# A Philosophical Approach about User Experience Methodology

Marcos N. Beccari and Tiago L. Oliveira

Departamento de Design , Universidade Federal do Paraná, Rua João Ramalho, 302 - casa07, Curitiba, 82820280, Brazil
contato@marcosbeccari.com, etsete@gmail.com

**Abstract.** The purpose of this paper is to identify some of the possible contributions of the entitled Philosophy of Design to the processes involved in the User Experience methods. After a brief introduction on User Experience principles and methods, we will make a brief overview of the history of research in Design. Moving on we shall review some of the main precepts of Philosophy of Design and, finally, make evident the scientistic and pragmatic predominance of the User Experience methods.

**Keywords:** User Experience Methodology, Philosophy of Design, Post-Positivism, Terence Love.

## 1 User Experience Methods

According to ISO 20101, User Experience involves human perceptions and responses that result from the use (or the anticipation of use) of a product, system or service. The User Experience includes all emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and achievements that occur before, during and after the use of a product. Bevan (2009) shows that the difference between User Experience and Usability is not exactly the measurements or methods used, but on the emphasis and focus established during the development of a product. User Experience points to a more global projective goal: not just attain effectiveness, efficiency and satisfaction, but it aims to enhance the entire experience of the user, from the expectation, through interaction and finally the reflection about the experience (op. cit.).

In a practical sense, User Experience probes to get closer to the user as a human being and not just the limited situation such as facing a particular product. Instead of concerning only in identifying and correcting problems, methods in User Experience question about what people do and why they do it. Still, there are methods in common with Usability, among these: Longitudinal Studies, Ethnography, Contextual Inquiry, Interview Retrospective, Focus Group and Daily. However the goal of this work is restricted only on some specific methods or techniques of User Experience, collected and described by Law et. al. (2009).

The first to be mentioned are called Emocards. It consists in 16 cards containing facial expressions, distributed in points along a circle divided in four parts: intense unpleasant, intense pleasant, calm unpleasant and calm pleasant. Crossing the circle, there are scales of values of satisfaction and provocation which are assigned to the

A. Marcus (Ed.): Design, User Experience, and Usability, Pt I, HCII 2011, LNCS 6769, pp. 13–22, 2011.

product. After a simple survey, its calculated the number of times each value was mentioned. Similarly, the method "PrEmo" uses animation to represent positive and negative emotions. The graphic animation of the body language combined with facial expression provides basic details on the representation of an emotion. After collecting data, results are compares and a final graph is generated.

As for the photographic language, the Moodboards evaluate, by means of questionnaires, the mood, perception and one's desires during the interaction with a product. For example, three different pictures form alternatives to answer the question "Which images best represents the environment where you want to use this product?".

Presenting with more options, Reaction Cards are a set of 118 adjectives or phrases that are selected by users to describe their interaction with the product and their perception of its qualities. When it comes to digital monitoring of the users interaction with a system, the instrument "True" is largely used: one records all interaction and intercalates it with contextual questions in certain periods of time. The behavioral data are then compared with data regarding users attitudes towards the system. Similarly, though focussing on the evaluation of online systems, Attrakdiff is an instrument based on a semantic differential with a 7 point scale: the user selects a position that can go from "confusing" to "clearly structured", for example.

In the face of these and many other examples of User Experience methods, how has the designer been acting? Which have been the foundations of their methodology? Does Design has its own body of knowledge? These are the kind of reflections that permeate this work. It is easy to see that User Experiences methods and techniques as a project discipline, even having its singularities, does not make clear what are the epistemological foundations on which they stand, making clear only the objectives they seek. There is no concern with the knowledge that precedes such methods - being only questionnaires that long to turn subjective facts into something objective strictly in order to "make it work". Our attempt here is to emphasize the pragmatic nature of the User Experience methods, so we will no longer simply define concepts as we have done so far, our attempt is to now open paths that starts from a philosophical attitude and points to a plural understanding of User Experience as a theoretical field. With this in mind, we will not break away completely from the methodological modulation of User Experience, but on the other hand, we wish to demonstrate how this modulation becomes fragile and perplexed when the perspective for the analysis is Philosophy of Design..

