

Rediscovering design education as a social constructivist foundation for innovative design thinking

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Abstract

Design has been described by Bruno Latour as *the missing masses*, and tellingly as “nowhere to be said and everywhere to be felt” (2005: 73). Traditionally, not only objects, but design’s presence in general has gone largely unnoticed by the public, but that is changing, due, in considerable part, to the ubiquitous presence of computing technology. Design, as representative of unnoticed and neutral objects, is no longer feasible, but design, as a participative presence in the lives of its users, is fast gaining ground in our complex society. Designers are no longer fully in control of the design process, meaning design practice, and as a result design education must change to adapt to the increasing pace at which different social groups are evolving new ways of communicating and living.

Introduction

Until quite recently, it seemed as if the prevailing notion of design was based on a linear cause and effect process that relies on logic, rationality and scientific rigour, a very orderly practice that guarantees control and defined outcomes. Unfortunately, this can result in fixed structures protective of design ‘truths’ and hence restrictive of thought patterns, and by concentrating on what is being designed and not reflecting on why these objects are being designed, we seem to have created a design crisis in self-conception. On the other hand, much has been written about the new era of design that acknowledges the shift in focus from the object itself to the process of design, with a further shift to what is being called service design, which takes the concept of process even further (especially in Scandinavian and Finnish publications). We find that in many fields of design the importance of a user-centred methodology has been emphasised, with this general approach further evolving to include the significance of the users’ experience. However, any approach to design research, theory and practice that deliberately includes the social element has to relinquish at least part of the ‘guaranteed’ control leading to defined outcomes that it depended on previously. Consider, then, this question: How do designers know when they are on the right track if there are no guarantees in design, if there are no set formulas to follow? How is it possible to design anything at all, let alone be innovative? Too many designers are trying to adapt to a new and complex world environment with a mindset that was formed during their educational phase, based largely on set formulas and ways-of-doing that just about guaranteed the outcomes.

Once a designer starts off on this road of social inclusion, however, the situation becomes worse. How does any designer progress to the point of being able to handle situations in our contemporary and complex socio-technical world? How is it possible for any one individual to be able to deal with a multitude of complex and seemingly opaque socio-technical situations that are encountered in the contexts that need design solutions? In order to know which direction (the process of) design needs to take at any given stage, where do we look to for answers? There seems to be far more questions than there are answers, and design is about finding answers, is it not? Isn’t it?

Wrong. Design is not about finding set-answer solutions, as if the socio-technical relationship does not matter and will not interfere with the design process. If we only had to concentrate on the technical, the mechanical, that would be easy, and engineers used a methodology called Cybernetics (now recognised as First Order Cybernetics), a system of control that

depended on negative feedbacks, hence the guarantees of defined outcomes. When this same system was transplanted to the study of the social, however, it was soon found that a negative feedback system, used to control the outcomes, simply was not possible, or indeed, desirable. People do not like to be controlled as if they have no choice, and hence no control over their own actions and decisions, and so the adaptation to cybernetic thought brought about Second Order Cybernetics, a system of positive feedbacks that studies thinking and acting human beings, a system in which the observer of that system (in our case the designer) becomes an integral part. A positive feedback system inevitably means that whatever is fed back into the system changes the system itself, the way it thinks and the way it operates (as AI researchers have found), an iterative process that amounts to a learning process. Seen against this background, if design were to be seen as a process of simply finding solutions to defined problems, it would have to use a system of negative feedbacks, and hence control over the whole process, leaving no or little space for the involvement of the social. Accept the positive feedback approach to design thinking, and the involvement of the social becomes not just indispensable, but crucial to the designer's ability to find direction, and knowing if the design process is on the right track or not; all of this depends on the total context and not on any single individual.

Design is not initially about finding answers or solutions, but about observing the system that needs design intervention, and *then* design becomes an investigative system to redefine the problem space, for, as John Chris Jones (1988: 224) stated, "the 'right' requirements are in principle unknowable by users, customers, or designers at the start". Observing the system also means redefining the so-called problem, for not only is it wrong to assume the stable nature of the problem requirements, but pre-empting the solution in this way means nothing much will be learned from the whole process, and hence very little innovation becomes possible. We all work with what most people would either call (professional) intuition, 'know-how' or tacit knowledge, the knowledge base we have built up over the course of a design career. Paradoxically, this working method can be the worst barrier to product innovation, because "At the start one's intuition is likely to be wrong, informed by what IS, but not by what is to be conjured into existence" (Jones, 1984: 136).

Designing more of what already exists, or derivatives of the same, is not what design trends should be about, not in our contemporary and very complex world with its quite specific and socially-based, and wide-ranging, *problem environments* that need addressing by people capable of systemic thinking. I will argue (below) that there are too many designers now having to work with complex world environments while using the learned thinking tools of the industrial age, set formulas that bring about guaranteed outcomes. For this reason they need rigid operational requirements, not realising that these same initial requirements can be very misleading, for the real requirements emerge from the collaborative design process (other designers, clients, users) that is, at the same time, a learning process (Jones, 1988: 223).

A good case in point is MIT's Engineering Systems Design (ESD, 2008); they have reconsidered their educational approach to design thinking, and with this process they obviously wish to influence design practice in the real world. That, I agree, can best be achieved by re-thinking design education to focus on the benefits of socio-technical relationships, thus my educational approach of focusing on the individual and his / her interactions with the world. Another department at MIT (Aeronautics and Astronautics), as part of the CDIO™ Initiative, also focuses on the individual via conceptual understanding (using constructivism as a learning tool), but they do so within the individual/group/real-world-needs relationship (Darmofal, et al., 2002). It is in this sense that the individual, as a critical thinker, can use design as a type of innovation intelligence, as Clark and Smith (2008) believe, and since design "innovation's terrain is expanding" it would be wise to use systemic solutions to solve complex real-world problems (Brown, 2008).

The purpose of this chapter is therefore to offer a version of a design educational methodology based on radical social constructivism, while at the same time exploring the emergent effects of an ontological phenomenological process that each individual (whether student or professional designer) has to experience before being able to systemically become part of a group network for design. Additionally, to more fully understand the relationship between the social and the technical, we need to look at the insights that Actor-Network Theory can bring to any discussion on user-centred design processes; many people tend to 'forget' that the word *user* presupposes the presence of a designed object, anything from a match box to the biggest industrial piece of equipment we have yet devised, and that this 'presence' is often anything but neutral and / or under our full control.

But, how can individuals think as if each constitutes a group? The individual, in an ontological sense, comes before the group, yet, seemingly quite in contradiction, the individual-self cannot come into being without the input from the group, from others external to this individual-self. Radical constructivism takes the stance that social reality is constructed, following the lead set by Dewey, Vygotsky, and Piaget, among others. Even though individual subjectivity is part and parcel of this process, it is because the formation of each individual-self depends on similar processes occurring in other subjective selves that the larger picture of social construction and re-construction can be studied, its actions investigated, and, in line with second-order cybernetics, these observing systems (each human, thinking being) can themselves become aware of their own observations. "Ceccato spoke of operational awareness, deliberately leaving implicit that he was focusing on the construction of knowledge" (von Glasersfeld, 2005:9), which, for educational purposes, means that students can learn how to learn, in the same way that Jones (1988) stated the designer has to learn what the requirements are, from the process of investigative design thinking. Students of design can thus also begin to learn that designed objects and systems absolutely depend, for their coming-into-existence, on many external-to-'design', and quite complex, factors that emerge during the socially constructed process of daily life.

Before tackling the systemic / constructivist and phenomenological aspects of design education, let's look at some of the trends that seem to be emerging in the world today.

