

The Value of Stimulated Dissatisfaction

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Abstract

“I’m not saying it’s a good quality to have, but my observation is that good designers are never happy, they’re never satisfied, never content” (Adrian Stokes, quoted in Spencer, 2008, p. 145).

It seems self-evident that designers, whose *raison d’être* is to initiate change in man-made things (Jones, 1970), devising courses of action aimed at changing existing situations into preferred ones (Simon, 1969), will be dissatisfied, at some level, with the way they experience the material world. However, recent research (Spencer, 2008) suggests that expert designers deliberately enhance the pressure and stress of the design situation – stimulating dissatisfaction. By stimulating the experience of dissatisfaction their imaginative and investigative action is given urgency, focus and purpose as they pursue excellence and attempt to unfold from their own view of the world to empathise with a broad project community.

This discursive paper highlights the need for a developed understanding of the reflective practitioner model to inform the post-rationalist generation of design methods. This paper: reviews critical literature about the experience of designing; discusses the role of dissatisfaction within the practise of design; and presents a research project that aims to evaluate the value of stimulated dissatisfaction for the purpose of supporting practitioners’ empathic appreciation in early design direction generation. This paper argues that the reflective practitioner model of the designer must address the stimulation of dissatisfaction as a condition of creative and explorative design practice.

Keywords

Design Practice; Reflective Practice; Experience; Dissatisfaction.

Understanding design activity is an extremely complex task; particularly, if we accept that designers are intimate aspects of the very context dependent problems they aim to resolve (Schön, 1983; Lawson, 2006; and English, 2006) where bounded action encompasses all the various parts comprising human existence (Bousbaci, 2008). This paper aims to contribute to our understanding of design activity, specifically contributing to Design Epistemology (Cross, 2006), by focusing upon design practitioners’ experience of practise (Spencer, 2008), reflecting upon the role of dissatisfaction, and presenting research that evaluates the benefit of stimulated dissatisfaction for supporting empathic appreciation in early design direction generation.

Theoretical Context

Based upon the ‘generation game’ (Cross, 1981), found within Design Methods, Bousbaci (2008), argues that each shift in the evolution of Design Thinking has been accompanied by a major shift in the implicit ‘Model of Man’, and, as a consequence, the implicit model of the designer (refer to Figure 1). Bousbaci states that, “each design theory, unless it puts forward its philosophical assumptions, assumes as well

a particular view (i.e., a model of the designer)” (ibid, p. 39). Bousbaci describes Design Thinking’s changing theoretical landscape:

- First-generation design methods shifted from the romantic, intuitive, and artistic model of the designer to embrace a very logical and rationalist view. The logical and rationalist model of the designer, which Alexander (1964) described well, has its philosophical roots in Descartes’ (1637) mechanical world and investigative method.
- Second and Third-generation Design Methods – which delivered intellectual tools widely used in contemporary design discourses: wicked problems (Rittel, 1972); solution focused strategy (Lawson, 1980); design conjectures (Hillier, Musgrove & O’Sullivan, 1972); primary generator (Drake, 1979); ill-structured problems (Simon, 1969); and problem space and generative processes (Newell & Simon, 1972) – rested on the premise that design was a problem solving process and the model of the designer supporting these views was conceptualised by Simon as Bounded Rationality (1945).
- The reflective practitioner is a post-rationalist model of the designer and the ‘reflective turn’ that Schön’s work provoked is the last paradigmatic shift in support of Design Thinking.