## 2 Historical Overview of Design Research

Before we analyze the existing epistemological paradigms in the User Experience approach, we shall take this opportunity to briefly raise some of the historical premises regarding Design Research that are essential to understand these paradigms. A context in which the modern discourse prevailed in Europe, form follows function or functionalism was the dominant tenet for decades in architecture and Design (FONTOURA, 1997). According to Cross (2007), Design Research initiated only with the first Conference on Design Methods, held in London in 1962. In an attempt to consolidate Design methodology as a scientific discipline, the Design Methods

movement sought to replace the intuitive process, still recurrent at the time, for the application of purely scientific and rational procedures, operational research methods, management techniques of decision making, creativity techniques, etc.

If in the 1960s the motto was to standardize and rationalize, the 70s was marked by the rejection of scientific Design methods of (op. cit.). However, the second generation of researchers, drawing on the pragmatist ethics of reasonableness, facilitated applied research and maintained the scientific status of Design. This made possible, in the 80s, a period of solid achievement of Design Research with the emergence of Design Research scientific journals2. Opposed to the pragmatism of the Design Engineering movement, the Italian Il Nuovo Design3 wanted the return of the inductive method by means of a a paradigm shift process in the sense give by Thomas Kuhn, in the project methodology. It was a critical and reformist position that followed a distinct path from the emerging Design Think, a third strand that wanted to study Design on its own, that is, based on the premiss that Design has its own objects of study and its own ways of knowing them.

It is only that in the 90s, as Cross (2007) points out, that Design would reach its adulthood with a significant expansion of conferences and journals. On the other hand, it is in this context that emerges the recurrent Philosophy of Design, a movement that criticizes the fragmented tendency of confusion, fusion and multiplicity in Design Theory.

## 3 Philosophy of Design

*"That there exists a substantial amount of confusion with respect to the underlying basis of many theories, concepts and methods. That in developing and validating theoretical aspects of the study of design, many writers are unjustifiably conflating concepts drawn from a range of sources. That there exists an unnecessary multiplicity of design theories and concepts. That the terminology of design research has become unnecessarily and unhelpfully confused and imprecise by dint of the above points"* (LOVE, 2000, p. 295)

Love had noticed this since 1992, in attempts to collect the main theoretical terms in the Design research literature in his publication Social, Environmental and Ethical Factors in Engineering Design Theory: a Post Positivist Approach (LOVE, 1998). After observing that there are so many different variations of Design and Design Processes as there are authors who write about them, different authors that use the same words for different concepts or refer to the same concepts with different words, Love (1998) acknowledged in his cataloging proposal an almost impossible task. Eder (1981) had already listed several words that were used with different meanings in Design Research, concluding that their meaning depended solely on the cultural context in question. Thus, the problem of internal confusion in Design Research became recurrent in the early 90s, and facing an increasing conceptual indeterminacy of Design, many researchers have proposed countless solutions or ways to deal with it. Some sought only to critically examine the various existing concepts, others preferred to organize and systematize what they considered to be Theory of Design.

Adopting Love's (2000) definition of Philosophy of Design, we will list here some authors that also refer to a philosophy of Design to understand its true meaning and

shape that User Experience takes as a result of that. Remembering that Design Theory is the discipline that investigates Design Methodology, Design Methods, Design History, among other studies that attribute a role, a consistency and validity to Design as an area of research (op. cit.). Philosophy of Design, on the other hand, would be a discipline apart that tries to investigate Design Theory as its object of study, and can also be considered a meta-theory (op. cit.).