Background

Designers have been described as change agents, and change is definitely in our contemporary air. The question is, who determines what these changes are, what they are about, and what they mean for design as a profession? For designers to function as change agents - since 'design' needs to be about action and change - they have to examine the nature of contemporary design, and from within that viewpoint look at the trends in design.

Some of the larger companies seem to be reversing the product design trend that has had a rich economic base as its non-thinking (in sustainable design terms) *raison d'être* for many decades now, in fact, a trend that has existed ever since the notion of planned obsolescence in design was first discussed when mass production became possible. It would seem as if General Electric, Nokia, and Proctor & Gamble are "creating entry-level goods for emerging markets," but then also 're-importing' these 'new products' (at a fraction of the cost of the original design) for the benefit of first-world markets (Jana, 2009). This would seem a good idea, because in these first world economies design has traditionally been brought into being for a mass and economically stable market (with its associated buying power) without taking the real people who make up that market into account: a consumerist market presupposes a large and captive audience willing and able to listen to the product-speak of the large companies. But perhaps this reverse trend has less to do with a change in how companies and

manufacturers regard their users, as it has to do with the economic recession. Such a quick change of heart regarding user expectation has less to do with altruism than with economic expediency, since “Not making a purchase was the most powerful impulse in the global economy ... Last year [2008] there was ample evidence that the muscle consumers were flexing most was that of constraint” (Hockenberry, 2009). As Jana (2009) emphasizes, the first-world customers are in need of bargains, and these companies can ‘score again’ by means of their ‘trickle-up’ innovative thinking, hence the re-importation of goods originally meant for emerging markets.

An example of this is the MAC 800, a portable ECG system that weighs a mere 3 kg instead of the nearly 30 kg for a standard machine. It comes with a laptop-type battery and a cellphone type keyboard, and is meant to improve the “Connectivity within a physician’s work environment [that] is key to coordinate care and improved diagnoses” (medGadget, 2009). A pity, then, that the target market physician was a Chinese one, and that the device was not originally designed (i.e. planned) for the first-world market. As Jana’s (2009) article bears out, past-their-prime products used to be passed on to emerging markets “as if they were unloading fleets of used cars”, but this ‘new reverse trend’ is proving much more profitable.

So what is a product designer to do? Why design cheaper products for first-world markets that can well afford more expensive equipment? What does the term *affordance* mean, and who are these *users* you are designing for? Take an even bigger step back, and dare to ask “What is good design?”, because this question “goes further than designers’ personal need for recognition and reveals a much deeper cultural anxiety about consumerism” (Hall, 2009). To attempt an answer to the last question first, good design is not what the MoMA exhibition of 1951 portrayed it as being (*if it sells well it must be ‘good’*). Hall assumes a moral dimension to this question, and we may well ask with him, “Whose ‘good’ are we talking about?” A further elaboration on this first answer would be to turn in the direction of the ‘social good’, and ask what can these users *afford*, in terms of buying power, but more importantly, in terms of Gibson’s notion of *affordance*, by asking, can we afford to allow this mechanical / technical device to enter into our network of social relations, given the possible (some foreseen but others unforeseen) results of its presence; will convenience help us do our work more efficiently, or will convenience become the enemy (words borrowed from Victor Papanek) of an existing social and work fabric? Even though Norman differed from Gibson, in the former’s initial translation and use of the term *affordance*, Norman (1999) now acknowledges the broader definition of affordance as reflecting “the possible relationships among actors and objects: they are properties of the world”, and it is these relationships between user-actors and designed objects that should be the core business of design education.

So where is a product designer to find direction? Change is definitely in the air, in terms of an enforced economic re-think that makes all types of consumers, from individual users to large institutions (cf. the medical health example, above), think twice about buying-as-usual, but, more importantly for design as a discipline, change has been in the air for some considerable time now. Lancaster and Northumbria Universities jointly hosted a Design PhD Conference (2009) based on the interrelationships between sustainability, innovation and design; “The changing nature of our activities - reflecting changes in society, technology, the environment and business - demands the development of new creative directions ... and new kinds of designers and creative professionals.” Findeli (2001) has warned designers about this transformative paradigm shift, and he called upon them to “open up the scope of inquiry ... and push back the boundaries of our system in order to include other important aspects of the world in which design is practiced.” This call to action was addressed at the Cumulus Kyoto 2008 Conference, entitled [Cu:] “*emptiness*” *Resetting Design - A New Beginning*, and a Declaration was signed which stated that all the people of the world live in interdependent

systems for living, a veritable groundless and perfectly cybernetic field for design investigation. This Declaration calls for the merging of the sciences and humanities, technology and the arts, and puts it clearly that design thinking places itself in the midst of this important paradigm shift, and must therefore redefine itself (Kyoto Design Declaration, 2008). These calls to action are based on real world challenges, and in *Brighton 05-06-07* (Boddington et al., 2008) a number of international designers urge the rest of the design community to accept the challenges of contemporary design, which serves as a reminder that this challenge has been taken up by design thinkers at, e.g., NextD, Doors of Perception and dott07 (the UK Design Council's *Designs of the time* 2007), Boddington et al. are asking designers to seriously look at ways to transform society through the powerful influence of design.

Calls for action and redefinition are not sent out by a few isolated individuals, but by *movements* based on design thinking and design sensibility, One of the keynote speakers at the Design PhD Conference (2009), Alistair Fuad-Luke, and Ezio Manzini, who organised the *Changing the Change* 2008 conference, are both advocates for Slow Design, a mode of interaction/living that promotes sustainability both material and metaphysical, These designers are representative of changes in design thinking, aligned with real-world paradigm shifts, finding, for instance, that in many different cultures around the world “an obsession with things is being replaced by a fascination with events” (Manzini, quoted in Thackara, 2006:6). Calls for action and redefinition also mean that, as Thackara (2006:7) puts it, the solo designer (who relies on stable problem requirements to guarantee the outcome, above) that acts as a ‘celebrity’ more than a facilitator of design solutions is no longer needed, being consequentially not part of the real-world context that harbours the complex systems that are shaped by the actors who initiate, construct and maintain these systems (cf. Actor-Network Theory, below). Designers are changing their roles from individuals essentially outside the system under observation (the sole author of objects, *vide* Thackara) to being simply one of the actors among the larger group of actors that need the design facilitation; design thinking changes from an individual supplying the group with a solution, to a new individual/group relationship that allows (*affords*) design solutions to emerge from particular social contexts.

It is in this sense that individuals need to learn how to ‘think like a group’ (Introduction, above), and how to learn and experience, systemically, what becoming part of a group network for design can mean for (individual) design thinking. Not only is social reality constructed, but also the complex social contexts that design thinking has to function in, a living and working context that is in no small part due to the interrelationships between user-actors and designed objects, and the best way to assure a new and sustainable future for design as a human activity is to redesign design education itself.

Design education

As I have written elsewhere (van der Merwe, 2007), design education still concentrates too much on styling and form-giving, but a curriculum that does not challenge students, one that makes it easy to move from logical idea to the logic of the finished form, is not conducive to development and innovation. Despite the increase in the complexity of social, economic and political structures on a world-wide scale, and the consequent increase in the complexity of designed objects, we have inherited design as an effect of the machine age c. 1851, and as a guild-oriented arts and crafts activity, something the modern world simply does not recognise anymore. Design, both as an activity and as education, must be approached from fresh vantage points to rethink and to broaden its character, and to do so a new educational structure is required. Not only do we need an understanding of the objects we design, we also need this same instructional understanding of the users of those objects and the contexts

within which both function (Beucker, 2004; Formosa & McDonagh, 2005; Gedenryd, 1998; Jonas, 1997; Kapustin, 1998; Kolko, 2005; Michl, 2002; Pombo & Tschimmel, 2005; Restrepo, et al., 2004). Not all design education curricula hold to this type of outmoded view, and one of the new design trends today is to focus on process instead of product, but the mere fact that these observations can still be made is cause for concern. "Perhaps design today is a reductionist parody of what should be a truly systemic activity" (Broadbent, 2005).

