Are the *Reflective Practitioner* and *Learning Cycles* Suitable Foundations for Theories about Designing and Design Cognition?

Dr. Terence Love

Edith Cowan University, Perth, Western Australia

Abstract

This paper challenges the use of the concepts of *reflective practice* and *learning cycles* as a basis for analysing designing, for building coherent theories about human designing and for developing design methodologies. It develops the argument via two paths: a review of the original formulation of the concepts of *reflective practice/practitioners* and *learning cycles*; and an analysis of the implications of recent findings in the areas of brain and neurology research for building theories about designing. The paper suggests researchers have over extended the use of the *reflective practice and learning cycle* concepts: concepts that were devised as relatively coarse structural formulations bringing together some of the more obvious macroscopic characteristics of individual human functioning for business consultants and educators. It argues that new micro-level understandings of design cognition emerging from brain and neurological research offer a better basis for building theories about designing.

Introduction

In the design research literature, concepts of *reflective practice* and its close associate *learning cycles* have been widely used as the basis for building design theories (see, for example, Craig & Zimring, 2000; Dorst & Cross, 2000; Dorst & Dijkhuis, 1995; D A Schon, 1992; D A Schon & G, 1992; Stumpf & McDonnell, 2002; Valkenburg & Dorst, 1998).

This paper asks whether these concepts are epistemologically and practically sufficient as structural foundation for developing design theories that provide full explanations of the human activity of designing and how humans interact with designed objects. It argues that the theoretical foundations of design research reach much deeper, and that the concepts of *reflective practice* and *learning cycles* are in fact peripheral, and relatively superficial, models.

The paper suggests that models of *reflective practice, learning theories* and *learning styles* essentially model the external phenomena only, and are thus not epistemologically well-aligned in purpose with modeling an activity such as designing that is intrinsically an internal human process. It suggests that the justifiable use of these concepts of experiential learning does not extend beyond their roles as aids to developing educational programs, as accessible constructs for students of design practice

and design management, and presentation aids for consultants involved in improving design management.

Brain research is now offering direct insight into the actual internal human processes of designing. This is a significant change in the design research field. Until recently, design theory making has been severely limited because research-based understanding of core aspects of human activities in designing could only be inferred by observations of external behaviours of designers and externally observable phenomena. The consequence has been that theory making efforts have been deflected into building theories about designing in terms of the structure and sequencing of externally observable activities; the properties of objects (forms); information used by or transferred between those involved in designing; models of social interactions; and human cognition, itself described in terms of these factors. What has been neglected is the essential core of the field: the human internal processes of designing, i.e. how humans design.

Trying to model the human activities of designing is difficult: the human processes are complex. Attempting to take theoretical shortcuts to avoid this complexity by focusing only on superficially accessible information about the external attributes of the phenomena and the human behaviours raises similar epistemological and practical problems as trying to infer the internal electronic circuits and software code of a calculator by observing the contents of is display, or trying to infer the program code of a word processor from the content of documents that have been produced using it.

The paper has five parts. In the next (second) section, the reflective practitioner, learning cycle and learning style models are briefly reviewed. In the third section, research findings about the key roles that feelings play in cognition and hence designing are outlined in terms of new findings about the physiological mechanisms by which feelings, emotions, cognition and actions are actualized. In the fourth section, the issues raised in sections two and three are discussed in terms of the construction of sound foundations for design theories. In the final section, the conclusion, a new structure is outlined that repositions the reflective practitioner and learning cycle/style models in design theory, design research and design education.

Reflective Practice and Learning Cycles/Styles

Schon's theories of *reflective practice, reflective practitioner*, and *reflection in action* originate in his research into experiential learning and experience-based action undertaken in the 1970s with Chris Argyris (see, for example, Argyris & Schon, 1978, 1974; D A Schon, 1983; Donald A. Schon, 1973).

The primary purpose of that research into individual and organisational learning was the aim of improving the effectiveness of managers and consultants offering services to increase organizations' performance. The theory basis of *action/experiential learning/ reflective practice* goes back, however, at least to Dewey's (1933) work on experiential learning.

Schon (1987) focused on two kinds of practical reflection: *reflection-**in**-action*, in which the reflection is undertaken during a task; and *reflection-**on**-action*, in which the reflection is done away from the task.