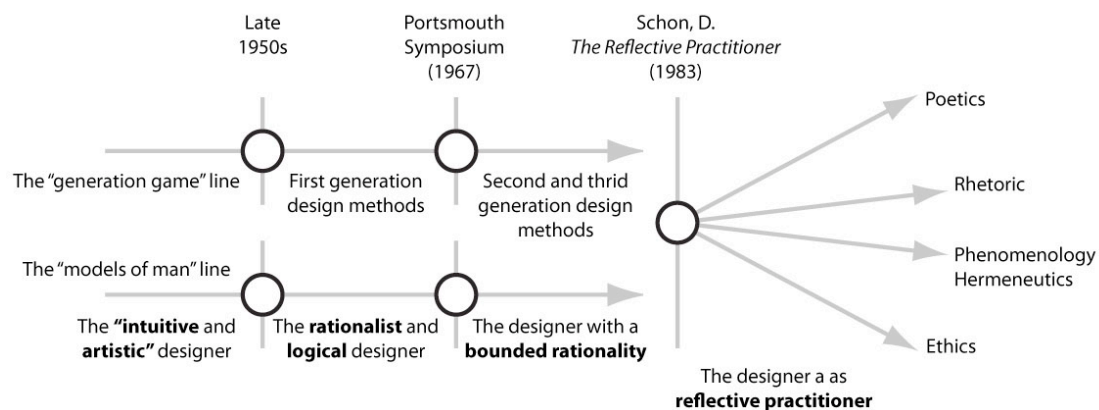


Figure 1 – ‘Some landmarks in the evolution of design thinking’, taken from Bousbaci (2008)

According to Bousbaci, Schön’s reflective practitioner is:

A post-rationalist model of the designer [that leads design theorists] to gradually abandon the very rationalist and logical concept of ‘problem’ (and the entire instrumental view of design as a ‘problem-solving process’) in order to adopt the more pragmatic and phenomenological concept of ‘situation’ (2008, p. 40).

The differences between the instrumental view of design, seminally illustrated by Simon (1969), and the constructionist view of design, as Schön described it, have been well discussed and dissected (Schön, 1983; Dorst, 1997; Spencer, 2008 & 2009). This paper is not concerned with debating the merits, contradictions, or paradoxes of these paradigms of design; it is concerned with examining the reflective practitioner model of the designer. If, as Bousbaci proposes, there is a causal relationship between Design Methods and models of a designer, then improving our understanding of the reflective practitioner model, furthering its detail and accuracy, should provide an improved theoretical foundation for developing fourth generation design methods.

In Schön’s reflective practitioner model, designers are makers in the broader constructionist sense; using professionally and personally determined practices and competencies to impose coherence and order complex situations, converting

indeterminate situations into determinate ones, bringing new things into being through their actions and inquiries. The reflective practitioner model describes the role and interaction of three different knowing modes: knowing-in-action, reflection-in-action and reflection-on-action. The knowing modes, knowing-in-action and reflection-in-action, are differentiated by the practitioner's ability to progress a task situation through action, and, reflection-in-action and reflection-on-action are differentiated by their relation, in time, to the task situation. The reflective practitioner model defines the pattern of inquiry (reflection-in-action) used when knowing-in-action is insufficient to proceed or when the situation falls outside the boundaries of 'normal' where knowing-in-action cannot be brought to bear. The pattern of inquiry, reflection-in-action, employed within an action present, is a process of: simplifying a situation's complexity (consciously or unconsciously naming the elements to be attended to); arriving at a standpoint about the situation, its problems and issues (framing); exploring the standpoint through action, experimentation and solution propositions (making moves); and considering implications and consequences in two directions, 1) forwards, to consider the value and consequences of the propositions and the barriers to successful implementation, and 2) backwards, to consider the restrictions and relevance of naming and framing and the appropriateness of the investigative actions (reflection).

For the reflective practitioner model of a designer there appear to be a number of factors that influence the effectiveness of an inquiry, they are:

- a) The designer's ability to understand the design situation – the methods, tools, skills and cognitive capacity to identify issues and their consequences – i.e., appropriate naming.
- b) The designer's ability to empathise with the project community – the creative capacity and knowledge to frame and reframe the design situation including personal empathy, commercial empathy and discipline empathy – i.e., appropriate framing.
- c) The designer's ability to explore frames – the discipline skills and knowledge necessary to explore frames and solution opportunities, expose them to internal and external audiences for feedback and complete projects within specific design domains – i.e., appropriate move making.
- d) The designer's ability to critically reflect – the sensitivity to recognise feedback from propositional explorations, the ability to recognise limitations with naming and framing actions, the ability to discover and see the implications of propositions – i.e., appropriate reflection.
- e) The designer's ability to engage uncertainty and manage mental and emotional states – the confidence to feel the discomfort of uncertainty; and the willingness to repeatedly explore alternative frames and solutions and expose the coherence of the thinking structure to criticism (Spencer, 2009), time allowing, or to commit – i.e., appropriate application of the practitioner's mental and emotional resources.