Much has been written about design methodology and the process of design, but too often, with hindsight, it can be said that to design in such a prescribed manner simply does not work, and that a much more sense-making and authentic practice is called for (Gedenryd, 1998). I would rather follow Jonas (2004) in declaring design, as a groundless field of knowledge, free from such prescription and allow design to re-create itself as a systemic activity. To do so design education will need to concentrate on the learning process itself, which means un-learning conditioned and uncreative habits, moving towards authentic, competent and cognitive design processes and practices, generic and holistic skills and understanding, and the promotion of life-long learning and development. New educational models must allow students to construct their own learning capabilities, thus structuring their own modes of knowledge acquisition, in order to liberate themselves from programmed knowledge and, instead, allow for emergence as a creative input (Albers et al., 2004; Basadur, in Van Patter, 2002; Beucker, 2004; Dowlen & Edwards, 2004; Gedenryd, 1998; Giaccardi & Fischer, 2005; Pombo & Tschimmel, 2005; Overbeeke et al., 2004).

A design methodology for future design development begins with the individual and ends with the group, but to do that we have to set aside, for now, the practical design of objects and, instead, concentrate on how and why designed objects come into being in the first place. If we do not forget that modern design is much more about the process than it is about the product, that means we can acknowledge the human element in the design thinking process, and so make sense of this statement: "It is ourselves ... that are the real purpose of designing. The biggest mistake is to take the product alone as the aim. It is always secondary" (Jones, 1988: 224). Now we can start to ask questions such as, *how do designers design* (synonymous with, *how do designers think?*), and *how do they know when designing becomes innovation?* Anne Richards (2008) makes an important connection between the work of Elinor Gadon (2006) and Gerard de Zeeuw (2005), in the sense that we have to pay attention to the relationship between the individual and the group. Gadon (2006) found through self-observation what many researchers believe to be the case: quality research is often driven by personal curiosity, with the focus on "a certain quality of mind and personality", and, for good measure, Richards also found that this type of quality research "is not just about publishing for career advancement but for the social good". De Zeeuw (2005) speaks of acquiring a high quality experience within one such "social good", which he describes as 'stable collectives', making a point, however, of warning that we have to focus on the difference between knowledge and experience: "people may have knowledge, while stable collectives are high quality experience." As part of their social constructivist education my students learn to deal with the ramifications of systems theory, firstly, to prepare them for actor-network theory, the ideal vehicle for observing a stable (albeit temporary) and sustainable 'collective' in the making, an emergent situation only made possible because of a co-design collaboration between a social group with specific needs, and the group of (student) designers who wish to create designs for a civil society: design for the 'social good'. Both 'personal' knowledge and group 'knowledge' can be engendered at the same time, and the 'design situation' of the group dynamic provides the high quality experience, something that many professional designers cannot seem to observe while it is happening.

Secondly, in re-thinking design education to focus on the benefits of socio-technical relationships, it means my approach to this situation is to not regard designed objects as of

primary concern, but to begin with, as well as to observe, the smallest element in the design / artefact / social / world relationship: the individual and his / her interactions with all things external to the self. It also means that students may benefit from the insights of a study of phenomenology, and specifically the ontological phenomenology of Heidegger, which not only deals with the socio-technical relationship, but sheds light on the seeming dichotomy of the individual / group problem. It is a contemporary given that designing for the social good, while dealing with a formative interaction between the individual and the group, is a matter of complexity-in-action.

The world that the designer has to deal with, be *concerned* with in Heidegger's terms, is a complex one, and we are not educating students for meaningful work once they enter this new world, according to Davis (2008). This author believes that design education treats the *fact* of complexity as a *problem* to be 'designed away' through positivistic reductionism, an old scientific treatment of anything that 'lacks' control. Davis deals head-on with the increasing distance between the real-world circumstances of design practice and what is being taught in our design schools, citing this (negative) relationship as 'disorienting', a term that is very apt in the light of the discussion to follow. Design education, as I believe large sections of design practice still demonstrate, avoids the complex problem of the making of meaning in the first place, and the still greater problem of 'designing' that meaning into an artifact / system, in the second place. Not only is design as educational subject, and design as practice, a complex relational system instead of a straightforward how-to model of simplistic form-giving, but students can, very early on, learn to deal with design basics while becoming familiar with the expressive qualities of the complex and the applied (Davis, 2008).

Looking forward to what the designer of 2015 should be capable of, a recent AIGA research project highlights a number of trends for the future of both design education and design practice (Davis, 2008), the gist of the report being corroborated by the *Design for Future Needs* (ICSID, 2001) project, run by European designers in collaboration with the business establishment, on behalf of the European Commission, while the ICSID/Danish Designers (2008) research project concentrated on design's vital role in society and the impact this should have on education:

- Design is being described as a 'weak' discipline *because* it has to deal with increasingly complex real-world challenges, which means design is seen as interpretative instead of prescriptive, forming a social discourse about reality in which hard facts are subordinate to perception and experience.
- Design is in need of new sources and a new basis of knowledge that will act as a new foundation for meeting the needs of users of the future, necessitating new techniques and practices that can responsibly and sustainably deal with emerging issues.
- Being a 'weak' discipline (cf. 'weak' nuclear forces), design operates on the strengths of a many-method platform while taking account of new and hybrid technologies; each new project for social interaction uses this new platform to blend such methods as are locally suitable, resulting in multiple future visions applicable globally.
- This approach leads to underscoring the importance of community, impossible without regarding the people we design for as co-designers in some form of collaborative and participatory process; design methods are now user-centred and dialogue-driven, fostering understanding between diverse groups.
- With the original meaning of the word 'design' changing from form-giving to design-as-planning we can look at the value-added potential of design as an innovation tool

- All this does mean that students have to learn how to work in large, interdisciplinary teams in order to deal with a complex and largely unknown future while acquiring the capability to effect transformation. Working within the socio-technical sphere and mining data-into-information from the users themselves will enable future designers to generate rich results from what appears to be poor and scattered inputs.

One thing, above all else, is non-negotiable: “We have to kill the myth about the solitary designer, who can see through the complexity of this world alone” (ICSID/Danish Designers, 2008), and nowhere is this changed vision for design made any clearer than in developing countries. Reminiscent of the statement that Danish design students “possess a large degree of humanistic understanding” (ICSID/Danish Designers, 2008), Tim Brown, the CEO and president of IDEO, states that innovative design thinking for developing countries can supply the necessary alternatives to our Western, developed modes of practice, and for this to happen we need to take a systems view, the many-method platform capable of accounting “for the vast differences in cultural and socioeconomic conditions” (Brown, 2008:90-91). The socio-technical example he cites is the case of India’s Aravind Eye Care System, a company that “built a systemic solution to a complex social and medical problem” by not just simplistically lowering their prices and providing cheaper products, but by sourcing ideas for quality and equivalent products from the communities they serve. The preferred (yet to be designed and manufactured) products had to comply with two constraints: the poverty of the social groups being designed for, and the fact that Aravind did not have easy access to the (expensive) solutions available to developed countries. The innovative design-for-the-social-good solution, forced upon them by the circumstances of their clientele, was to design and manufacture their own intraocular lenses, using alternative technology (cf. new and hybrid technologies, above), to be able to offer their users the equivalent of \$200 Western quality lenses for \$4 a pair.