This new discipline was initially proposed by some collaborators of the international journal Design Studies. Terence Love (2000) elaborated an analytical and meta-theoretical approach for the construction of a unified theoretical body to Design, and two years later, published the article Constructing a coherent cross-disciplinary body of theory about designing and designs: some philosophical issues4 (LOVE, 2002) in which some of the key elements are proposed for a more coherent grounding to research and construction of theories in Design. Noticing a growing number of researches5 interested in developing a unified theoretical body of Design, Love describes the inconclusive increase of theoretical conflicts between researchers in different contexts. To Calvera (2006, p. 100), "the situation can be seen as the fight of a young discipline against his parents, older and sometimes conservative. "Such conflicts will increase the difficulty of theoretical validating that takes account epistemological and ontological aspects - which could define according to Love (2002), a consistent body of Design Theory. The lack of clarity on the focus, range and limits of existing theories generates more obstacles every year for initiating researchers (graduate students) who seek to establish a satisfactory literature review for their research, not being able to identify the epistemological foundations facing a wide variety of theoretical perspectives (op. cit.).

"*The analyses in the paper point to a significant political question to be resolved by the field: whether researchers who have an investment in past literature with its philosophically problematic foundations and domain-specific theories can be persuaded to support the development of new and more coherent cross-disciplinary foundations and the building of a single body of theory and knowledge about designing and design*s." (LOVE, 2002, p. 359).

Before investigating exactly how Design researchers are merging many concepts inappropriately, Love (2000) explains how these mergers may occur and how they can lead to the incorrect development of Design theories: If A is related to B and B is related with C, then A is related to C. Initially it is a mistake in the relationship between abstract entities - "The cat has four legs and a dog has four legs therefore a cat is a dog" (LOVE, 2000, p. 297). Although it recurs to the primary socratic rhetoric6, the intention here is to show how logical reasoning can lead us to inappropriate associations that, once taken as theoretical grounds, can generate naively equivocated conclusions, or fallacies. For instance: "Designers think and cognitive psychologists study thinking, therefore, research into design lies within the discipline of Cognitive Psychology" (op. cit.). As much as this type of deduction are not made in a such naive way in Design, Love's distrust points to the uncontrolled production of literature related to Design research since the 50s. Even with hundreds of books and articles published every year, theories are speculative proposals coming from a wide variety of theoretical perspectives, however, they are not sufficient to make an epistemological and ontological analysis (op. cit., p. 298). This is because

there is little agreement on fundamentals aspects (such as the definition of the word Design), but this does not prevent research to continue to develop in a fragmented way in various theoretical provinces (op. cit.).

In this context, the misguided and naive associations become inevitable in a theoretical development with a temporal base, that is, as attempts are made to describe patterns in theories made by previous generations (op. cit.). One of the first authors to propose a "simplification in the research paradigm of Design" was Cross (1984) when trying to map some of the themes that were being developed sequentially, each assigned to correct the failures of its predecessor. In other words, Cross (op. cit.) identified some chronological paradigms that use the same terms and concepts to refer to different meanings according to each historical context. The thematic thread of these paradigms goes to the following direction: management of the Design process, the structure of Design problems, the nature of the Design activities; reflections on the fundamental concepts of Design (op. cit.). Love (2000) suggests the addition of two other themes to this developmental paradigm: knowledge about the environment in which Design occurs, and the necessary knowledge to conceive Design, that is, about objects and Design processes7. Ten years after his paradigmatic analysis, Cross (1993) abandons his kuhnian approach and recognizes such naive mergers described by Love in a "conflactionary" development of theories that crosses through all paradigms simultaneously, thus creating a terminology confusion. Dixon (1988), on the other hand, confronts this terminological confusion by arguing that research in Design still is in a pre-theoretical stage, that is, only with the purpose of establishing "testable" scientific theories to Design, and all attempts established so far, however, are impossible to be applied in practice (op. cit.).