Schön describes the good reflective practitioner as being willing to enter into new confusions and uncertainties, but does not provide a good account of states of confusion or the experience of uncertainty and how these affect reflective inquiries. The conversations that Schön presents (1983 & 1987), focus upon illustrating how naming, framing, making moves toward solutions and evaluating through reflection develop through dialogue, focusing upon design content and action (descriptions of solutions and frames; and explanations of moves and reflective behaviour). Schön does not highlight what it is like, experientially, to be in a reflection-in-action moment. Nor does Schön focus upon the affect a practitioner's mental and emotional state has

upon their ability to have effective conversations. The role of a designer's mental and emotional conditions is a potentially fruitful area of investigation for informing the reflective practitioner model of the designer. In order to inform the reflective practitioner model of the designer, this paper: discuss findings about expert design practitioners' experience of practise; reflects upon the role of dissatisfaction within the practise of design; and presents preliminary research that aimed to test the value of using a Dissatisfaction Matrix to stimulate early stage design direction generation.

Investigating the Experience of Designing

Spencer (2008) conducted an investigation into the experience of designing. The research examined experiences of expert design practitioners' practise of reflective practice. His study was an embedded multiple-case study with multiple units of analysis, where qualitative data about the experience of designing were obtained from eight semi-structured interviews with expert designers.

Spencer's work suggested that design practitioners explore their design situations, through the propositional experimentation process suggested by reflective practice, intuiting the value of frames and solution propositions as a felt experience. It appears that dissatisfaction plays an important role as practitioner's continually strive for better personal and professional performance through their design inquiries, avoiding the extremes of conceit or stress induced inertia and avoiding habitualisation in preference to reflection-in-action. It is also suggested that in addition to developing self awareness of the personal and professional performance dissatisfactions, which can bring about changes in identity and expertise, there are also dissatisfactions with things beyond the person and the business, including: products, processes, services, communications, policies and politics. Each of these anticipated or experienced dissatisfactions become part of the context around which, and within which, the designers design. Dissatisfaction is therefore argued to be an integral part of motivation for change and motivation to design. Nevertheless, this does not mean that it is possible to use all dissatisfactions positively in a given context, for example dissatisfaction over price, when reducing price makes it ethically unacceptable; or dissatisfaction about diversity of choice, when the breadth of product range is already unsustainable in the marketplace. There is also a question as to whether the positive prompting of dissatisfactions can provide the same benefits throughout a design process; dissatisfactions at the ideation and brief development stage are anticipated to support in a different way, to dissatisfaction identification at design specification.

To illustrate the role of dissatisfaction that Spencer identified in the expert designers' experience, it is useful to present some of his research findings – descriptive statements about the experience of designing. Sample transcript excerpts, taken from his thesis's discourse analysis, follow the findings and a brief commentary is provided.

Finding 1

Expert designers are optimistic about their ability to resolve design problems, see problems as opportunities and begin their task with positive excitement (Spencer, 2008, p. 286).

There's a sort of optimism that designers have to have, you have to be optimistic that you can solve the problem (Tim Brown, quoted in Spencer, 2008, p. 205).

As a designer you need to be quite passionate about solving things and I think that most designers want to do things well, they want to create a better world, they

want to do better things, they want stuff to be better (Mark Delany, quoted in Spencer, 2008, p. 206).