Taking a systems view of design’s development also means that ideas come directly from the community, and are thus user-centred and dialogue-driven. During 2005 the Bank of America commissioned IDEO to create a new product, one that I recognise as corresponding to a pattern of behaviour from my own daily life, and a product designed to establish and maintain brand loyalty. Working as a collaborative design / industry team, they called this new savings account “Keep the Change”, since that focuses on consumer behaviour that the consumers themselves would willingly transform into something more positive, since we all know that the change we receive from a cash sale somehow ‘disappears’ because nobody really keeps track of what happens to it. Now you can ‘siphon off’ the small change left over from a credit card transaction and transfer these amounts directly to your electronic piggy-bank account (Brown, 2008:92), and it really does amount to a substantial figure at the end of a year’s worth of indirect saving. This same basic idea has been put into effect in a very practical and sociocultural way, and it is called a *stokvel*, a community-driven solution to poverty that was ‘designed’ by ordinary black people in South Africa. Stokvels are very ‘low-technology economic instruments’ in first-world-speak, and means that a number of people get together to create an informal, mutually supporting, savings society, every member paying a fixed amount into the stokvel on a monthly basis, with, usually, each of the members being handed the full amount, each month, in turn. “Despite the high level of unemployment in SA ... poor people do save [despite unconventional methods, because] they realise the importance of saving for funerals, education and emergencies” by forming stokvels (Shezi, 2005). On a par with the Bank of America idea of creating a product sourced directly from an activity inside a community, First National Bank (FNB) designed the Stokvel Account, targeting the poor who could not or would not make use of any form of banking facility in the past. No fees are payable for cash withdrawals or deposits, all transactions are physically recorded, two designated signatories from the group are able to access the funds, and all

movement of monies are regulated by a constitution drawn up by the members of the group (FNB, 2008): in other words, a product was designed that incorporated the best features of a working system already in place, making it more transparent and safer.

In the West we hardly need more of the same products we have been offered, by design, for so long. What we do need is something else, hybrid 'products' that will make more sense of our lives on a personal, on a social group, and on a sustainable future level, and these hybrids "will be complex combinations of products, services, spaces, and information" (Brown, 2008:92), in fact, hybrid products that make full use of the possibilities inherent in a social constructivist approach to design thinking, based on innovative knowledge of the socio-technical interactions of our daily lives.

Radical social constructivism

In the constructivist classroom teaching and learning must be approached with the assumption that the teacher's personal constructs of the world cannot be made readily available to the students, as if these constructs could be found in a textbook on design. Each student must of necessity construct his or her own version of the world, as well as the information in and of that world, as it appears to them; at best they can compare notes on what they have discovered, and so correlate their constructs (their 'designs' of what the world looks like to them). Here, however, von Glasersfeld (2005:5) makes an important point from which I extrapolate the following: in correlating your constructs with those of your fellow constructionists, you are, in fact, valuing your 'new' construct against another construct that not only already exists, but a construct that is based on previous interactions between other constructs and the world, as it appeared to *them*. Our knowledge of the world are interpretations of information already interpreted by other actors-in-the-world, and while it is accepted that knowledge is an individual construct, it is also known that this process is based on the communal interpretation-of-interpretations of the world and its interactions with all the actors in our information sphere.

The point made by von Glasersfeld is that the term *environment* has two meanings, depending on your observational viewpoint, and the capability we have to acquire is to observe how these two can merge into one:

On the one hand, when we speak of ourselves, environment refers to the totality of permanent objects and their relations that we have abstracted from the flow of our experience. On the other, whenever we focus our attention on a particular item, environment refers to the surroundings of the item we have isolated, and we tend to forget that both the item and its surroundings are part of our own experiential field, not an observer-independent objective world. (von Glasersfeld, 2005:5)

To individual students interacting with the world, their total environment consists of all manner of formal and informal teaching environments, which include other students, teachers, family and friends, as well as information from texts, objects and conversations / discussions, images from popular culture and entertainment, and (to a student, *really* 'external' to much of their 'world') news from the rest of the world's events. It could seem as if information from these disparate sources is simply readily available to be picked up by the individual, take-aways to be transformed into knowledge by the act of assimilation, as if we can unthinkingly consume them instead of having to experience them. The *flow of experience* means we have to 'tell' ourselves what we are experiencing, and that 'telling' means interpretation, leading to the making of meaning: we abstract from these sources what we need, and this *need* will vary from context to context. We do not, and cannot, allow all of the possible information coming from these sources, which constitute our experiential field at

any given moment, to enter into our meaning-making process, since that would simply create a sensory overload. We abstract and select, turning the flow of experience into a filtering system at the same time, thus designing a process of individuation based on the collective.

A non-constructivist approach sketches a different scenario. As human knowing organisms, ones that can 'draw' information towards ourselves and turn this into knowledge, we assume the same process is applicable for all other organisms and objects outside our own environment. As von Glasersfeld points out (above), when we focus our attention on a particular item outside our own environment - an object, a book, a person - we tend to see these as discrete items each with their own environments that supply information to be turned into knowledge, which is in turn embedded in that item. What can be easier than to extract this knowledge from the book, the object, even the person (i.e., the teacher)? There is one small problem, however. There are various means of extraction, but any process used turns individual knowledge back into mere information, because knowledge cannot be transferred *intact*, it has to be constructed, or, rather, re-constructed, by the individual receiving that information. My environment and your environment may look different from each person's observational viewpoint (which includes literal *and* figurative perception, as well as personal experience and memory), but when I instigate the interaction, *your* environment becomes another item for *my* environment, and must be treated as such, as another item / object / event in my experiential field that can add to the information mix I need for my flow of experience to be activated.

There is only the one, larger, experiential field of possibility that all human systems can make use of, to varying degrees, depending on the particular context, and the processes we use to make meaning, to construct knowledge *for understanding*, these processes need to be *holistic* views of the complete network of relations created by people, activities, and technologies, instead of treating any item (especially technological devices) as if it could be understood in isolation from the rest of the network (Winograd and Flores, 1988:6). This approach, of course, correlates with the views taken by Richards (2008), Gadon (2006) and de Zeeuw (2005), discussed above. There will always be a relationship between an individual and the rest of the group, who are, lest it be forgotten, all individuals themselves, and we must become capable of discerning the web of relations between all the individuals in any grouping around human action issues. Knowledge is supplied by each of these individuals to the group, but from the viewpoint of an other-than-self individual, the pool of 'knowledge' accessible is at best quality information based on narratives of individual experience. Only *participation* within the *concerns* of this group (to borrow a term from Heidegger) will give me access to what this quality information / 'experience database' can offer and afford the individual-self who wishes to tease out the emergent properties within this new group database, also known as a collective memory.

A mobile library, for example, with its smaller database in the form of a limited number of books, connects a group of individuals to a central and much larger database, thereby creating a relational network between people and the potential knowledge in a couple of hundred books. But the 100s of mobile library books are supported and enhanced by 1000s in the central library, while these in turn are backed up by as many other depositories of cultural memory as our contemporary electric culture can offer, making this network essentially endless, without boundaries. But the question has to be asked, does all of this simply represent *storage space*? What is being stored? Not knowledge, for only data and low level information can be stored and kept. All the texts in the Alexandrian library were not much more than cellulose and keratin crumbling to dust, if it were not for the capability of human memory, and shared memories within the group. "In this concept memory is not a 'container' for remembrances, not adherence to the past, but rather a prerequisite for communication" (Halter, 2005:81). As thinking human beings we are who we think we are

only through negotiated, interactive, and therefore constructed, communication, the most important culturally designed 'product' human beings have ever devised. As an essential 'technology', communication in its many forms is, really, all we have, leading Luhmann (2002:156) to state, "only communication can communicate" in the networks we have to build, and the resultant actions we decide upon are the result of our understandings generated within these (actor) networks of communication. Memories, and especially collective memories, are socially constructed narratives that are re-told with each interaction within the group, and with each contact between different groups.