Schon differentiated between:

- *Espoused theories:* the theories that people say underpin why they do things
- *Theories in action:* the theories that actually underpin why people do things
- *Reflection:* theory that gives feedback into either theory and experience

In exploring the theory aspects of how people best gained from their experiences, Schon focused on five processes:

- Undertaking an action
- Reflections on experience of that action
- Using a theory
- Reflections on using that theory
- Reflections on the idea of reflecting about a theory of e.g. action (meta-theoretical reflection)

Kolb and Fry developed an alternative approach to experiential learning in the mid-1970s (Kolb, 1975). From this research, and that undertaken earlier by Lewin (e.g. Lewin & Cartwright, 1952; Lewin & Lewin, 1973), emerged the *Kolbian learning cycle* of:

Concrete experience > observation and reflection > forming abstract concepts > testing these abstract concepts in new situations> more concrete experience etc.

As Ekpenyong (1999) inferred, this can be seen as an unpacking of the simple behaviourist stimulus-response (S-R) theory to provide room for a theory of learning. The experience of Kolb and other educators and consultants in applying the *learning cycle* in educational and consultancy situations indicated that some individuals performed better and were more enthusiastic about some parts of the *learning cycle* than others. This pointed to potential benefits from categorising individuals in terms of *learning styles* predicated on their preferred part of the cycle.

These he called *Convergers, Divergers, Assimilators*, and *Accomodators* (D. A. Kolb, 1985, pp. 61-95). Kolb's learning styles sit between axes on the *learning cycle*. Alternative *learning style* categories by Honey and Mumford (1982) (*Activists, Reflectors, Pragmatists* and *Theorisers*) locate learning styles on the cycle axes. Like the Myers-Briggs and personality types, the cultural roots of Kolb's (and presumably Honey and Mumford's) ideas on learning styles were Jung's personality types (D. A. a. F. Kolb, R, 1985, p. 78).

These theories about reflective practice, learning cycle and learning styles are grounded in observation of the *behaviour* of individuals, groups and larger organisational arrangements. These observations were made and theories developed alongside a conceptual backdrop of models and theories from education and psychology. The discourse within the material indicates that the development of these theories is marked by four significant, but often tacit, factors:

- Theory is built on a stimulus - response focus on observable behaviour rather than an understanding of causal mechanisms.
- Theories tacitly assume and presume models of internal human functioning such as cognition. Where explicit these are also predicated on observation of external responses rather than knowledge of internal processes.
- Epistemology of new theories, and new theories themselves, are drawn relatively uncritically from fields of Psychology and Education.
- Theories are built on simple mathematical relationship models, e.g. linear relationship, feedback relationship, circular relationship, oscillatory relationship.

Neurology and Physiology as Foundations for Design Theory

Theories of affective cognition models the ways that feelings, body states, conscious and subconscious thoughts, attention and memory processes influence, or *cue*, the formation of new

thoughts and the processes of successive thought development and management (see, for example, Bastick, 1982; Damasio, 1994; Love, 2000; Mosca, 2000; Ridley, 2002).

Unlike the above simple models of reflection in action, reflection, learning cycles, and learning strategies and styles, a physiological understanding of how humans design is complex. The complexity is not born of obscure medical and biological concepts: it is that the processes that go on inside humans brains, neurological, hormonal, visceral and other physiological systems are intrinsically much more complicated, even when the description is limited to understanding them in terms of the embodied information flows. For example, viewing brain and body processes at a general level, Damasio (1994, pp. 127-164) describes more than a dozen different neurological and hormonal pathways and at least ten feedback systems involved in an individual's perception of an emotion (not including the cognitive processes such as visualising, bringing out memories, judging, creating new thoughts, or deciding on actions).

When designing, designers convert problem statements into internal problem gestalts and draw on their experiences, bodily perceptions (feelings), emotions and external information to generate multiple partial solutions to these problem gestalts, compare them imagenically in their mind's eye, and communicate these partial design solutions and their associated *design worlds* to others. It is this level of analysis that is needed for design researchers to have a sound understanding of how people design, and how people understand, and learn to utilise, designed artefacts, products, services and systems. Understanding designing and creating the foundations of design theory in reality requires an understanding of the dozens of separate physiological, neurological, infomatically-embodied feedback systems.

In terms of physiological systems, there are several processes / responses that offer a basis for the *reflective practices* described by the experiential *learning theories* of Schon and others. Cognitive neuroscience models differentiate between two affective system pathways, one of which passes through the frontal cortex, and one that does not. For those aspects of affect that pass through the frontal cortex, some may be available to conscious attention as *body states*, i.e. feelings or quale (John Dewey, 1895), whilst others come into consciousness as pre-conceptualised entities or cognitive artefacts (objects in the mind's eye) realised in the imagenic aspects of the brain.