Cross (2006) stated that “the uncertainty of design is both the frustration and the joy that designers get from their activity” (2006, p. 54). Spencer refutes that claim: “it is not the uncertainty of design that expert designers enjoy, rather it is the potential and pregnant opportunity that uncertainty represents, it is the fear that is generated as the designer experiences uncertainty that is enjoyed” (Spencer, 2008, p. 242).

The excitement a designer feels at the start of a project appears to be a consequence of the opportunities they see in the design challenge. Spencer’s data suggests that the uncertainty, inherent in the design situation, provides perceived opportunities to make positive contributions to society through the activities of design and to achieve positive re-enforcement of the designer’s professional identity. The dissatisfactions implicit in Finding 1 are: a) the belief that society and material culture is not as satisfactory as it could be and can be improved by deliberate and organised action (design); and b) that one’s own practice can be further improved and refined and hence has not yet fully met self-imposed standards.

Finding 2

As expert designers engage with a professional context that is uncertain, ill structured and ambiguous they personally experience uncertainty. As the uncertainty of the challenge is grasped, fear develops about their ability to resolve the design problem’s issues and exploit its opportunities (Spencer, 2008, p. 285).

Often the first month or so you’re kind of stabbing away and it’s all a bit hazy and you’re a bit worried you’re going in the wrong direction, [...] there’s always that uncertainty at the start of a project *‘Are we going to be able to pull it out of the bag this time’* (Kevin McCullagh, quoted in Spencer, 2008, p. 208).

Even now, after God knows how long that you’re doing it, whenever you get a project in there’s still a little bit of panic at the start of it, *‘Shit, I don’t know what I am going to do, I don’t know what the answer is’*, and that fear is quite enjoyable. I think the moment I lose that fear is the time that it’s like time to give up! (Mark Delany, quoted in Spencer, 2008, p. 208).

The situation, and phenomenological state, that Finding 2 describes, is presented as central to practitioners’ reflective inquiry. The design situation in itself is dissatisfactory and it is the designer’s role to produce solution propositions for satisfying the issues, contradictions and conflicting commercial demands. As described by reflective practice theory and by the design expertise literature (Lawson, 1994, 2003 & 2004; Dorst, 2003; and Lawson & Dorst, 2009), the form of inquiry dominant in design practice requires practitioners’ intimate engagement and personal investment. The initial engagement with an ill-structured design situation is complex. In addition to external ambiguous conditions and criteria there is the designer’s experience of this situation, as Spencer highlighted:

Expert designers, in addition to imposing order upon their situation of practice and developing solution propositions, must cope with their personal response to the experience of uncertainty and its discomfort and their personal doubts and insecurities that are given focus as they engage with challenging design problems (Spencer, 2008, p. 242).

Spencer’s data illustrates that designers experience the situation’s uncertainty without necessarily being immediately able to unpick and cognize the strands of doubt that create it. This phenomenological state seems crucial, and Spencer suggests that designed outputs can be viewed as a result of coping with, and attempting to resolve, this state of uncertainty and stress; therefore, reflective

practice is a series of attempts to escape from the unsatisfactory experience of uncertainty, creating conceptual certainty and coherence by employing imaginative and investigative action.

Finding 3

Iterative attempts to develop solutions can lead to frustration as the expert designer assesses his/her propositions as inadequate for resolving the design challenge. Over time, if solution propositions continue to be assessed as inadequate, dread is experienced as the expert designer questions his/her ability to resolve the design challenge. Mental paralysis can occur after this stage where the expert designer is unable to further explore the design situation (Spencer, 2008, p. 285).

Coming up with ideas is pretty easy; making them reach the other end of the net is not easy. Ideas are two a penny at one level, even though people say, '*How do you have ideas*', ideas is not the problem, making them the right ideas, better ideas is a problem and you can only do that if you have reference points to judge better-ness against and then successfully exploit them (Steven Kyffin, quoted in Spencer, 2008, p. 210).

There is a huge amount of worry to turn that [creative] moment into a finished product. Without that moment there would be no successful products and without that worry there would be no successful products. There are all these opportunities to ruin that moment (Adrian Stokes, quoted in Spencer, 2008, p. 210).