For the purposes of design, as part of the socially constructed process of the reassembling of parts to form new wholes, the notion of a collective memory is worth exploring, particularly to combat the comparison between the human brain and the computer, as storage space, "yet another anthropomorphic technology model of the Modern Age" (Halter, 2005:79). Citing the work of Esposito (2002), who in turn based her sociological theory on Luhmann's theories of social communication, Halter (2005:82) points to the contrariness of memory's strength: what is 'stored' has more to do with *forgetting* than with what is in fact 'there', with *remembering*. Not only does memory not store contents as such, but it makes much of what contributes to 'memory' quite redundant, a quality without which memory could not help us identify differences, and certainly without which variety, which leads to the recognition of innovative ideas, would not be possible.

As human thinking beings we are pattern recognition organisms, and are used to dealing with what might appear to be fragments (parts) instead of wholes. Condensing information as pattern in memory is simply a cost effective way to deal with the world, specifically in our complex modern world with its ever-threatening information overload (always at hand, like a brooding presence that has to be taken notice of). Our patterns of perception, in the first place, are mediated by thought, not based on the Cartesian split between mind and body, nor based on the Kantian disinterested thought as objective observation, but thought processes that are constructed because of our interactions with everything external to our self as individual, thus making thought socially constructed. The seeming paradox, that the information quanta obtained through our senses can be 'mysteriously' increased in the image-schema areas of the brain, can be explained through the contrariness of memory that 'forgets' and makes large sections of information 'redundant'. When we use an expression such as 'having something in mind', are we referring to just what went into our memory banks and was stashed away, unadulterated? Not only is social reality constructed instead of corresponding to an objective reality 'out there' in the *real* world, but our memories are similarly and socially constructed, and worse still for positivistic realists, what we 'remember' about so-called reality is nothing but abstractions. Social constructivism is *radical* in this sense only, that what we perceive, feel, think and remember, are constructed image-schemas devised by us, the *collective*, even though we would call the image schemas we live by uniquely, individually, ours. I stated (above) that, following von Glasersfeld, we take our *flow of experience* to mean we 'tell' ourselves to ourselves, and this is applicable in both directions - perception *and* memory. This interpretative process allows the making of meaning, and abstraction plays a vital role; we abstract from our sources what we need for any particular task at hand, and if the source is our own memory, we still cannot allow all of the possible information coming from our sources, which constitute our experiential field at any given moment, to enter into our meaning-making process. We abstract and select, turning the flow of experience into a filtering system at the same time, thus designing a process of individuation based on the collective, and designing a process of remembering based on the collective and the forgotten, except that the proper name for this 'forgetting' is 'convergence'.

Whenever you retrieve a 'memory' you are, in fact, 'retrieving' a convergent pattern that is also an augmented version of what *you* may call an individual memory, but which is anything but. When we perceive something, we do not *see reality*, but patterns created by this mode of interaction, and this act of quite considerable abstraction focuses on just the essential features of what is perceived. Call this convergence-from-divergence, or less from more, but we appear to lose information in this redundancy process, were it not for the fact that (abstracted) convergence loses nothing at all, not only requiring less storage space but, as mentally compressed 'zip files' the convergent process carries within itself the possible bounty of the divergent circumstances from which it was abstracted. Socially and constructively thought-into-being, as it were, every time you remember something, because what emerges is an augmented version of what went in, interpretations of previous interpretations, created by personal knowledge expressed via the individual memory fragment recalled, but now (as happened previously) combining with the new data obtained from information in the world, to create a new memory fragment to put before the group. What we need to bear in mind is that all perceptual inputs are stored in what appears to be a fragmented process, parts of the 'whole picture' stored here, parts way over there. The smell of the coffee here, the impression of the café setting over there. You may or may not recall the intact picture, because the first augmentation happens on the first pathway followed to the storage spaces, and the second augmentation happens on the way out, as a remembered 'fact' that is, really, 'contaminated' by other memories along the same pathway. All memory parts are combined or associated with information 'already there', which makes it possible to retrieve more information than that stored, because retrieval requires those same associanistic pathways to different loci in the brain, and this second augmented production (reinterpreted mindful artifice) has the possibility of enhanced complexity because of the specified pathways (Bohm and Peat, 1989:64; Dembski, 1997; Paivio, 1977:48-51; Pribram, 1977:172). The very possibility of clear, innovative thought and 'flashes of insight' is created by this *new* flow of experience, first because of your need to abstract from this, your own memory-as-source, and secondly, in the group dynamic, and according to Kelly (quoted in Bannister and Mair, 1968:2-4) this version (of 'the truth') has as much relevance to us as the objective and so-called *real* world out there.

"But how can a concept of memory that is simultaneously and exponentially characterized by forgetting be relevant for design [if] The point is ... to mediate between man and machine to enable meaningful communication"? (Halter, 2005:83). One theory that investigates these mediated relationships, and especially the more difficult (for being 'missing' in the sense of unnoticed) socio-technical relationship between human actors and the non-human actors called designed objects, is Actor-Network Theory.

Actor-Network Theory

The paradox of *remembered redundancy* can be explained in another way. In our dealings with other people, other actors, we can be seen to operate as if on automatic pilot, for how do we *know* how to act, what to say, what *not* to say, how to respond adequately or even just within the bounds of propriety? What is appropriate behaviour, and do we just follow the rules that we were taught as if reading from a text book? How, then, would we deal with new and unforeseen circumstances, and would we be able to 'think on our feet' in an emergency? Apropos of this, how do we 'know' how to operate the many and varied mechanical and electronic designed devices that fill our homes and work places? Can all this knowledge be put down to training and / or following the rules, and would this obedience (really a form of obeisance) suffice when things go wrong?

Actor-Network Theory (ANT) is a way of observing the relationships that develop between human beings and all manner of designed objects and systems, and it treats people as human actors while treating machines, designed artefacts, systems and even events as non-human

actors that play roles within this created relationship cycle. It also investigates how and when people acquire this knowledge to act, but can also focus on actions and decisions that are obviously out of line with the relationship cycle that was established by any grouping at the start of the relationship, whether that grouping consist of a single user and a designed object, or a number of people attracted to and by a collective interest. The latter situation can normally obscure the fact that many non-human actors are involved, and that the very issues around which the human actors are grouped can themselves serve as actants in the total relationship. ANT, as a way of seeing and understanding the world, is thus normally concerned with the human / machine interface, but it can also shed light on the relationship between two communicating human actors, and begin to answer the question, how do we *know*?

The paradox of *remembered redundancy* is twofold, and we dealt with one aspect, in that memory, as source material for action, can be augmented on two counts, in order to deal with everyday situations and the designed objects that play non-human actor roles. How do we *know* how to use / operate designed objects, especially in the case of interface design? We 'remember', and bring this knowledge, twice augmented, to the new situation involving the designed object. The larger the gap between the designer's field of experiential knowledge and that of the user, the more chance there is that the design will be boring (got that, done it before), too new (how *do* you turn this thing on?), or dangerous (let's see, if I push *this* button ...). How do you as designer *afford* the user the accessible knowledge to operate your device (i.e., design into the device the *information* to be turned into *knowledge*, on which to base a *decision* that can lead to an *action*)? The users will socially construct knowledge of the situation, including how to deal with your designs, *as non-human actors*, by following their own paths of discovery, as always. Do I, as user, recognise the role that your design is playing, or not? Make this role part of my flow of experience, especially if your 'new design' has to rely on my *new* flow of experience (above), and I will be able to construct the knowledge I need to use your end product.