Each of these form a causal foundation for *reflective or experiential learning* by which the human organism responds and learns. The differences between these can be seen, for example, in the potential responses from an individual putting a finger too close to a candle flame:

- **Subconscious primitive learning mechanisms** resulting in near instant removal in which *reflective* processes do not pass though the conscious mechanisms of the frontal cortex but instead involve subconscious primitive processes that result in a faster/stronger *instinctive* response next time a similar situation happens.
- **Response based on the individual's conscious perception of their somato-sensory body-based feelings**: whether direct feelings as in *hotness of the fingers* or of the *kineasthetics of movements*, or other body state parameters such as palpitations and muscular tension.
- **Response based on the individual's attention to the situation as expressed in terms of cognitive artefacts**: (such as flame, finger, heat and candle) that are, in whatever way that they are individually conceptualised, available to the individual's thinking from their prior learning.
- **Secondary somato-sensory grounded reflective feedback**: due to the individual's perception either at the time or later of the above three processes.

In working situations, the above somato-sensory *reflective processes* combine with other information-based *reflective processes*. Consider a situation in which a professional in their normal activity undertakes a task involving an aspect of reflection. Key elements are:

- The actuality of the task
- The gestalts and contexts within which the task is undertaken
- Their access of memories of previous similar tasks, gestalts and contexts
- Their access of memories of outcomes of those tasks and gestalts
- In some cases, their access of memories of situations and gestalts prior to undertaking those similar tasks
- Their access of memories of their reflection on the tasks, gestalts, contexts, prior considerations and outcomes
- Their access of memories of their judgement as to the quality of their reflective processes
- Their access of memories of their decisions, judgements and heuristics that they developed as a result of the prior reflective processes
- Their analysis of differentiating factors
- Their judgement processes that support the professional choices they make in identifying guidance form these past analyses that influence current behaviour
- Their access of memories of the reflection and reflection processes

For each of these information processes, one or more of the four responses in the previous list may apply. The combination indicates the number of aspects of a simple practical reflective task that need to be included and addressed by an adequate theory of reflection.

For reflection relating to the human activity of designing the situation is considerably more complex than that described above because it also has to include a description of the ways that reflection activities influence the complex processes associated with the generation of new thoughts: including the simultaneous (or almost so) processing of technical, social, environmental, ethical and aesthetical information with all its necessary reflection and brain-body/feeling-thought processes. In addition, alongside these issues must also be added the processes and physiological pathways associated with designers' communication of their partially conceived problem statements, *design worlds*, gestalts, partially completed solutions, and the relative evaluation of those solutions between designers and other stakeholders. Together, they indicate that a reflective practice model that satisfactorily explains sufficient of the real human processes to provide a full explanation and model for improving the outcomes of design activities is considerably more complex than *reflection theories* based on external observations of individuals' behaviour.

Discussion

The development of coherent design theories requires they are grounded on epistemologically sound foundations capable of supporting required analyses. All forms of theory about designing explicitly, or tacitly, assume and presume particular underlying theories of human functioning. Theories derived from the external characteristics of objects, here including human behaviour, cannot, by their nature, definitively explain or model the internal workings of the objects or, in this case, the internal human processes. The layered nature of theories; in which individual theories provide assumptions for less abstract theories and depend on more abstract theories; means it is not possible for theories that depend on or presume an internal human mechanism of designing to explain that mechanism.

Four core issues that a body of theory about designing and designs must address are:

1. The explanation of how designing occurs inside an individual.
2. The modelling of how users' internal processes shape their interactions with design products, services and systems.
3. The creation of new thoughts.
4. Closure, i.e. the internal human conscious and unconscious automated processes that stop, start, continue or redirect human external and internal activities.

The sketches in the preceding section also point to a more complex view of learning and reflection processes than that described in the *reflective practice* and *learning cycle/style* literatures. Human activity at an individual and social level is more complex than the *reflective practice/ reflection in action* and *learning cycle/style* models indicate.

Schon's theories of *reflection, action and practice*, Kolb's *learning cycle* and the *learning styles* of Kolb, Honey and Mumford have major limitations as foundations for building design theories because of their grounding in external observation of practice, rather than an understanding of what happens inside humans whilst they are involved in designing. They are unsuited to being foundational to theorising about designing because do not provide the data or theoretical means to infer and model deeper underlying processes of human functioning by observing the superficialities of behaviour and practice.