I think designers are inspired by quite negative emotions, you know you're really frustrated with something and you want to design it better, or you're just frustrated with the way things are going and you need to solve it, you cannot let it go until you solve it, you know I think any creative act involves a bit of pain, you've got to give a bit (Mark Delany, quoted in Spencer, 2008, p. 211).

I think there's something about the creative process that requires your brain to work pretty hard and it has to be open to certain things and so you can't be scared and frightened. If you're scared and frightened you can't design, you can't be in too much of a hurry all of the time or you can't design and you need to be fit, mentally fit and physically fit [...]. So there is something in being in a good state of mind and state of body that does help you be creative. I mean you see it in people who have been working too hard for too long they just stop having good ideas (Tim Brown, quoted in Spencer, 2008, p. 212).

It's amazing how confidence can desert you; emotions are very fickle, lifting your mood sky high or just shutting you down. At those moments you never look at the bigger picture, 30 years of achievement for example, you always just think, '*Oh God, I'm in trouble*' (Adrian Stokes, quoted in Spencer, 2008, p. 214).

Finding 3 describes ongoing proposition experimentation and the emotional states that can occur if solution propositions are assessed as inadequate. This finding highlights an interesting area for further research: what influence does the experience of stress and uncertainty have upon a designer's assessment of their solution propositions. An ideal-type designer would be one that has developed tactics and gambits to help manage the effect that strong and/or sustained levels of anxiety have upon their practise of design while maximising their motivational benefits positively – they would be effective in the appropriate application of their mental and emotional resources.

Discussing the Experience of Designing

Spencer's research explores the application of practitioners' mental and emotional resources as they practise design. His investigation, however, is not intended to be, nor claimed to be, a complete picture. The methodology and cases studied shape the scope of the research and its limitations provide avenues for further inquiries. However, Spencer's thesis is useful in developing our understanding of the reflective practitioner model of the designer; it highlights that reflective practice has a significant phenomenological dimension to it beyond the action-orientated theory of Schön. Spencer's (2008) findings deal with aspects of experiencing dissatisfaction, but do not address the role of dissatisfaction and relate it with stages of the design process, nor does his work address the significance that dissatisfaction has upon a practitioner's practice over time. The Dissatisfaction Matrix project described in this paper outlines an experiment that is an attempt towards evaluating the role of dissatisfaction in Opportunity Identification (Hilton, 2002).

The generation of the experience of uncertainty and its discomfort is evident in Cross and Clayburn Cross's (1996) study of Gordon Murray. In a description of his situation of practice Murray is quoted as saying, "the pressure then to come up with something new becomes intense, and the responsibility is all yours, and you get sort of panicky" (op. cit.). Cross and Clayburn Cross suggest that innovative designers frame or reframe the design situation in a way that creates significant challenge. Davies and Talbot (1987) stated that although ideas can occur at any time they seem "most likely to occur when the person has to cope with significant life events, and/or a particularly knotty design problem" (1987, p. 23). Spencer suggested that, expert designers stimulate their experience of uncertainty and inquisitive discontent: "engaging with design problems of increasing complexity appears to ensure that expert designers' experience of their design challenge is at the edge of what they are able to cope with" (2008, p. 282). Perhaps, taking on problems of increasing complexity and framing a problem so that it is seemingly impossible are tactics designers use to enhance the pressure and stress of the design situation, creating the unsatisfactory experience of uncertainty and discomfort from which they attempt to escape through their professional activities. If this is the case, it appears that the reflective practitioner model of the designer must address the stimulation of dissatisfaction as a condition of creative and explorative design practice. Also, if this is the case, then designers may manipulate their awareness, and perception of project progress, in order to improve creative engagement and performance. This control of stimulation may in part relate to the balance of Boredom and Anxiety for Flow experiences (Csikszentmihalyi, 1975 & 1992).