As a designer you can also rely on the second aspect of *remembered redundancy*, which is simply a part of our communicative makeup. After writing *Les Misérables* the author went on holiday, but wanted desperately to know how the publication was faring. So Victor Hugo sent this abstracted letter to his publisher, containing only one symbol, namely "?". In reply he got this answer, "!". How do we *know*, and where does this information come from? Much of it is already there, and only *seems* to be forgotten or made redundant. Norretranders (1999: 92; 109) calls this contextually relevant information that we can have access to, *exformation*, socially constructed information that both parties, above, still had access to. In another context and at another time Hugo's "?" would have been meaningless, but after writing his latest book the abstracted *information* made sense because it was backed up by the still present *exformation*. Design a 'new' device and users can still access the information they will need because of this phenomenon; to paraphrase Norretranders, a design will have meaning to users if it contains a large quantity of *exformation*. "We do not consider the fact that there is more information in an experience than in an account of it. It is the *account* that we consider to be information. But the whole basis of such an account is the information that is discarded" (Norretranders, 1999:109). The individual can gain information leading to knowledge from the group high quality experience (de Zeeuw, 2005), and much of it is based on the construction of *exformation*. Do not rely on the *account* (the actual, surface design) to convey all the information that is needed, but communicate with the user via this largely untapped and 'discarded' basis of knowledge, in experience. Let the role that the design can play in a person's life be part of this construction of knowledge.

As a way of sharing this knowledge among a group of like-minded people, ANT is a methodology that works well for designers, but we must remember that, as a theory, ANT is

not applicable to anything (Latour, 2005 141). Any good methodology, as a good theory, is not a method for doing anything, and it is not a recipe that guarantees an outcome. Latour's (173-74) description of how ANT can be useful includes "specific tricks to help resist the temptation to jump to the global", because, in the very act of communication, in forming networks (even if only between one local actor and a second), we are moving ('jumping') from the local (the individual) to the global, to the many, to the away-from-us. "A ploy has to be found to make the two social theories diverge, letting the sociology of the social go its own way while the sociology of associations should be able to keep drawing more and more accurate maps." ANT is, simply put, [1] a way of looking at the roles that human and non-human actors play in any one situation, with non-human actors identified as designed objects, rocks in the road, the snow in winter that will not let your car start, the window that sticks and will not open. Non-human actors are all the external-to-being-human objects (even events) we notice when they do not work as they should, and, more seriously, objects that intrude in our (un)consciousness and our decision-making processes even though we are not aware of the fact. ANT looks at the relationship we have with these objects, and considers the observation of social systems as of necessity having to include both. More to the point, but more difficult to 'see', is the ANT approach to the context of the social. There is no such thing as 'the social' in ANT terms, because "In the alternative [ANT] view, 'social' is not some glue that could fix everything including what the other glues cannot fix; it is what is glued together by many other types of connectors" (Latour, 2005 5). When ANT speaks of the social, [2] what is meant are the associations entered into by the members of that 'social' - which can be a single conversation between two people, or a whole group of like-minded designers coming together in order to decide on the way forward, for the sake of a sustainable, living future. The 'social' is a temporary concept, which might last for many years, or centuries even, but change it most certainly will, and in our contemporary age change is not only inevitable, but quick (van der Merwe, 2008).

So, what has all of this to do with design education, and, more to the point, with design practice? What can help people who wish to adopt a way of life that focuses on long-term sustainability? ANT proposes a number of phases any individual (in joining a like-minded group) has to go through for the theory (of looking at the world differently) to be given any chance of changing your mind, about anything. ANT can tell you what to look out for, but it will not, and cannot, help you make up your mind. Because ANT is also known as the sociology of translation, everything we touch (everything / everybody we reach out to, whether physically or with our thoughts, we 'touch' and explore phenomenologically) we simultaneously translate. That would normally mean we interpret the phenomena confronting us, in order to understand, not the phenomena themselves, but to understand our own selves, in translation. Everyday contact with the other, every interpretation of the external, is a translation of our old selves into our new selves. We are not really interpreting or translating the other, but moving our old understanding from its previous position to its new position, in relation to this new association. As far as I understand the ANT process, most descriptions seem to agree that there are four major phases to go through, and, it needs to be said, I am appropriating this theory to the extent that my understanding is a design-based sociological translation of the actant texts I work with, and we will only deal with the first two phases:

Phase 1] *Problematization*, which simply means you, the focal or main actor in the system, identifies something outside your system / knowledge environment that does not fit into your scheme of things (who, what, and how you understand, anything), and, this is so important, you must suspend disbelief, must imagine, for a moment, that you do not know all there is to know. That is the first moment of translation, the first obligatory passage point (OPP), when you 'recognise each other', when you recognise that there is something external-to-the-self that you need; where design knowing would start to veer off is in ANT's recognition of the focal actor's role, not so much in this first phase, but the implications for the second phase,

and, particularly, with Callon's (1986) notion of this focal actor "rendering itself indispensable".

Phase 2] *Interessement*, the second moment of translation (and here understanding will start to founder if we do not acknowledge that translation must be admitted into the process as transportation, which in turn, creates the environment for transformation), is usually the persuasive phase of enrolling others in your network of belief / understanding. However, here is a second point on which the usual ANT process, as described (a little too pre- and inscribed?) by certain texts, differs from design / systemic thought. *Interessement*, as a second phase of translation ... stop. What are you 'translating'?

In the first phase, *Problematization*, the focal actor (you, as the individual 'I') identifies that, as a system, something is lacking, something that is vitally necessary for the continuation of the (your) system. Your gaze upon the world-out-there, the other systems external to yours, is initiated because of a need within the system itself. It would be a *falling back into* (cf. Heidegger's *Verfallen*, below) the trap of concepts that ANT can replace (in terms of constructing a human as opposed to a social world viewpoint), in the sense that these concepts manufacture meganarratives, or stories of conduct that become inscribed, in no uncertain terms, in the social book of conduct, the very notion that Latour says is false! So, what are you translating, with a weather eye kept on transformation, if what you need for the survival of your system depends on the acceptance, by the other systems, of your narrative, or system of survival? Allied to radical social constructivism (RSC), the notion of autopoiesis (self-generating systems) and second order cybernetics (observation of observing systems) position our understanding on the knowledge plane where each system reacts 'selfishly', because "it" needs to survive. This, on the face of it, seems to support Callon's contention that the focal actor should render itself indispensable, but that would be a one-sided interpretation with no transportation at all. An autopoietic system has no interest in rendering itself indispensable to its environment, but it does have an interest in rendering its conduct - its interaction with the external environment - congruent with a sustainable future: a system cannot draw from its environment to the extent that this environment becomes unstable and therefore unsustainable (to its own survival). Cybernetics tells us that, as a designer, you want to keep the second phase of *Interessement* as neutral as is humanly possible, therefore you let the 'translation' circulate where it will (along with its shadow, meaning your specific version of 'it') to, not 'persuade' others into your circle of knowing, but to offer your new-self-understanding of /an object, a person, an event/ to whomever needs it and can use it. That is called metadesign thinking, which is nothing, and potentially everything (new).