This is a limitation that Schon was well aware of from early on (D. A. Schon, 1987). He identified that what was really needed was a model of human cognition derived directly from an understanding of human cognitive processes and not based on observing behaviour. One way of seeing Schon's theories of reflective behaviour is that they are an approach that aims to make the best of a difficult situation limited by the lack of information about human internal processes, and an attempt to maximise the theory making potential available from external observations and individuals' subjective perceptions of their own thoughts, experiences and feelings.

Another way of viewing this situation is in terms of theorising about the internal functioning of a *black box*: an approach widely used in systems analyses. (A *black box* being one that nothing is known about its internal functioning. A *white box* is one in which everything is known about its internal processes. A *grey box* is somewhere in between.). The models of Schon, Kolb, and Honey and Mumford regard humans as a *black box* and do not look inside the box. Their theories model the relationships between humans' inputs and outputs rather than trying to understand the feelings and thoughts and internal human processes that are the causal basis of the humans' outputs. In epistemological terms, these are theories about the behaviour of objects rather than theories that explain why human behaviour occurs.

The use of *black box* systems theories as tools for developing predictive and explanatory models is however always limited by lack of knowledge about the processes inside the *black box*. The data about inputs and outputs that is collected, by its nature, cannot be used to formulate theories about why the behaviour occurs or why and how the underling processes and mechanisms are likely to produce other sorts of outcomes. In essence, the theories are at the level of explanations such as pressing harder on the brake results in the vehicle decelerating more, rather than an explanation of *how* the brake system works and *why* pressing on the brake pedal will result in the changes to the vehicle's acceleration.

The essential foundational aspect of designing, the creation of new thoughts, the management of gestalts, the communication of partially completed design possibilities between designers and other stakeholders in design processes, the interpretations and understanding of function embedded in

designed artefacts, systems and services all depend on underlying human embodied processes. These can only adequately be explained in terms of the physicality of human processes, i.e. the moment-by-moment, conscious and unconscious events and processes that result in doing, and not doing, particular activities, thinking, and not thinking, particular thoughts.

The above analysis also points to the weakness and, at this point, failure of traditional rationalist theories of cognitive science in explaining human designing, and the ways that humans interact with actualised designs. Epistemologically, practically and pragmatically, the only ways to establishsound foundations for building theory about how human beings undertake designing, and how they interact with designed products, systems and services is to focus on the internal processes revealed in the physiology of real humans.

As a postscript to this discussion, it is necessary to acknowledge that theories about *reflective practice, learning cycles* and *learning styles* have been attractive to design educators and practitioners. In most cases, it appears that the reasons are because they offer political benefits rather than because they provide sound theory foundations. The most obvious benefits are that they align well with ideas that prefer:

- Design learning as a master/apprentice relationship
- Design critique and evaluation should be based on designers *explaining* their designs, or that designs should *explain* themselves
- Experiential learning supports arguments that design education should be based on craft skill training modalities.
- The learning cycle echoes simple models of design process in which a practical design problem is explored, some ideas for solutions are conceived, these ideas are investigated and tested, and eventually a plan is chosen or confirmed as a new idea/design.
- The segregation of professional expertise into categories that indicate designers are a unique breed. The learning style divisions fit well with customary biases that designers must by nature be *divergent* and free thinking, whereas theoreticians are *assimilators* building models of things, engineers and scientists are *convergent* appliers of models, and professionals such as managers and manufacturers work with models in concrete, real environments.

If uncritically viewed, the *learning cycle* also provides justification for a description of designing in which the designer/ practitioner starts off from a concrete situation, reflects on the situation, and as a result of that reflection, produces ideas, and then experiments with them to create new knowledge: a description that can be interpreted to imply that design practice should be viewed as identical to research.

Conclusion

Building sound underlying theories about the activities of designing and the ways that humans use of designed outcomes requires a different and more fundamental approach than that available through theories of organisational and action learning such as the theories of reflective practice, learning cycles, and learning styles described earlier.

The development of foundation theories in the areas of designing and the use of designed products services and systems must go deeper than theories about individuals' *reflective practices, sequences of learning*, or simple categories of *learning styles*, In epistemological terms, these latter models lie *alongside* design theories rather than offer foundations for them. Theories based directly on the

underlying human physiological mechanisms of designing, and the embodied mechanisms that underpin how individuals interact with designed products, services and systems and other aspects of their external environment offer a sounder foundation for a body of knowledge on designing and designs. This has not yet been adequately developed in the design research field.

