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A (Cybernetic) Musing: Design and Cybernetics

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Introduction

In 1969, Gordon Pask published a paper that explicitly proposed a vital connection between cybernetics and architecture. "The Architectural Relevance of Cybernetics" (Pask, 1969) was one outcome of an extraordinary series of debates and presentations centred around the theme of limits to science presented at the Architectural Association School of Architecture (AA) in London. The proceedings were published in the journal *Architectural Design*, at the time one of the most open and experimental publications in the UK. I give these details to show how open the AA in particular, and architecture in general, were to other subjects. At the time, Pask had been on the staff of the AA as a consultant for several years. He not only argued the architectural relevance of cybernetics, he lived in an environment where this was accepted and acted upon.
Pask's central argument concerned conversation. Three years before he published officially on *conversation theory*, he explained how conversational exchange could help client and architect develop a proposal that became better than it would have been if simply briefed by initial instruction. Fourteen years later, Donald Schön (see Schön, 1983), a professor of planning at MIT with an interest in education and systems, examined the knowledge professionals develop and use in the practice of their professions. He referred to this as *reflective practice*. His insights were taken up by architects (one of the professions he examined) and other designers. He also examined the environment in which architects and designers are educated and work: the studio. [1].

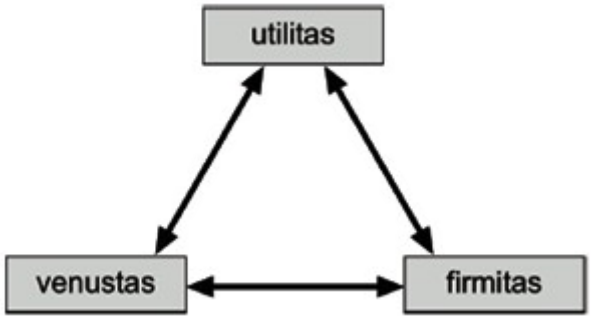
Schön borrowed the idea of conversation (a reflexive conversation with the situation) to explain the central act of the designer: holding a conversation with oneself through paper and pencil. This was not a new insight: many teachers of architecture, including Pask and myself, were using this metaphor—a metaphor presented to me when I was a student (What is the drawing telling you?).
So it can be seen there is reason for assuming a critical connection between cybernetics and architecture and design. I have alluded to such a relationship in these columns. I hold we can consider design as a practical expression of cybernetics, cybernetics as a theoretical study sustaining design. I have never presented the argument coherently in this column. I aim to make good this failing, here.

The Shape of the Column

Writing in *Cybernetics & Human Knowing*, I assume we share an understand of what cybernetics is. If I am wrong, there are many articles readers can refer to.
Design is a different matter, not least because those who originally used the word in English use it in one way, while a number of other, later, users use it in a different, restricted manner. So I start with an essay on design as I would like it to be understood in this column, especially highlighting the importance of delight, and (what I take to be) the central act of design—which generates novelty and assimilates and accommodates complexity, and which I elaborate on below. Having rehearsed something of my understanding, I explain how design and cybernetics mirror one another.

Design

It is generally agreed that the first western text on architecture and design, dating from around the year 0, is Vitruvius *De Architettura*. [2] Vitruvius states that architecture [3] (within which I include design) is constituted of three parts, normally arranged in a triangle:



Vitruvius's Latin text was first translated into English in 1624 by Sir Henry Wotton, who used the terms *firmness*, *commodity* and *delight* ("Well building hath three conditions: firmness, commodity, and delight"). [4] Contemporary usage might be well-constructed, fit-for-purpose, and delightful, sometimes stated as fabrication, function and form.

Fitness-for-purpose and **function** are relatively easy to specify and test for. [5] Delight, being harder, is often left out, often with the excuse that it is unscientific. And then, whose delight are we considering? In my view, delight is for all. That includes the client, users, constructors, and designers—delight both in the object or process produced, and in the designing of it. (In English, the word *design* takes the form of both noun and verb. I am primarily interested in design as verb.)
This difficulty, of accommodating delight, can be read as a commentary on the modernist slogan, first stated by American architect Louis Sullivan (inventor of the skyscraper). He insisted:

Form follows **function** [6].

This slogan became a credo amongst designers of the modern movement, and amongst the design theorists of the immediate post-second world war period. It was taken to imply that if you dealt properly with functional requirements, the appropriate form of the designed object would arise automatically, and would bring delight. Delight could thus be ignored as a criterion: the designer need not worry about form (which, largely, gives rise to delight) because fulfilling the function generates it automatically. Other slogans reinforced Sullivan's: for instance, Le Corbusier told us the house is

A machine for living.