For a design understanding of ANT we need not go further, and it is my contention that Callon did *not* state the necessity of the focal actor's indispensability, on the contrary, what he described were "attempts by these researchers to impose themselves and their definitions of the situation on the others", in clear violation of the first ANT principle of *agnosticism*, i.e., impartiality between actors (Callon, 1986). The designer, as the first focal actor, must deal with this issue of impartiality, and be willing to become just one of the actors in the design relationship with the users *and* the potential product designs-in-the-making as developing non-human actors. Callon (2005:181) later confirmed that one of the strengths of ANT is the fact that a theory of the actor is an unstable one, and *not* fixed; biological systems need *stable* environments (above) for symbiotic survival, but social systems need *unstable* environments for learning and development; "rather, it [ANT] assumes the *radical indeterminacy* of the actor" which approach breaks with orthodox social science viewpoints, but agrees with that of RSC, which also supports, as does ANT, the dissolution of "the sterile individualism / holism dichotomy" (Callon, 2005:182). The quality of a user *and* a designer who can construct the capability of moving between the individual and the group, of

answering the question, *how can individuals think as if each constitutes a group?* is dealt with by social constructivism, by ANT, and, as we shall see, by an ontological phenomenological approach. In focusing on the after-ANT scenario, Law (2005:10) makes it clear that, in dealing with complexity issues, the diasporic nature of ANT means it transforms itself, perfectly adaptable to the design contexts it can help illuminate, and like RSC the framework for understanding is constructed *inside* contexts, using the elements *from* the grouping, in the relational context surrounding the design problem space. In concord with the issue of memory storage and more from less, Law (2005:12) describes the understanding of the after-ANT scenario as one that recognises neither singularity nor multiplicity or plurality; “this is something that is indeed *more than one and less than many*”, refusing the easy single / plural opposition in favour of a relational emergence, much the same way that Giddens (1986: 3; 14; 24) refused the opposition between agency and structure. Understanding, as a framework-for-action, has to be constructed somewhere in-between the single and the multiple, the individual and the affordances for structuration to be found in the ‘quality experience’ of the group.

When we consider the importance of communication, it has to be borne in mind that what is of essence, for understanding human relations, is the associations being entered into in the very flow, in the act of true communication. If there can be a glue that holds everything together, it is this. New associations mean new ways of augmenting existing knowledge, in fact, it means that learning takes place, and that means the new individual is at the heart of this association, or reassembly, as Latour prefers to call it. ANT, it must be remembered, is also known as the sociology of translation, and it is well to remind ourselves that the act of communication (any relationship with the external-self) is at the same time a transportation of both what we know and of the information we are dealing with, a flow from one contact point to the next, and in this flow transformation takes place. Giddens (1984, xx), in focusing more on ‘ontological concerns’ rather than on epistemology, meant by this statement that his structuration theory of the social “should be concerned first and foremost with reworking conceptions of human being and human doing, social reproduction and social transformation”. To designers, these ‘ontological concerns’ should mean, very simply, an ongoing and constant becoming (Heidegger 1962, 359), the crucial point, to both Latour and to Giddens, being that the people making up the grouping, and the designed objects and systems we surround ourselves with, cannot be separated as if they do not structure each other. In this duality of structure, the human need to voice what cannot be seen (human-world experience) nevertheless demands shaped expression, which becomes literature, art (Steiner 2002, 279-280), or becomes design, an outward expression or manifestation of who we are, and what we want or need to become (van der Merwe, 2008). The necessity of rethinking design education and the role of design in most peoples’ lives is thus of paramount importance.

Ontological phenomenology

That, I believe, can be achieved by making use of, amongst other ‘like-minded’ theories of being-human, Heidegger’s notion of ontological phenomenology, or at least my ANT ‘translation’ of the term. Phenomenology is the study of how we look at and experience the world, and it is a study of subjective experience, following Husserl, although some have used this approach to deny any experience beyond the concrete objectivity of what is. Others have contrasted phenomenology to ontology, which studies the essence, the very nature of existence. Put the two together, and Heidegger’s ontological phenomenology starts to make sense, in that individuals can study themselves as developing structures, coming-into-being through a movement away from the *what is* existence of a concrete world, towards a possible existence in renewal. Ontological phenomenology allows each individual to map their own progress, even (especially) from within the group, of like-minded people, of course (van der Merwe, 2008).

Heidegger should never be read as if one could interpret his texts too easily, and never literally, since, very much in the vein of Merleau-Ponty, he writes about the visible only in order to make us see the invisible, something which has an intelligence of its own, as Findeli (2001:12) suggested, in advising design education to understand human social systems from within, using a qualitative, phenomenological approach to do so. This makes the work of Heidegger wonderfully relevant to design thinking, because you simply cannot 'see' the process and the experience of design directly, but have to describe it in a circumspect and indirect way, via the actions, intentions, and (more difficult still) the emotions of the people involved. When a designer thus claims that a designed object does not exist in phenomenological terms, it means the design is not interactive in any sense and does not contribute anything to the flow of experience of the user. Heidegger (1949) maintains that only man exists, but not rocks, trees or horses. This does not mean that human actors are the only real entities, but it does mean that we are the only 'designs' that are emergent and ongoing, while rocks, trees, housing estates, cars and animals are all 'finished designs' as far as 'existence' is concerned. That marks a difference that is crucial - ontological phenomenology studies the ongoing and emergent nature of peoples' *existence*, not simply *what is*, and not the everyday lives we lead in Dasein's *Verfallen*, but a future and better existence that is being 'designed' as we speak. The world designs us and we design the world, e.g., the effect we have on our environment (including other people) through our actions and our interpretations results in changing that very environment, and this change, in turn, again affects us as we interact with our (new) environment in Dasein's everydayness. Heidegger used the term *Dasein* to indicate a person going about his or her ordinary business, in a state of *Verfallen* or falling back into the world of things and events, so much so, that nothing at all can change; we simply do not notice, being far too busy 'living'. For Heidegger, *existence* means Dasein can and should become aware of the *Beingness* of a better and other-self, something not to be found in appearances, but in action and change, and therefore something that can be 'found' when things 'break down'.

I am not so much concerned with physical breakdowns as with an interruption of concerns, e.g., when we do not 'notice' a piece of equipment, or do not 'notice' the way we drive our cars, then we are in a state of *Verfallen*, so busy 'using' the equipment that these designs become 'missing' in Latour's sense of the term, and we take them for granted by not noticing, not so much the things themselves, as not noticing our own interactions and the possible consequences of say, bad driving habits, because the car has ABS brakes and power steering, designed devices that will keep us safe, as if these were real human actors 'in charge'. The design (phenomenological) 'breakdowns' are things such as beeps that sound when you are about to exit the car without switching off the headlights. These designed interventions can become intrusive, or they can become part of the lifeworld system within which they can prompt a change in action, for the better. The design of industrial products can benefit greatly by our studying not only the phenomenal user worlds of experience, but also the gap-creating breakdowns in the use of the most ordinary tools. I have yet to see the new designs for a one-handed chainsaw, and my challenge to students to design a one-handed power drill has not yet been taken up. Tree fellers use chain saws in situations that were never designed for such use, and I have used a power drill two meters off the ground, clinging on to a ladder with my knees. Users will always interact with your designs in ways that you cannot foresee, and you cannot design for all possible circumstances, but you can use the notion of breakdown to innovatively redesign equipment so that the gap between knowing and not-knowing can be bridged.