Anyway, it is not hard to notice a post-positivist trend among most researchers, including Love, that proposes a philosophical approach to the theories of Design. Mainly represented by Karl Popper and Thomas Kuhn, post-positivism (also called post-empiricism) is a philosophical movement that seeks to criticize and improve positivism in a meta-theoretical way (ZAMMITO, 2004). Following Poppers principle of falsifiability, design philosophers declare that is impossible to verify whether a theory is true, although it is possible to identify false theories when they are arranged in a manner favorable to refutation. Kuhn's perspective is adopted with the conception that not only individual theories, but all world-views should change in response to evidence presented in each cultural-historical paradigm. This argument is defended, for example, in Margolins (1992) on investigating the foundations of the cultural basis behind Design History. Recurrent in the social sciences for practical and conceptual reasons, post-positivism is not a pure form of relativism, because it still preserves many foundations from positivism: the ontological realism, the desire for objective truth and the use of experimental methodology (PHILIPS, BURBULES, 2000 ).

By following this path, Design philosophers believe that, generally, human knowledge is not based on incontrovertible truths, but only on hypotheses. If we build a brief timeline on the influence of post-positivist in the Philosophy of Design, we could begin the research with Thomas and Carroll (1979) who hypothesized that Design is best conceived with theories that value the individual and psychological dimension. As a deployment to this, Daley (1982) starts to examine the role of objects in a psychological dimension, while Dilnot (1982) notes that the limitations of the

definitions of Design generally exclude the social context in which they operate. This motivated Broadbent (1984) to critically discuss the theories constructed in Design, directly influencing the investigations of Coyne (1990, 1991) that assumes an increasingly post-positivist character. A short time later, Sargent (1994) proposes for the first time a meta-theoretical discussion to argue about the impossibility of an unification between science and design, claiming the existence of an incommensurability of views on research in Design. In the same direction, Liddament (1999) is concerned with "coded" and "computational" nature of the research in Design as a limitation to the ontological, epistemological and methodology development of Design. Simultaneously, Galle (1999) explores how the definition of Design is dependent on the explanation of human agents in different interactive situations. Finally, it is also worth mentioning the new approach proposed by Oxman (1999) for a Design education focused on the dialectical nature of the word Design, associating cognitive theories with the post-positivist epistemology.

However, it is especially with Bamford (2002), in his article From analysis/ synthesis to conjecture/analysis: a review of Karl Popper's influence on design methodology in architecture, that post-positivist influence in philosophical research in Design peaked. "All designing (...) can reasonably be described as hypotheses or, in some respects, conjectures, given the usual unknowns and uncertainties." (BAMFORD, 2002, p. 260). While Bamford (op. cit.) recognize that Design is not literally made out of trial and error, his critical thinking goes against the analysis / synthesis that would be prevalent in the Design methods, that is, deductive reasoning. Instead, Bamford (op. cit.) proposes an inductive reasoning, especially by means of analogies. Returning to Schön's (1988) assumption that both guesswork and technical knowledge, ideas and algorithms are part of the problem solving process in Design, Bamford (2002) is positioned in a more unilateral way demonstrating reasons to reject the analysis / synthesis in favor of conjecture / analysis.

Bamford's (2002) article was published in the 23rd Volume of the journal Design Studies, being this issue specifically dedicated to the emerging issue of Philosophy of Design. In the article that closes this issue, Love (2002) complains that the word Design and its derivatives such as projects and the verb project are being used in a sense quite diluted in the literature. After postulating that all the key concepts in Design should be chosen more carefully, Love (op. cit.) proposes a particular conception of Design as being a primary function of man similar to thinking and feeling. In a similar vein, Houk, Vermaas, Dorst and Vries (2002) suggest a definition of Design as a specific type of action, something that involves plans, intentions and practical reasoning. With respect to the issues raised by Bamford (2002) on methodology of Design versus scientific methodology, Kroes (2002) considers the Design methodology extremely prescriptive and process-oriented, as opposed to classical scientific methodology, that he believes to be descriptively and product-oriented. Following this assumption, Kroes (op. cit.) believes we should establish some criteria for measuring quality, success and failure of the process in Design. Trott (2002) also accuses the lack of criteria quality in Design ("standards of excellence", as she calls it), suggesting the platonic maximum (types or properties of abstract thought and timeless, as entities existing independently of their instances) as a source to such criteria. A third philosophical approach to quality in Design is suggested by Baljon