Early researchers into design as a field (perhaps beginning with the work in the 1950s at Hochschule für Gestaltung [7] in Ulm by Rittel [8] and his colleagues) were trapped within positivist science. They tended to consider design not so much as they found it, but as they thought it should be. A general view at the time was that design was defective science. Therefore, researchers concentrated on replacing what designers did by a new, scientific approach. Given delight was difficult to formalise, and the slogans (above) made delight arising from form-giving a guaranteed consequence of good functioning, it was not

hard for researchers to deal only with the simply characterisable: construction and, especially, function.
The exclusion of delight is particularly apparent in Engineering Design, where it is often seen as superfluous—a trivial distraction. Engineering Design comes out of Engineering, attaching the notion of design to itself without apparent concern for how the word came into English or the (designers') original usage. I hazard a guess that the word design was added to increase status.
I would not want to suggest engineers never produce the delightful. The best engineers are wonderful designers (in the original sense of the word), producing work of imagination, quality and delight. Nevertheless, I have rarely found reference to delight, in engineering design publications. If some of the objects produced are delightful - as when delight arises out of form following function - that is an incidental by-product. Yet, more than half of the total publications published as design research come from this stream, [9] so design is often portrayed without that crucial concern (delight): those who acquired the term design have started to re-define it to suit their particular, and (in my view) constrained view.
Engineering design pursues a broadly scientific approach. The anticipated benefit is that requirements to be satisfied can be specified and quantified. The problem is reduced to atomic components, assembled in a logical manner, generating an unquestionable result. I maintain this approach is the opposite to the approach that typifies the original users (in English) of the word design, denying its central act. I will explore what this act is and how we use it to our benefit, further on. For now, it is enough to recognise that there is a difference. [10]
The significance of delight in design finds expression in another aspect. Design is about doing more than simply satisfying the necessary (being well-built and fit-for-purpose). Consider this statement attributed to the architect Sir Denys Lasdun, who held

Our job is to give the client not what he wanted, but what he never knew he wanted till he saw it. [11]

This statement insists the architect/designer should strive to do more than satisfy requirements, give more than the necessary. This is an act of generosity. The concept of generosity sits well with delight: it is delightful, as giving delight is generous. Designers try to put a bit extra in, always aiming to achieve more than the strictly necessary. In the case of architects this is rightly so: In order to create what they create, they generally destroy something first (their building has to go somewhere): There is an implicit ethical requirement that they produce something better than what they have taken away. [12]
As a researcher into and teacher of design, my interest is in the difficult stuff: how those who do design can understand their doing in a way that empowers, coupled with an insistence on the value of delight. I hold design research that fails to consider this is inadequate: a form of research in which what designers do is seen as material for other approaches to exploit, rather than as a source of a type of research and generation of knowing that comes from and is sensitive to the subject itself.

The Act at the Centre of Design

I have presented a short account of (the use of the word) *design*, and have characterised an approach that, producing a type of scientific research, fails to recognise both the original users' use of the word, and one of the criteria for design presented in Vitruvius's original text—delight. I place so much emphasis on delight because it is the one of Vitruvius' three parts that is downplayed—and wrongly so! Now I should elaborate on what I have come to understand as the central act of design. I have argued that aspects of what the designer does are relatively straightforward: functional requirements should be satisfied, the outcome should be fit for purpose, and well-enough constructed. Often challenging and always important, these are not at the heart of my concern, which is how

the designer comes up with what he/she does come up with. This is the aspect I shall deal with. If I don't mention the other aspects (Vitruvius's *firmitas* and *comoditas*) it is not because they are not important: I take them as given. But they are not what makes design special—they are not associated with a particular behaviour leading to a unique outcome.

In my account, the central act of design involves the designer holding a conversation with him/herself through the medium of paper and pencil in an act of doodling or sketching. [13] (I don't mean exclusively or literally paper and pencil, but to indicate a simple way of making marks.)

To understand how this works as a mechanism, I will use another idea Gordon Pask (1975) clarified, which I suspect most readers will recognise without difficulty. In his conversation theory (developed from a formalisation of exchange mechanisms in normal conversation), Pask differentiated between psychological individuals (abbreviated p-ind's) that carry out mentative processes, and their embodiments in mechanical individuals (m-ind's) which house them. This differentiation allows for phenomena such as group intelligence, in which what may be construed as one intelligence is shared in/across many (separate) mechanical individuals (bodies). It also permits more than one p-ind within a single m-ind (body). In this latter case, Pask's formulation allows different personae to dominate at different times, or to coexist so more than one persona is present simultaneously.

