design' partly overlap. But they cannot be treated as synonymous. Design, as it is understood in this context, means a particular form of innovative action that focuses on the concerns of a community of users. Design without innovative components is an evident contradiction. But innovative action, which creates something new, something that did not exist before, is not sufficient to describe all the aspects of design. For that reason the idea of concerns needs to be introduced, and this establishes a link with ethics.

It may be maintained that all design ultimately ends in the body. Perceptual space occupies a prime position, because people are first and foremost creatures with eyes. In the case of tools - both material and immaterial (software) tools - the task of design is to attach the artefacts to the human body. That process is described by the term 'structural coupling'.[2]

The traditional interpretations of design use the terms 'form', 'function' and 'style'. Instead of linking design to these categories it is to be more fruitful to see design as located in the domain of effective action. The answer to the question why products are invented, designed, produced, distributed, sold, bought and used, is simple: products are invented, designed, produced, distributed, bought and used in order to enable effective action.

To assess an action as effective, the implicit standards always need to be identified. To an anthropologist a lipstick is an object for the production of a temporary tattoo, which is applied as part of a pattern of social behaviour that we call seduction and self-representation. The criteria by which its effectiveness is judged are very different from those that would be applied to a text editor, a concert poster or a bulldozer used in road construction.

There is no point in talking about effectiveness without also stating the scale of values by which a product is judged as effective for a certain action.

The concept of interface will help to explain the difference between engineering and design, insofar as both are design disciplines. A designer looks at the phenomena of use with interest that focuses on socio-cultural efficiency. Categories in engineering do not include user functionality; they are based on the idea of physical efficiency, that is accessed through the means of the exact sciences. Design, however, builds the bridge between the black box of technology and everyday practice.

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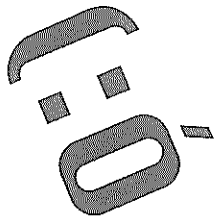
[1] Elmar Altvater has commented on the inexact nature of the terminology used by the former socialist countries: "The term 'real socialism' came into use in the Brezhnev era and it is used to avoid problems with terminology. These problems would be even greater by using phrases like 'societies in transition' (transition from what to what?), Eastern European countries (there have been socialist experiments in other areas as well as Eastern Europe), 'post-revolutionary' societies (can one really speak of a revolution in many of the countries that are practising real socialism?), centrally steered economies (a term from the neo-liberal theoretical debate), planned economies (this blurs the specific quality of the social model) and so on." Altvater, Elmar, *Die Zukunft des Marktes*. Münster: Westfälisches Dampfboot 1992, 2nd revised edition, p. 22.

[2] Maturana, Humberto and Francisco Varela, *El árbol del conocimiento*. Santiago: Universidad de Chile 1990, 6th edition, (1st edition 1984), pp. 50-51.

The chain of innovation



science and technology policy

cognitive innovation in research

operational innovation in technology

everyday cultural innovation in design

the matrix of innovations

Innovation is today's buzz word. It drives the dynamics of industrial society. In fact, innovation has become an imperative. Peripheral countries fall behind in this process, either because they lack the financial resources, or because neither managers nor politicians recognize the urgent necessity to engage in innovation in order to prevent a widening in the gap between centres of innovation and the peripheral world. They do not understand that it is not enough to engage in basic scientific research, which is regarded as the only indicator of progress.

Science is embedded in a system where technology and design play an equally important role. To support that statement, a comparison is made between three types of innovation: science, technology and design. However, only in exceptional cases do the bodies responsible for science and technology policy recognize that these three domains are tied together: without design the objectives of that policy cannot be reached. As far as innovation policy is concerned, peripheral countries are stuck halfway, and they do not harvest the fruits of an already sparse investment in innovative activities. The situation is not much better in the industrial countries. Science and Technology ministries do not generally recognize design as a discipline in which research is and must be carried out.