There appear to be sets of interesting relationships between the balance of dissatisfaction/satisfaction and ambiguity/clarity for our understanding of Design Expertise and designers' personal development. The point at which an individual design practitioner experiences enough satisfaction with their approach to designing to be uncritical about the way they design is interesting. It perhaps signifies the point where competency and confidence has allowed a practitioner to deploy their critical attention to a different area or set of concerns regarding their profession. However, it may also signify the point where a practitioner believes that they no longer need to deploy the extra effort to critique their practices, as they are sufficient to do the job. It may also be the case that a practitioner may not know how to do things differently without potentially sacrificing quality. Spencer's (2008) data highlights that a lack of curiosity, or the early satisfaction of curiosity, is an issue that becomes a point of friction between designers:

This is a bit of a personal bug bear; when people just want to slip into a pattern that they're familiar with, '*So we did this with the last project let's do that*', rather than go, '*Well what's actually the right thing to do on this project*' (McCullagh, K., quoted in Spencer, 2008, p. 223).

I think that there are some designers, quite a lot of designers that are insufficiently curious or critical about what they are doing on the other hand they have job and a mortgage and have to pay off their credit card bills, like along with many other people they don't make life complicated they just do their job (Thackara, J., quoted in Spencer, 2008, p. 223).

In Spencer (2008) Stokes, A., suggests with astonishment, that the majority of designers that he has trained or known do not develop because they are too easily pleased with themselves and too smug (ibid, p. 145), he states: "they became complacent, lazy designers and lazy people who took things for granted and were more interested in going out to the pub at 5.30 than they were about their work and the world around them" (Stokes, A., quoted in Spencer, 2008, p. 149). As a designer develops solutions that provide greater clarity of a concept, they become more satisfied with the concept's development and so continue to move towards the specification phase. However, it has proposed that ambiguity is a resource for design (Gaver, Beaver, and Benford, 2003), in that it allows for more open association and intuitive leaps to take place, and therefore the feelings, if satisfaction is arrived at too early in the process, could reduce beneficial engagement with creative thinking, and the project may therefore conclude with less value added.

Dissatisfaction Matrix

Inspired by the research into the value of stimulated dissatisfaction, and in an attempt to further understanding of this area of research, a Dissatisfaction Matrix was developed by the authors as a tool to test if dissatisfaction could be prompted to support creative engagement with ambiguities. The Dissatisfaction Matrix was intended to offer designers a multi-perspective association approach to inspiring Opportunity Identification (Hilton, 2002) at the ideation and brief development stage. This proposition was a further development of work using 'personas' for design critiquing (Hilton and Henderson, 2008), where here, the matrix was to prompt using characteristics, a selection of which might make up a full persona's concerns. Using the Dissatisfaction Matrix requires that the designer/design team imagine and consider dissatisfactions for specific characteristics in specific contexts, providing a structure to empathic appreciation, and informing their understanding of the project community's design challenge. The characteristics of dissatisfaction, which populated the prototype matrix, were identified through a session that involved naming product and service related dissatisfactions and later categorising them. This list was not exhaustive or intended to be in any way definitive, it served to create a reasonable test framework. Lists should always be viewed as 'live' not 'set', able to be questioned and added to, or made more specific, to be appropriate to the design task.

The research method required that the design-teams, each made up of three 2nd year industrial design undergraduate students, imagine and list on post-it notes either dissatisfactions or ideas for each of the characteristics against each context. In each case, the 5 teams of 3 students were briefed and given two hours to generate as many responses as possible. In addition to the verbal briefing session, each team was provided with written details of the task and efforts were made to ensure that each design team carried out the two hours task in separated workspaces free from distractions.

This project involved an iron and a kettle, in two separate sessions, so that participants had opportunity to compare experiences of using the Dissatisfaction Matrix, to list dissatisfactions, against traditional brainstorming (Dominguez, 2008) or the Dissatisfaction Matrix used to list ideas. This enabled the investigation of differences in dissatisfaction/idea-fluency between a traditional

brainstorming format, and two applications of the matrix, one for dissatisfactions the other for idea generation.