Pask does not argue humans suffer from multiple personality disorder. He points to what many of us realise: On different occasions, we behave in different ways, as if we were different people. So, for many of us, talking and listening require the assumption of different personae: we might think of the talker leading, the listener following. When I switch from talking to listening, I switch not only what I'm doing, but aspects of who I am (the role I'm taking). We recognise our ability to assume different personae in expressions such as "wearing my cybernetician's hat."

The designer, sketching or doodling, switches between the roles (personae) of marker and viewer—or, to be pedantically precise, the drawer-who-then-listens-before-drawing-again, and the listener-who-then-draws-before-listening-again (but I shall restrain myself to the simpler drawer, of I-the-drawer and listener, of I-the-listener) - a visual equivalent of talking and listening. The mark is often made without intention: it's not the shape of something, it's an exploration, a vague question. Make a mark, view it, remake (change) the mark, review it. This is a type of play, full of unspoken "What if?" questions, the form of a conversation held with oneself: statement uttered, statement heard, statement restated.

The point of a conversation is that it allows communication between personae (pind's) that construe the world differently. It does not presume meaning is communicated: rather, each persona constructs its understanding (hence, meaning), allowing it to behave in concert with its partners-in-conversation. Within the same body, I-the-drawer and I-the-viewer, seeing differently what is taken to be the same (the marks), offer insights to their partner participant that are different, through this mismatch, from what was previously understood. In other words, personae create novelty for/with each other: Sketching/doodling leads, inevitably, to change. The designer, sketching/doodling, starts somewhere but ends somewhere else, often unable to explain the move from the one place to the other.

A possibly mythical story offers a powerful example. The painter Wassily Kandinsky is commonly thought to have invented abstract art. One day, looking down his studio, he saw some paintings he did not recognise. He could not work out who the artist was and what the paintings represented. On closer inspection he realised the paintings were his, but placed upside down. When he painted them, he understood them one way: Returning, he saw them differently, thus construing them anew, inventing abstract art in the process. I maintain this circular [14] act of conversing with oneself (normally through a medium such as paper and pencil), with the concomitant switch between personae (often achieved

so fast that both effectively co-exist), is the central activity in designing. I have argued it is fundamental to how we behave, and may be seen as the origin of cognitive activity (Glanville, 2006b).

The reader might ask what evidence there is for my assertion. I will answer in two ways. First, recognition. When I give this account of what they do to designers, the response is recognition. They understand my point, which resonates with their reflections on their experience. This is not scientific evidence, but it is strong evidence gathered in a manner which reflects the sort of knowledge Donald Schön (1983) claimed is at the heart of professional activity and knowledge acquisition: reflective practice. It is recognised by professionals such as architects in exactly this self referential manner: acting through reflection.
Second, a growing body of work argues both from principle and from experimental and observational work. Although designers might attribute the original conceptualisation of design as a conversation with oneself through drawing with Schön (in his work on the architectural studio, 1985), Pask introduced the conversation in his 1969 paper. I am sure we could find others who precede Pask. This aside, there is a recent burgeoning of work by a number of scholars characterising design as conversation, summarised in Lawson (2004). Henrik Gedenryd's (1988) doctorate *How Designers Work* is one of the most sensitive and revealing studies. More recently, Alice Lo (2008) has compiled and edited a book of case studies in personal design processes by staff/student pairs, which are essentially conversational. There are many other examples. Pask and I talked of the central design act as conversational already when I was his cybernetics student in the early 1970s. In other words, there is a body of scholarly work that supports my position.

