Can you feel it? Yes we can! Human limitations in design theory

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Introduction

Feelings, intuition and emotion are often regarded as the heart of design practice and creativity. Designers' feelings, intuition and emotion are seen as the main basis of addressing 'wicked' or complex design problems.

This presentation reports research analyses that suggest that this assumption and the associated theories and philosophy is in error.

In terms of design philosophy, it is possible to see a clear trajectory in the design theory literature:

Pre-1960s	Traditional formalized processes of design with different design roles segregated into different departments such as concept design, styling, detailed design, research and development with individuals with specialist skills segregated into these group roles. Design activity viewed as primarily dependent on skill and knowledge (primarily about manufacturing technique).
1960s	Systematic design. Focus on design processes. Design teams. Automating design. Dealing with complicated design problems. Design activity as containing a subconscious cognitive process (e.g. Synectics). Development of design methods to improve design processes
1970s	Separation of design problems into normal design problems and wicked design problems.
1980s	Increased application of artificial intelligence approaches and approaches based on linguistic analysis
1990s	Moves towards increased inclusion of human aspects of design and social issues as in participative design, collaborative design , activity theory, social network analysis
2000s	Widespread adoption of ideas of emotionally-based design cognition
2010s	??? Re-thinking design on all fronts to address the widespread failures of previous design theory and design philosophy

In parallel, some researchers have focused on building design theory that also addresses the contradictions to established design theories. The end result of is 'disruptive innovations' in design

theory and practice arenas. Theories can be disruptive in the same sense as 'disruptive innovations'. Experience indicates disruptive theories typically have some of the following four properties:

1. The new theory challenges the roots of crucial swathes of existing theory in a given field
2. The new theory challenges individual professionals deeply held beliefs about how they themselves function
3. The new theory requires radical changes in how individuals operate as practitioners: in this case as designers and design researchers.
4. The new theory is available as commonplace and well evidenced understanding in a closely related field and this knowledge has been overlooked in the new field for decades.

The project described in this presentation has all four.

Research background

This presentation outlines research analyses that draw attention to the biological limitations to the types of design situations people can think about unaided. These biological limitations apply to everyone; and are not circumvented by intuition, feelings, insights, creativity or any other method of human functioning. The hypothesis and related theory came out of analyses by myself and Dr Trudi Cooper exploring how best to design interventions to shape the dynamics of power and decision making in complex socio-technical systems. It draws on evidence from the systems dynamic field relating to urban planning, business management, quality management and environmental design. This project is currently the focus of development of a large-scale study involving the Australian Army.

Before outlining the detail of the presentation, I would like to thank and acknowledge discussion on topics that have contributed to this work. In particular I would like to thank and acknowledge Prof Brynjulf Tellefsen at BI in Oslo, Dr Judith Gregory from ID in Chicago, members of the ANZSYS systems group, Dr Chuck Burnette of www. idesignthinking.com and the many contributors to the phd-design list on Jiscmail.

Centrality of behaviour prediction in design

In design (theory, research and philosophy), the ability to predict the BEHAVIOUR of designed outcomes is central. Without the ability to predict the behaviour of design outcomes, it is unclear that any design can be regarded as fulfillment of a legal contract between designer and sponsor. In professional terms, the ability to predict the behaviour of a designed outcome is also the central characteristic of competency of any design professional. If designers are unable to predict the behaviour of design outcomes then this opens designers to legal challenges to their professional competence. In turn, it opens the door to potential legal litigation and financial claims against the designer for incompetence.

There are some strong indications that it is possible to identify a large range of design situations that designers CANNOT predict the behaviour of design outcomes using thought, intuition, feelings, creativity and insight. Research analyses suggest that such a bound can be easily identified and that it is located towards the middle of the spectrum of design situations that designers typically address. There are significant implications for design practice, design theory and design philosophy: it challenges the validity of many of them.

Spectrum and structure of design situations

The research described in this presentation takes as a starting point a spectrum with, at the left end, very simple design situations and at the right end, very complex dynamic socio-technical design situations. It locates 'wicked problems', as viewed by most design professionals, as being well into the left hand half of the spectrum, towards the simpler end. In other words, it takes the position of asking how we deal with and theorize about designing interventions that are much more complex and difficult than what people have for the last 3 decades been calling 'wicked' design problems.

Design situations can be construed as having sub-parts (sometimes called dimensions, variables, aspects, entities, concepts or 'chunks') connected together by a small or large number of connections. If there are only a few sub-parts to the design situation and these are only sparsely connected we might call the design situation 'simple'. Sometimes these are called "sparse' design situations.

Conversely, if there are lots of parts of a design situation and /or they are connected with lots of connections then the design situation can be regarded as 'complicated'. When sub-parts of the 'complicated' design situation are relatively unconnected or do not affect other parts, the design situation is sometimes referred to as 'orthogonal' or 'decomposable'.

When the *complication* of a design situation is high it can becomes difficult to address, especially if the relationships between design elements are non-linear. When it exceeds that which can easily be handled mentally, or when some parts of the design situation are unknown, at that moment, the design situation is typically called a 'wicked problem'.