Truly innovative designs will emerge from this qualitative, phenomenological approach, because, as human, biological systems we are not different from the other "complex adaptive systems in the biosphere [that] evolve to a natural state between order and chaos, a grand

compromise between structure and surprise” (Kauffman, 1995:15). Breakdowns in the normal flow of experience, and specifically those that involve devices more complicated than a screwdriver, can be a source of innovative information to not only improve designs, but that lead to new adaptations, and from there be a springboard for totally new devices. All we need to remember is that one of the Blackberry’s grandfathers used to be an old bakelite landlocked telephone, and that the *ontological* flow of experience (of dialogic communication) experimented, as it were, with these swings between structure and surprise, between what seems to us to be order (while it works) and what could turn into chaos, when it either physically breaks down, or we experience a ‘breakdown’ in the flow of experience because we want something else, something that *adds more value*. As Prigogine (1980:95) reminds us, to be alive as a biological (hence an *adaptive*) system, to *exist* in Heidegger’s sense of a constant *becoming*, means that feedback mechanisms (feedback loops) are of prime importance, and it is more than tempting to see structure, in particular one that flirts with Kauffman’s structure / surprise *indeterminacy*, as a breakdown of the *stability of systems*, not something that we want to avoid, since this surface appearance of instability simply points to “a situation of non-obviousness, in which recognition that something is missing leads to unconcealing ... some aspect of the network of tools that we are engaged in using” (Winograd and Flores, 1988:165).

Willis (1999) calls ontological designing a radically different approach to the practice of design and to the understanding of the objects of design, which viewpoint would correspond to the insights of Heidegger. However, she also states that ontological designing involves equally different ways of looking at ourselves, who and what we think we are, and our ‘place’ in the world. That this makes ontological designing sound like a cross-over between social constructivist and actor-network theories is no mere coincidence, since to Willis this essentially describes the relational network between people and the spheres they inhabit, between human actors and everything in their lifeworlds, including Heidegger’s views on the ontology of equipment. Winograd and Flores’s reference to *unconcealing* is derived from Heidegger’s use of the Greek term *aletheia*, thus equating ‘truth’ with *unforgetting*, and when one *unforgets*, something is brought forth from a *space of hiddenness*, thereby equating truth with discovery (Dreyfus, 1991:270). The term ‘truth’ is, of course, used in the sense of an *ontological development* that is emergent in human action, supported by reflection throughout. Heidegger (1962:62) made it clear how, in a process of ontological understanding, an alethic truth may be discovered that can serve both human and non-human actors (‘some aspect of the network of tools’). In this very process of *understanding-towards*, we strive to uncover both the beingness and the structure (the ontology) of Dasein *and the ontology of equipment*, because, *in so doing* we create the very conditions that can further uncover both the beingness and the structure of entities that are not-Dasein, i.e. non-human actors, conditions that are described by Willis (1999) as “the breakdown [that] opened up a space for interpretation, an opportunity towards disclosure of the thing itself”, that design space we can create and where “We are concerned with what happens when new devices are created, and with how possibilities for innovation arise” (Winograd and Flores, 1988:177).

Heidegger (1962:98) named this ontology of equipment, *readiness-to-hand*, and it is in this space of becoming that new and innovative product designs will be forged, in opposition to run-of-the-mill copies of existing (as in *merely occurring*) products. The beingness of tools that we chance upon through *readiness-to-hand* “can be exhibited phenomenologically if we take as our clue our everyday Being-in-the-world, which we also call our ‘dealings’ in the world and *with* entities within-the-world” (Heidegger, 1962:95), a ‘hindsight’ endorsement of Actor-Network Theory. Heidegger also named this readiness-to-hand aspect of equipment by using the term *Gestell*, in his own inimitable way, of course. This new interpretation of *Gestell* works along the lines that the after-ANT approach would have us look at the world, by transporting the ‘original’ meaning to a different space of meaning-making, and thus

transforming it without relinquishing the whole of the old meaning, only adding value to the new hybrid (very much like the design process, really). *Gestell* now denotes both a reunion or reassembly (*Ge-*) and place, as in location, or placing (*Stelle*), and Ciborra (1998:318) rightly asks, “what has such a reunion to do with technology?”

On the face of it, nothing, because it has nothing to do with the equipment itself, but everything to do with the human actor who uses that equipment, and how, in what *sense* the interaction takes place. Expressing the ontology of equipment through *Gestell*, Heidegger is focusing on our interactions with the world, a space where we do not *regard* (as in seeing, observing, and reflecting) designed objects as mere collections of things, but a specific space where we come to look upon designed objects “as ‘in order to’ devices endowed with functions” (Ciborra, 1998:318). This is the phenomenological space-of-reflection that design students and professional designers alike have to learn to create, and then to occupy for long enough, in order to emerge with the interpretative ‘disclosures’ of equipment, created by the breakdown effect, that Willis (above) mentioned. For Heidegger (Ciborra, 1998:318) the essence of technology was anything but technical, a sentiment echoed by Winograd and Flores (1988:179) in considering our own transformation as a non-technical evolution, within the relational network we form with other, and non-human, actors, in this ontological space where “we continue becoming the beings that we are”.

Conclusion

Product design is increasingly moving towards the field of interactive design, and as a natural result of user expectation and user experience-driven innovation, a merger between product design and human-computer interaction (HCI) design is inevitable. The exact proportions do not matter that much, whether it is the latest model car, washing machine, or any industrial design product that is ‘live’, i.e., that uses some form of electronic circuitry, or whether it is a designed object that runs almost exclusively on digitally enhanced binary blood, e.g., cellphones, televisions, computers, and all forms of electronic, computerised gadgetry that we find so indispensable today; these products become part of the contemporary lifeworlds of users, and they do have a formative effect, as non-human actors, because we *allow* them to play these roles in our lives, and at times we have no choice in the matter, e.g., when a device is introduced to the workplace, and the worker / user has to accommodate this new ‘actor’ in the network of communications and associations that make up a ‘normal’ work environment. This state of affairs is a given, and as designers we have to make use of what is becoming an environment for innovation, rather than a liability. Product design practice has to change its very nature and become an adaptable hybrid, and to do so design education will have to change fundamentally, and become an interdisciplinary endeavour, to start with, and change very basically, meaning we have to teach students to teach themselves, by helping them to acquire the capability of reflective, constructive, and if necessary, radically critical thinking.

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KEY TERMS AND DEFINITIONS

Radical social constructivism: Believes that 'reality' is a social construct, and that we cannot have objective or direct access to 'a real world out there'. With the design's focus shifting from product to process and experience, social constructivism becomes vitally important.

Actor-network theory: As a way of seeing the world, and specifically the relationships and associations that people enter into, ANT regards all entities that play a role in these relationships as equal actors in an unfolding narrative, including designed object as non-human actors.

Socio-technical: Allied to both RSC and ANT, this term implies that a working relationship has to exist between users and all manner of technical devices, since a reciprocal designing process is at work between the two.

Ontological phenomenology: Phenomenology studies all aspects of the world as they subjectively appear to us, not 'as they are', objectively. An ontological approach, in Heidegger's terms, studies the coming-into-being type of 'existence' that is enhanced by our interactions with these phenomena.

Complexity: As a scientific theory, complexity has much to offer the study of design, in terms of communication, e.g. when two communicative wavefunctions collide (person A's communication structurally coupling with person B's communication). Not to be confused with complication, complexity (the structural interplay between order and chaos) has always been part of life.

Exformation: The world runs on exformation, those unsaid, sometimes taboo, and very large areas of knowledge that still exists, but are not present in fact, yet present in reference mode. The explicit information we are offered relies for its effectiveness on the implicit exformation knowledge held by a particular audience.