Cybernetics and Design

I now argue some connections between design and cybernetics, using the notion of design conversation developed earlier. I am neither the first, nor the only person who believes there is a link between cybernetics and design: A 2007 double issue of *Kybernetes* I edited (Glanville 2007a) [15] contained 27 papers on the theme. [16]

Conversation demonstrates several key cybernetic concepts. It is circular and iterative: a feedback loop. Two (or more) participants each hear what the other has to say, and repeat back their understanding to the other, in their own formulation. X talks to Y; Y listens, constructs his understanding and talks to X. X, in turn, listens and constructs her understanding. Differences (errors) may be corrected by comparing understandings before and after this exchange. Organisationally, a conversation is essentially the same as a thermostat: The difference is in how we understand the enhanced mentative abilities of the elements X and Y.
A diagrammatic presentation of the stages in a normal Paskian verbal conversation may help:

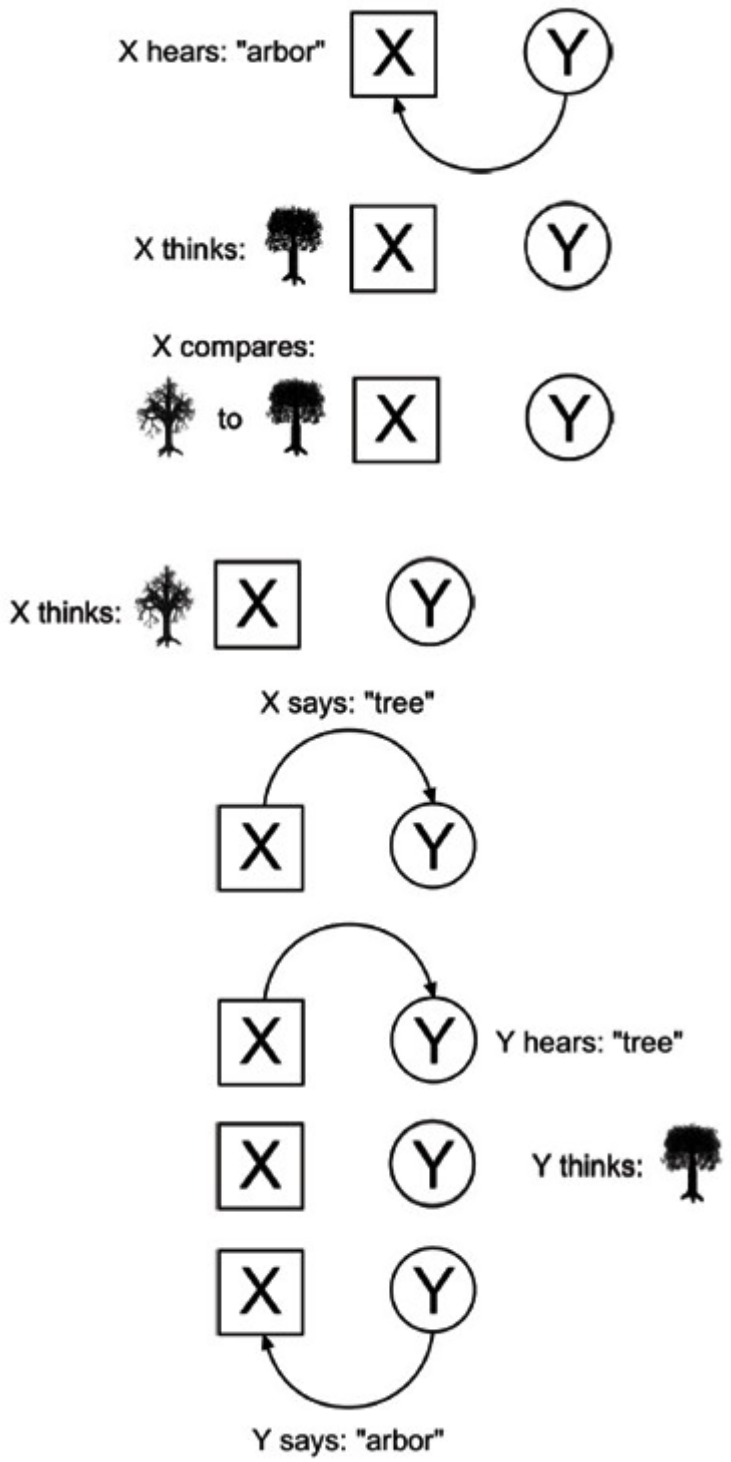


Figure 1

It should be noted that, in a normal conversation, the comparison at the final step may be used to minimise difference, whereas in design it is often used to enhance, or at least accept the difference.

The design conversation (held with the self in a different role) is a modification of the basic conversational form, in that X and Y are often within one body, understood as different personae, rather than different people; and the utterances are mainly drawn and viewed rather than said and heard. However, whereas in most models of communication the concern is to reduce error, in design the so-called "error" may be a source of novelty. What is often thought of as error is welcomed as a means of enhancing creativity. This novelty comes from everything in the system working together. Ross Ashby (1991) explained that the description of even such an apparently mechanistic device as the Black Box arises from interaction between Black Box and its investigator (Glanville, 2009).