The results showed a greater fluency of responses where ideas were required. When ideas were required it was noted that 1-5% of the post-its listed dissatisfactions, whereas when dissatisfactions were required it was noted that 20-85% of the post-it notes listed ideas. There was an obvious slew towards the habitualised ideation process, possibly in part due to lack of practice with the dissatisfaction matrix, possibly in the way responses were framed as ideas even if they originated as feelings of dissatisfaction.

The participants found the Dissatisfaction Matrix to be engaging and proved to be a good way of ensuring that a large number of associations were considered. The Matrix therefore functions in a more prescriptive fashion than the theme prompting of idea flow experienced in a traditional Brainstorm.

The nature of the matrix approach, requiring a fast response in order to complete within a two-hour period, was reported to be exhausting. This reported exhaustion, is believed, by the authors, to be because there were a greater number of matrix associations, than there were brainstorm themes, making the experience much more one of thinking against the clock. Although it was reported to be more challenging to list dissatisfactions, a number of participants did describe feeling that the dissatisfactions would provide more concrete direction for concept development than many of the ideas. This conjecture would have to be investigated with future research using listed dissatisfaction for concept development and design, as a comparative study with concept development and design using listed ideas. It would also be of value for future research to investigate the design practices of critically reviewing and selecting noted dissatisfactions to progress, in comparison to what would occur with noted ideas, and then seeing how the selections influenced the quality of design process and creative output. It is expected that experienced practitioners may generally have become more critical, more dissatisfied, though some may have become somewhat apathetic. This leads to further research and raises the question of Design Apathy and whether there is any evidence of it.

Conclusions

It has been argued that expert designers stimulate their experience of dissatisfaction to create the phenomenological conditions for their imaginative and investigative actions to be given urgency, focus and purpose as they pursue excellence and attempt to unfold from their own view of the world to empathise with a broad project community. As such the reflective practitioner model of the designer must address the stimulation of dissatisfaction as a condition of creative and explorative design practice. Further research could explore designers' variety of responses to design-situation induced anxiety and discomfort and how this influences design decision-making and reflection.

The value of stimulated dissatisfaction within design practice and to the practise of the design practitioner, as an alternative approach to idea generation, would appear to be the heightened awareness of needs for improvement, as opposed to wants or hopes. This would make it more useful in certain cases where a more critically developed brief is required for example, possibly prior to a more divergent traditional brainstorm session being run. Choosing dissatisfaction assessment appears to bring a more critical view of needs, helping to address any possible over-optimism or motivational bias to reflecting upon, and working with, what works well.

The value of stimulated dissatisfaction, for the design practitioner, appears twofold:
1) it helps form phenomenological conditions that a designer attempts to resolve

through the use of their creative cognitive capacities, i.e., it helps to keep a designer designing; and 2) it helps to keep the design situation at the boundaries of a designer's capacities; it ensures reflection-in-action, i.e., it helps to keep a designer designing. The descriptions, in this paper, have illustrated the use of stimulated dissatisfaction as a positive resource for creativity and design. How defined the balance is between healthy and positive usage of stimulated dissatisfaction and unhealthy and destructive usage is unknown and a source of further research.