This is an entity relationship model of design situations. Using entity-relationship representations of design situations is useful across all branches of design theory and design philosophy because the 'entity –relationship model of a situation is the conceptual primitive for linguistic, scientific and other philosophical ontological and epistemological representations found in design research and design philosophy. The entity-relationship approach to representing design situations applies equally as well to qualitative and quantitative design issues and to social, psychological, technical, user-focused and participant/collaborator design situations involving intrinsically human interactions.

Using the entity relationship approach to representing design situations means that design situations can be mapped directly into mathematical representations. In turn this enables design situations to be classified and grouped by classifying and creating taxa of the mathematical representations.

One property that gives a measure of the relative order of complexity of design situations (as distinct from their 'complicatedness')is to look at the number of feedback (or feed forward) loops in the situation. One can categorize design situations in terms of complexity where a measure of complexity is the number of feedback loops – a different dimension from that of 'simple' vs. 'complicated'. This differentiation between complicated and complex is conventional in systems design and cybernetics (and engineering design in, for example, the area of design on non-linear control systems).

Evidence from the system dynamics field relating to complex systems design, urban planning, social systems design, management, business process design, manufacturing systems, quality management, security design and user-related design provides substantial indication that

professional designers across a wide variety of design fields are unable to predict the behaviours of design outcomes and understand design situations with 2 or more feedback loops.

The significance of this is that many design situations have substantially more than 2 feedback loops. This is particularly evident in the case of the new areas that the Art and Design design fields have claimed that Art and Design design methods apply. It suggests that these claims are false.

Can you feel it? Yes we can: the delusion

A fundamental problem, in pragmatist philosophical terms, is that when designers reflect as to whether their feelings, intuition, insights, emotions and creativity can offer them a reliable prediction of the behaviour of complex design situations they get a positive answer that is false.

That is, designers are typically mistaken and in error – deluded- when they feel confident that they understand and can accurately feel their way around complex design situations.

This is easily tested and has been done so widely over a large amount of design professions.

Our current research is to identify accurately the biological limits of design relating to complex design situations and provide guidelines to designers as to which design situations conventional design approaches apply and which they do not.

Outcomes of research analyses and hypotheses

- Humans are not capable of understanding, 'thinking through' or predicting the design behaviour of complex design situations, i.e. those involving 2 or more linked feedback loops.
- Intuition, creativity and feelings do not help and do not under any circumstances provide correct answers to predicting the behaviour of complex design situations
- Designers, design researchers and design philosophers, when testing the trueness of the feelings, intuition or creative insights, have 'feelings' that falsely gives them the beliefs that their intuition, feelings, creativity or insight is allowing them to understand and predict the behaviours of complex design situations. These are delusions.
- Typically where people intuit, feel or apply creativity to identifying strategies or interventions to improve complex design situations, they chose interventions that move the behaviour of the designed outcome in the opposite direction to that intended.
- Designers typically address complex design situations by attempting to ignore the complexity and address them as complicated design situations – this approach results in faulty design solutions.
- When designers create designs for complex design situations, the outcomes typically after a short time become faulty due to the effects over time of the feedback loop. Designers usually blame the error on issues beyond their control or call it the result of the design situation being a 'wicked problem'. This is implicitly a way of trying to avoid legal responsibility for lack of competence.
- Collaborative, participatory, crowd design or other multi-participant approaches do not work for complex design situations. All that happens is there are multiple people who do not understand the situation and are incapable of predicting the behaviour of the designed

system. The main benefit is that the group self supports themselves psychologically that they are all going to make the same design mistake and will all be blamed equally.

Solution: a design approach for complex design situations

The solution as a design approach is straightforward, has six parts. It applies to 'wicked problems' AND to design situations that are much more complex:

1. Undertake background research to identify the main aspects of the complex design situation and the causal feedback loops (collaborative design approaches are useful here)
2. Create a predictive behavioural model of the design situation taking into account all significant factors
3. Identify the preferred outcomes and the factors that can be most easily changed (collaborative design approaches can be of use here)
4. Make the changes to the predictive model and observe the outcomes
5. Identify the characteristics of the configuraiotn of the design situation that will give the preferred outcome
6. Use these characteristics to define the framework for the design and its implementation.

Implications of the above research analyses

- Challenges the validity of all design theory and design literature as it applies to complex design situations (and wicked design problems)
- Challenges the validity of participatory design, collaborative design crowd design and all other similar group based design practices as they apply to complex design situations (which is where they are mostly applied)
- Challenges the belief that humans can intuit, feel or have correct insights about complex design situations
- Challenges core elements of existing design theory, design research and design philosophy.
- Challenges personal individual assumptions about our own abilities and competences.
- Draws attention to a major self-delusion the assumption about the absence of which has been a core presumption of substantial amount of design theory making about design skills, practices and cognition.
- Challenges the validity of recent claims by Art and Design fields that their methods apply also to complex design situations.
- Challenges claims by the Design and Emotion sub-field, that complex design situations can be addressed via research into user's emotional responses.
- Challenges claims by user-based design approaches that user-based analysis is sufficient to define design solutions.
- Provides justification for an alternative design method that resolves all the problems raised by the above challenges.