Gordon Pask understood this from his earliest work. The outcome of this behavioural interaction is unpredictable and beyond what can be achieved by one participant alone. Unfortunately, interaction has been reduced to responsiveness by the computer industry, to the impoverishment of our conceptual world. Interaction is behind the novelty generated. Conversation epitomises interaction, perhaps its simplest, clearest and best formalised example.
Other important behaviours of this essentially cybernetic act are as a means to encourage and manage accommodation (the process of adapting and adjusting to someone or something else), affordance (in the opportunistic sense of J. J. Gibson, 1979: finding opportunity in objects and processes that were not part of an original intention) and assimilation (to absorb, integrate and fully understand ideas). In a conversation, that which was not expected may arise (named as novelty and creativity), and be taken on board. But we can also bring in, rather than generate, that which was not previously under consideration. Thus, we accommodate needs not previously considered; see what we have done in a new light affording unanticipated possibilities; and assimilate separated concepts which become integral. These three moves (essential to the development of our cognitive abilities) are crucial to the development of a design scheme. They are not (in my view) central design acts, but ways we can use that central activity to help us deal with design tasks and enhance our design ability.
These connections are not the only possibilities: they reflect my interests, establishing a metaphor with key understandings in second order cybernetics.
Many people demonstrate other types of connection in architecture: the cybernetic control of systems within buildings (lifts and heating systems); systems that change the building (responsive louvres); cybernetic management principles (ordering the construction of the building); the cybernetics of communication (between those involved); buildings that result from cybernetic actions (in some form of automatic generation or as a consequence of a cybernetic act, for instance space stations); even the image of cybernetics (eg., the work of Archigram).
A lista continua. The list goes on. I make no attempt to complete it.

Design and Cybernetics

Hidden in the above, is an unexpected (and novel) extension of cybernetics.
Describing the central act of design through the metaphor of conversing with oneself connects to the idea different personae don't see the world in the same way, form the same understandings, or know the same things. We can reconstrue this: The variety of any one persona cannot equal the variety of all (other) personae. Readers may remember when I wrote of unmanageability as a way to enhance creativity (Glanville, 1998). Normally, cybernetics is interested in systems which conform to its one universally accepted law, Ashby's law of requisite variety, thus being manageable. In contrast, I propose we should develop an interest in the unmanageable: a form of anti-cybernetics.
So what about doodling? I described it as purposeless. If doodling has a purpose, it may be to find (rather than assume) purpose. One of the basic assumptions of cybernetics is that we deal with purposive systems: Wiener's first cybernetic paper (Rosenblueth, Wiener and Bigelow, 1943) is notable for bringing purpose (intention/goal) into scientific discussion. [17] It may, now, be important to consider a cybernetics of the purposeless.
Thus, I position myself as much as an anti-cybernetician as a cybernetician, much in the manner I value ignorance as much as I value knowing (for ignorance is a source of knowing). Is not the unmanageable and the purposeless equally the source of variety and purpose, of cybernetics? If so, telling the story with design as the conceptual source, expands and enhances cybernetics, as our understanding of cybernetics helped us account for design.

Conclusion

I have spent a major part of this column discussing how I understand design, why some uses of the word might be considered inappropriate, the particular criterion of delight and the importance of form, for I believe readers of this journal are not particularly familiar with design, at least in the understanding used here. I characterised an activity I hold is at the heart of design, and how this activity—the conversation with oneself via paper and pencil—is so very cybernetic: and I extended it to include the mechanisms of accommodation, affordance and assimilation.
This is why I claim cybernetics may be thought of as the theoretical arm of design while design may be thought of as the practical arm of cybernetics.

I can summarise the position argued, quoting from a talk I gave in 2006 (Glanville, 2006a):

- Design, according to Vitruvius, deals with three qualities: firmitas, utulitas and venustas.

- Conversation is essentially constructivist: each participant constructs his/her own meaning and value (therefore, each is responsible for this).

- Design is a conversation held primarily with the self (but also others): selfconversation emphasises the significance of listening/being receptive.

- Designers develop and amplify ideas, make the new from differences in meanings - when difference in expression is welcomed, not hidden.

- The process of design is circular, iterative, unknowing (including rejecting and restarting), constructive: explanations are post-rationalised.

- The new is beyond prediction.
Implicit in conversation (and thus design) are many ethical qualities we think of as deeply human and desirable.