(2002) that, through a systematic analysis of some historical evidence, seeks to elucidate the mechanisms of success of the "canons of Design". Interesting to point out that the approach of Baljon (op. cit.) is purely historicist, that is, it is considered that the history of Design is more important than any other theory.

In opposite to the normative criteria of quality for Design, as well as for the recurrent Popperian empiricism, Coyne, Park and Wiszniewska (2002) prefer to adopt a terminology of the phenomenological analysis, specifically Heidegger's notion of "revelation"8 applied to the Design process. Such an approach naturally gives emphasis to the artifacts produced in Design: on one hand they are physical objects with a certain structure on the other are also intentional objects with a given function. This "dual nature" of objects is also exploited by Kroes (2002) that, through an analogy with the principle of Niels Bohr9, posits that it is not clear, philosophically speaking, the relationship between function and structure of an artifact, particularly referring to the transition between one concept and another. Working with Kroes in a project in common, Houk, Vermaas, Dorst and de Vries (2002) mapped in detail a sequence of actions to specify both the physical structure of an object and the fulfillment of its function. Extending this issue to the collaborative Design framework, Bucciarelli (2002) contends that linguistic is what allows designers to fill the gap between function and structure. However, Bucciarelli (op. cit.) rejects the possibility of a strictly rational and instrumental method for reconciling the linguistic differences, since designers are satisfied with very limited linguistic. Similarly, Bestelius and Doevendans (2002) rejects any attempt to reconcile the multiplicity of views, although proposing an alternative to explore rhetoric as a way of undermining the prevailing pragmatism.

This predominance was identified after an historical analysis on the transition of "modernity" to "postmodernity" in the Design field, analysis made by this Bestelius and Doevendans (op. cit.) and Bamford (2002). Proposing paradigm shifts in patterns of thought in Design, both researchers report that the methods of Design are as antiquated as the scientific methods adopted in the seventeenth century (op. cit.). With this, we return to the meta-theoretical analysis, prevalent in almost all authors, including Baljon (2002) - in this case, the author adopts a historical meta-analysis as a philosophical explanation to history itself. This trend (if it can so be called) is against Love's (2002) proposal for a unified theoretical body of knowledge about Design. It is "a foundation for research and theory in Design and a coherent and interdisciplinary theoretical body of knowledge that is not confused with other disciplines" (op. cit. p. 345). To this end, Love suggests a system of research areas to be further explored in Design, discusses the delimitation of some fields of knowledge close to Design and offers guidance for the definition of key concepts for building theories of Design. However, this proposal contradicts Bucciarelli's (2002) empirical findings about the impossibility of a unified language for Design, just as it does not corroborates the apparent complementarity of physical concepts and intentional artifacts dictated by Kroes (2002). It can be noticed, therefore, a first point of disagreement between these authors, while some do not believe in the possibility of building a unified body of theory in Design, defending that the multiplicity of theoretical perspectives somewhat positive, others are concerned about how to develop such pretension.

## 4 Philosophical Questions on User Experience

In face of this brief overview, the following pertinent question is: has the whole taxonomy contained in our methods been working in User Experience? Can any result of the interaction process between user and product be considered consensual? And can all Design projects be viewed as a structured consensus? These are statements on which, despite being in full accord with the pragmatist logic, does not manifest a significant impact on the theoretical development of the discipline of User Experience. The issue can not be summarized only in "the user has the mere status of an isolated stage in the Design process, or should be simultaneously focused along with all stages?" because the problems brought by Philosophy of Design is in the process itself that is faced with the dilemma: "user experience as means or end?".