References

- Alexander, C. (1964) *Notes on the Synthesis of Form*. Cambridge, MA: Harvard University Press.
- Bousbaci, R. (2008) 'Models of Man' in design thinking: The "Bounded Rationality" episode', *DesignStudies*, Vol 24 (4).
- Cross, N. (1981) 'The coming of the post-industrial design', *Design Studies*, Vol 2 (1).
- Cross, N. (2006) *Designerly Ways of Knowing*. London: Springer-Verlag.
- Cross, N. & Clayburn Cross, A. (1996) 'Winning by design: the methods of Gordon Murray, racing car designer', *Design Studies*, 17 (1), pp. 91-107.
- Csikszentmihalyi, M. (1975). *Beyond Boredom and Anxiety*. San Francisco: Jossey-Bass.
- Csikszentmihalyi, M. (1992) *Flow. The psychology of happiness*. London: Rider.
- Darke, J. (1979) 'The primary generator and the design process', *Design Studies*, 1(1), pp36-44.
- Descartes, R. (1637) *Discourse on Method*.
- Davies, R. & Talbot, R.J. (1987) 'Experiencing ideas: identity, insight and the imago', *Design Studies*, 8 (1), pp. 17-25.
- Dominguez, P. (2008) *IDEO's 7 Rules of Brainstorming*. Available at: <http://www.greenbusinessinnovators.com/7-rules-of-brainstorming-from-ideo> (Accessed: 1 September 2009).
- Dorst, K. (1997) *Describing Design: A Comparison of Paradigms*. PhD thesis. Technical University Delft.
- Dorst, K. (2003) 'The problem of design problems', *Expertise in Design: Design Thinking Research Symposium 6*. Cross, N. & Edmonds, E. (eds.) University of Technology, Sydney, Australia, 17-19 November 2003.
- English, S. (2006) 'Design thinking – Value innovation – Deductive reason and the designers choice', Design Research Society Conference, Lisbon 1-4 November.
- Gaver, W. W., Beaver, J., and Benford, S. (2003) Ambiguity as a Resource for Design. Proceedings of the SIGCHI conference on Human Factors in Computing Systems, Ft. Lauderdale, Florida, pp 233-240.
- Hillier, B., Musgrove, J. & O'Sullivan, P. (1972) 'Knowledge and Design', in Mitchell, W.J. (ed). *Environmental Design: Research and Practice*. Los Angeles: University of California, pp245-264.
- Hilton, K. H. (2002) *Stimulating the Practice of Opportunity Identification*. 'Shared Visions'. ADC-LTSN Conference, Brighton.
- Hilton, K. H. and Henderson, K. (2008) *Developing Criminal Personas for Designers*. British Society of Criminology Journal, Vol.8.

- Jones, J.C. (1970) *Design Methods: Seeds of Human Futures*. London: John Wiley & Sons.
- Lawson, B. (1980) *How Designers Think: The Design Process Demystified*. London: Architecture Press.
- Lawson, B. (1994) *Design in Mind*. Oxford: Butterworth.
- Lawson, B. (2003) 'Schemata, gambits and precedent: Some factors in design expertise', *Expertise in Design: Design Thinking Research Symposium 6*. Cross, N. & Edmonds, E. (eds.) University of Technology, Sydney, Australia, 17-19 November 2003.
- Lawson, B. (2004) *What Designers Know*. Oxford: Architecture Press.
- Lawson, B. (2006) *How Designers Think: The Design Process Demystified*. 4th edn. Oxford: Architecture Press.
- Lawson, B. & Dorst, K. (2009) *Design Expertise*. Oxford: Architectural Press.
- Newell, A. & Simon, H.A. (1972) *Human Problem Solving*. Englewood Cliffs: Prentice-Hall.
- Rittel, H.W.J. (1972) 'Second generation design methods', in *Design Methods Group 5th Anniversary Report: DMG Occasional Paper*, 1, pp. 5-10; also in Cross, N. (ed.) (1984) *Developments in Design Methodology*. Chichester: Wiley & Sons, pp. 317-327.
- Schön, D. (1983) *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books.
- Schön, D. (1987) *Educating the Reflective Practitioner*. San Francisco, CA: Jossey-Bass.
- Simon, H. (1945) *Administrative Behaviour: A Study of Decision-Making Processes in Administrative Organisations*. New York: The Free Press.
- Simon, H. (1969) *The Science of the Artificial*. London: The MIT Press.
- Spencer, N. (2008) *An Investigation into the Experience of Designing*. PhD thesis, University of Northumbria at Newcastle, Newcastle Upon Tyne.
- Spencer, N. (2009) 'The relevance of rigour for design practise', International Association of Societies of Design Research Conference, Seoul.

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seeing, thinking, and behaving towards a more sustainable lifestyle, and positive change through Redirective Practices.