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Notes

[1] I have written about studio education in this journal: see Glanville (2003). See also Schön's study commissioned by the Royal Institute of British Architects, Schön (1985) and Broadbent et al.'s (1997) follow up. [back to text]

[2] Retrieved from http://en.wikipedia.org/wiki/Vitruvius in October 15, 2009 [back to text]

[3] Leandro Mazaro reminds me Vitruvius stated his understanding of the scope of architecture, thus: "There are three departments of architecture: the art of building, the making of time-pieces, and the construction of machinery. Building is, in its turn, divided. …" I include this here to remind the reader that architecture is not uniquely identified with building. [back to text]

[4] Retrieved from http://en.wikipedia.org/wiki/Henry_Wotton in October 15, 2009 [back to text]

[5] Nevertheless, briefing for a new project is often difficult, specially because of our lack of practice (as Pask's 1969 paper indicates). What is needed, and how to satisfy this, is hard to capture. So are apparently minor functions (using the w.c. as a bolt hole because it is lockable, for example). [back to text]

[6] In architecture and design, the word form is used to refer to shape, balance, composition and symmetry, rather than to the abstract forms of (for instance) Platonic and Kantian philosophy. [back to text]

[7] It is interesting to consider words used for design in various European languages. The German refers to the whole (*gestaltung*, as in gestalt psychology). The Dutch use *vormgeving* (to give form to). The Italians use disignare (to draw, to designate or give significance to), which relates to the Greek, *σχεδιάζω* (in the Latin alphabet, *skediaze*, to intend or sketch). [back to text]

[8] Rittel later modified his position, introducing the concept of the wicked problem - Rittel and Webber (1974). [back to text]

[9] I owe this information to a conversation I had with Dr Terry Love, October 2008. [back to text]

[10] There is another confusion, between design as discussed in this paper and design meaning fashion/style. This "designer" notion is not our concern. However there is a profound and subtle understanding relating to design-as-style (paralleling learning styles), which is (personal) style as a way of believing complex problems are solvable. I owe this insight to Prof Stephen Gage. [back to text]

[11] I have had this quote in my database for several years, with the annotation that it appears in Lasdun's *Times* obituary. Unfortunately I have not been able to confirm this recently. Having known Lasdun, I am sure it is correct. It is certainly a quote that reflects accurately the view many architects hold, which can appear arrogant but is, I believe, based firmly in the notion of humble service. [back to text]

[12] This way of describing the situation in which creation of architecture takes place, which he calls *KillSpace*, is due to the Belgian architect and media artist, Marc Godts. [back to text]

[13] According to the Apple Oxford Dictionary of American English, the word sketch comes into English in the mid 17th century from the Greek *skhedios*, meaning done extempore, probably via the form of the Dutch *schets* (see, also, footnote 7). *Doodle*, meaning to scribble absentmindedly, entered English in the early 17th century from the German *dudeltopf*, meaning simpleton. The current sense of the absent minded doodle developed in the 1930s. Some people are very proprietorial about their personal use of these words and the distinctions they make, to the point that friendships are lost! I use them more or less interchangeably, though for me doodle is a bit more mindless and a bit less purposeful (and more playful) than sketch. [back to text]

[14] Some would prefer to say spiral. The progress of the conversation may be spiral, but the form within which this progress occurs is circular: Hence my choice to describe it that way. [back to text]

[15] With assistance from Ben Sweeting. [back to text]

[16] One author was Klaus Krippendorff. Krippendorff was educated as a designer in Ulm (1956–61), and studied cybernetics under Ashby. He and I thus share a background,

although I think we have radically different interests and hold radically different positions about the relationship between the individual and society (Krippendorff sees the individual residing in society, I see society growing out of aggregations of individuals). I wrote a review article of his book *The Semantic Turn* (Krippendorff, 2006) in this journal (Glanville, 2007b), concentrating on his development of a way of handling the *user* rather than his *science for design* because of this difference, and particularly its consequences when we consider the source of meaning and the significance of language, which Krippendorff holds to be primary, but which I do not. Here, I recognise aspects of a common background, but note Krippendorff's interest in design, and mine, are very different: and that my interest lies in what I have referred to as the act at the centre of design. My wish is to explain my position, not to argue against his: but, because of the similarity of background, I felt I had to mention his work. [back to text]

[17] Of course, we have much older examples: What would Darwin's theory of evolution be without purpose? [back to text]