There is probably general agreement that science and technology are interdependent, although one cannot maintain the claim of linearity that technology is a *direct* result of investment in scientific research. Less clear are the relations between science and design. One question is: What

purpose does design serve in a scientific research institute? Far from being secondary, design is a constituent element in the general process of innovation.

Science, technology and design are independent fields, each with their own traditions, quality standards, institutional settings, professional practices and discourse. Each of these three fields manifests a specific way of looking at the world, of approaching it and acting in it. A matrix of five comparative categories will help to clarify the differences between these three innovation producing fields:

- objectives of innovation
- rules of discourse
- standard practices
- social context
- conditions of satisfaction

These five filters are applied to the three forms of innovation (science, technology and design) in the form of the following questions:

- What is the objective of the innovation?
- What is the predominant discourse?
- What are the standard practices?
- What is the typical micro-social environment of the innovative activity?
- What are the conditions of satisfaction?

Matrix of Innovation

	SCIENCE	TECHNOLOGY	DESIGN
INNOVATION OBJECTIVE	cognitive innovation	operational innovation	socio-cultural innovation
RULES OF DISCOURSE	assertions	instructions	assessments
STANDARD PRACTICES	producing evidence	trial and error	producing coherence
SOCIAL SETTING	institute	companies	market
CONDITIONS OF SATISFACTION	acceptance by peers	technical viability	customer satisfaction

Science

- The objective of scientific innovation is to produce new knowledge. Science performs its function through cognitive innovation.
- Typical scientific discourse consists in formulating statements that can be proved.
- It is standard procedure in scientific discourse to produce evidence that can be checked by other observers. Truth is the condition of satisfaction. The scientific approach is concerned with the production of true - and not false - propositions.
- The social context of scientific work is generally the institute; this can be seen as a factory in which new knowledge is produced.
- The condition of satisfaction in science is the recognition by the participants in scientific discourse, especially the people who are acknowledged as authorities (peers).

Technology

- The objective of technological innovation, which is carried out mainly by the engineering sciences, is to develop new products, materials and processes, that is, to produce know-how (How is an object made? Using what materials? With which tolerances? And

which finish?) Consequently, these are operational innovations.

- The language of technology is the language of instructions and commands like a cook book: Take ingredients *x*, *y* and *z* and subject them to process *w* in order to obtain a result *v*, in the form of a product or service. A technical drawing contains a number of coded instructions.
- The standard practice in technology is the process of trial and error, not in order to check the truth of a proposition, but in order to find out whether an innovation is viable.
- The institutional context of technology is the company and pilot plant.
- The condition of satisfaction in technology is the technical and commercial viability of making a product or offering a service, and its physical and economic efficiency.

Design

- The objective of design activity is neither to produce new knowledge nor to produce know-how, it is to structure the interface between the artefact and the user. The specific innovation of design is manifest in social practices in everyday life and is therefore socio-cultural innovation.
- The language of design is neither the language of statements nor that of instructions, it is the language of assessments. These cover practical and functional aspects, as well as formal and aesthetic qualities.
- The standard practice of design is to produce variety and subsequently to reduce variety, in order to achieve and guarantee coherence in usage, appearance, environment and lifestyles *(Lebensform)*.
- The social environment in which design is performed is mainly the company and exposure to the competitive market forces.

- The condition of satisfaction of design can be formulated in one simple sentence, a declaration by the customer: "I am satisfied". The condition of satisfaction in design is not to establish a truth that can be checked, nor is it the empirical confirmation of technical and commercial viability. It is the correspondence between the expectations (needs) of a customer/user and what is offered, in the form of a product or service.

The process of innovation passes through the various stages - science, technology and design. If one link in that chain is missing, innovation will lack commercial and social response. If science is separated from the other two stages there will be academicism. If technology is separated from the other two stages, there will be technocracy. If design is treated in isolation, there is a risk of falling into the trap of aesthetic formalism. Design is the last link in the chain through which scientific and technological innovations are fed into everyday life. For that reason design has considerable potential if it is incorporated into scientific and technological research institutes.

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