In the user experience as means to achieve a particular end, the end is constantly simulated in a mechanism of a "funnel", that is, it is not the ideas that already exist that must be controlled, but those that should not exist, excluding all those considered unacceptable. It is therefore a dialectical and manichean reasoning, in which occurs the overlap of a thesis and an antithesis in order to reach a synthesis previously stipulated. On the other hand, when the User Experience is seen as the goal, it presented, from the beginning, its end, as if it had always been like that, that is, an edifying intent based on an idea already built. In this case, everything we do due of something else is considered partial, in order to achieve efficiency as a function of itself. In both cases, it is believed that each user thinks not only in their own situation of use, but also in the process as a whole, coming to a result partially predicted as a concrete consequence.

The question that calls for great attention to User Experience researchers refers to the Popperian prerogative that you can only identify false experiences, and only when they are arranged in a favorable manner to refutation. As Bamford (2002) postulates, the logic of conjecture / analysis, instead of the consolidated analysis / synthesis, could contribute in the processes of Design in the extent that it puts in vogue the hypothesis under which its pretended to be analyzed. If in one hand it was possible to find, as referred to Philosophy of Design, an approach that is at the same time critical and progressive, on the other hand, one can not identify a coherent position on the User Experience methods - dealing with philosophical proposals that do not systematized, that merely resume ancient empirical techniques that only make evident the predominant scientism and pragmatism in Design.

It is true that the Design field, that to this point was guided by objective and concise criteria, is now being seriously questioned. If on one hand it highlights a fertile ground for new research, on the other there is a risk of no significant evolution in case our production happens in a unilateral way, without taking into account different points of view. The universal claim of user-faced models - which in fact are very effective in their contexts - manifested it self in statements that are intended to be self sufficient in any situation. Now, if we take Design in a too orderly and streamlined way, we can ignore our eternal user and subject matter: the human being. We believe this is the great role of Philosophy of Design on User Experience, regardless of what epistemological position is adopted: to examine and problematize, under a philosophical dignity, the methods used - leaving aside, even if provisionally, the so desired project solutions

Our considerations and questions could not take us any further than this. It would be necessary now raise other questions such as: User Experience must focus on the users intention or their uncertainties? Would the User Experience methods be a more effective mean to the Design than Design it self? A structured project focusing exclusively in User Experience, where the user guides the whole process, can still be considered a project of Design? How can we separate and measure the importance of each step in a User Experience project? This is what we would like to discuss in a future article