At a pragmatic level, contemporary brain research is beginning to offer simple heuristics on which to build higher-level design theories. Evidence is emerging that supports some socio-psychological theories such as the role of attention in Constituent Market Orientation theories, and points to weaknesses in others as described above. It also offers direct causal explanations (Damasio, 1994) for anecdotal concepts such as:

- Light complex, innovative fast modes of thinking are associated with positive, happy, relaxed body states.
- Slow, repetitive, limited thinking - associated with tense, negative, painful, distressed body states

In summary, theories of organisational psychology and experiential learning (such as reflective practice, learning cycles and learning styles) offer consultants and managers models that indicate that if certain things are done then certain consequences are likely to result. For educationalists, they indicate that some educational approaches are more likely to be effective than others in specific situations when assessed against particular criteria. For those involved in managing organisational learning processes in commercial organisations, they offer both. Their use as theory foundations is, however, epistemologically unjustified.

For design researchers wishing to build theory on sound foundations, the human physiological mechanisms that underpin human creative thinking, feeling, values, judgement, decision-making and motivation are more appropriate

References

Argyris, C., & Schon, D. A. (1974). *Theory in practice: increasing professional effectiveness* (1st ed.). San Francisco: Jossey-Bass Publishers.

Argyris, C., & Schon, D. A. (1978).*Organizational learning: a theory of action perspective*. Reading, Mass: Addison-Wesley Pub. Co.

Bastick, T. (1982). *Intuition: How we think and act*. England: John Wiley and Sons.

Craig, D. L., & Zimring, C. (2000). Supporting collaborative design groups as design communities. *Design Studies, 21*(2), 187-204.

Damasio, A. (1994). *Descartes' Error: Emotion, Reason and the Human Brain*. New York: Grosset.

Dewey, J. (1895). The Theory of Emotion. (2) The Significance of Emotions. *Psychological Review, 2*, 13-32.

Dewey, J. (1933). *How we think: a restatement of the relation of reflective thinking to the educative process*. New York: D.C. Heath and Company.

Dorst, K., & Cross, N. (2000). Creativity in the design process: co-evolution of problem-solution. *Design Studies, 22*(5), 425-438.

Dorst, K., & Dijkhuis, J. (1995). Comparing paradigms for describing design activity. *Design Studies, 16*(2), 261-274.

Ekpenyong, L. E. (1999). A reformulation of the theory of experiential learning appropriate for instruction in formal business education. *Journal of Vocational education and Training, 51*(3), 449-471.

Honey, P., & Mumford, A. (1982). *The Manual of Learning Styles*. Berkshire, UK: Peter Honey.

Kolb, D. A. (1985). *Experiential Learning: Experience as the Source of Learning and Development*. New Jersey: Prentice-Hall Inc.

Kolb, D. A. a. F., R. (1975). Toward a theory of experiential learning. In C. Cooper (Ed.), *Theories of Group Process* (pp. 33-57). London: John Wiley.

Kolb, D. A. a. F., R. (1985). *Experiential Learning*. New Jersey: Prentice-Hall.

Lewin, K., & Cartwright, D. (1952). *Field theory in social science: selected theoretical papers*. London: Tavistock.

Lewin, K., & Lewin, G. W. (1973). *Resolving social conflicts: selected papers on group dynamics*. London: Souvenir Press.

Love, T. (2000). Computerising Affective Design Cognition. *International Journal of Design Computing, 2*.

Mosca, A. (2000). Review Essay on Antonio Damasio's 'The Feeling of What Happens: Body and Emotion in the Making of Consciousness'. *Psyche, 6*(10).

Ridley, R. M. (2002). *Brain Mechanisms of Memory and Cognition: Cognitive Neuro Science Neural Basis of Selective Attention; the Binding Problem*. Available: http://www.psychol.cam.ac.uk/pages/teaching/NST II Dr Ridley Brain Mechanisms of Memory and Cognition/ .

Schon, D. A. (1973). *Beyond the stable state: public and private learning in a changing society*. Harmondsworth, Middlesex: Penguin Books.

Schon, D. A. (1983). *The Reflective Practitioner*. New York: Basic Books Inc.

Schon, D. A. (1987). *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass Publications.

Schon, D. A. (1992). Designing as Reflective Conversation with the Materials of a Design Situation. *Research in Engineering Design, 3*, 131-147.

Schon, D. A., & G, W. (1992). Kinds of Seeing and their functions in designing. *Design Studies, 13*(2), 135-156.

Stumpf, S. c., & McDonnell, J. T. (2002). Talking about team framing: using argumentation to analyse and support experiential learning in early design episodes. *Design Studies, 23*(1), 5-24.

Valkenburg, R., & Dorst, K. (1998). The reflective practice of design teams. *Design Studies, 19*(3), 249-272.