## References


1. Baljon, C.J.: History of history and canons of design. Design Studies 23, 333–343 (2002)
2. Bamford, G.: From analysis/synthesis to conjecture/analysis: a review of Karl Popper's influence on design methodology in architecture. Design Studies 23, 245–261 (2002)
3. Bestelius, I., Doevendans, K.: Planning, design and the post-modernity of cities. Design Studies 23, 233–244 (2002)
4. Bevan, N.: What is the difference between the purpose of usability and user experience methods? In: Proceedings of the Workshop UXEM 2009 (INTERACT 2009). ACM Press, Uppsala (2009)
5. Broadbent, G.: Design and Theory Building. In: Cross, N. (ed.) Developments in Design Methodology. John Wiley, UK (1984)
6. Bucciarelli, L.L.: Between thought and object in engineering design. Design Studies 23, 219–231 (2002)
7. Calvera, A.: Treinando pesquisadores para o Design: algumas considerações e muitas preocupações acadêmicas. In: Design em Foco, vol. III(001), pp. 97-120. EDUNEB, janeira-junho, Salvador (2006)
8. Coyne, R.D.: Objectivity and the design process environment and planning. Planning and Design 19, 361–371 (1990)
9. Coyne, R.D., Snodgrass, A.: Is designing mysterious? Challenging the dual knowledge thesis. Design Studies 12(3), 124–131 (1991)
10. Coyne, R., Park, H., Wiszniewski, D.: Design devices: digital drawing and the pursuit of difference. Design Studies 23, 263–286 (2002)
11. Cross, N. (ed.): Developments in Design Methodology. John Wiley, UK (1984)
12. Cross, N.: Science and design methodology: a review. Research in Engineering Design 5, 63–69 (1993)
13. Cross, N.: Editorial: Forty years of design research. Design Studies 28, 1–4 (2007)
14. Daley, J.: Design creativity and the understanding of objects. Design Studies 3(3), 133–137 (1982)
15. Dilnot, C.: Design as a socially significant activity: an introduction. Design Studies 3(3), 139–146 (1982)
16. Dixon, J.R.: On a research methodology towards a scientific theory of design. In: Newsome, S.L., Spillers, W.R., Finger, S. (eds.) Design Theory 1988, Springer-Verlag, Berlin (1988)
17. Eder, W.E.: Report on workshop W3. In: Hubka, V., Eder, W.E. (eds.) Schriftenreihe WDK 7 Results of ICED 1981, Rome, Heurista, Zurich (1981)
18. Fontoura, A. M.: As manifestações pós-modernistas no desenho industrial e suas repercussões no ensino do projeto de produto. Dissertação de Mestrado em Educação – Pedagogia Universitária. PUC-PR, Curitiba (June 1997)

19. Galle, P.: Design as intentional action: a conceptual analysis. Design Studies 20(1), 57–82 (1999)
20. Houkes, W., Vermaas, P.E., Dorst, K., De Vries, M.J.: Design and use as plans: an action-theoretical account. Design Studies, 23, 303–320 (2002)
21. Kroes, P.: Design methodology and the nature of technical artefacts. Design Studies 23, 287–302 (2002)
22. Law, E., Roto, V., Hassenzahl, M., Vermeeren, A., Kort, J.: Understanding, scoping and defining user experience: a survey approach. In: Proceedings of the Human Factors and Computing Systems 2009. ACM Press, Boston (2009)
23. Liddament, T.: The computationalist paradigm in design research. Design Studies 20(1), 41–56 (1999)
24. Love, T.: Environmental and Ethical Factors in Engineering Design Theory: a Post positivist Approach. Praxis Education, Perth, Western Australia (1998)
25. Love, T.: Philosophy of Design: A Meta-theoretical Structure for Design Theory. Design Studies 21, 293–313 (2000)
26. Love, T.: Educating those involved in changing human futures: a more coherent programme for design education. In: Swann, C., Young, E. (eds.) Re-inventing Design Eucation in the University. School of Design, pp. 242–248. Curtin University of Technology, Perth (2001)
27. Love, T.: Constructing a coherent cross-disciplinary body of theory about designing and designs: some philosophical issues. Design Studies, 23, 345–361 (2002)
28. Margolin, V.: Design history or design studies: subject matter and methods. Design Studies 13(2), 104–116 (1992)
29. Oxman, R.: Educating the designerly thinker. Design Studies 20(2), 105–122 (1999)
30. Phillips, D.C., Burbules, N.C.: Postpositivism and Educational Research. Rowman & Littlefield Publishers, Lanham & Boulder (2000)
31. Sargent, P.: Design science or nonscience. Design Studies 15(4), 389–402 (1994)
32. Schön, D.: Towards a marriage of artistry and applied science in the architectural design studio. JAE 41(4), 4–10 (1988)
33. Thomas, J.C., Carroll, J.M.: The psychological study of design. Design Studies 1(1), 5–11 (1979)
34. Trott, E.: Permanence, change and standards of excellence in design. Design Studies 23, 321–331 (2002)
35. Zammito, J.H.: A Nice Derangement of Epistemes. Post-positivism in the study of Science from Quine to Latour. The University of Chicago Press, Chicago & London (2004)