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# Methodological Bricolage – What does it tell us about Design?

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*Abstract*— This paper explores an approach to design research that is becoming more prevalent in practice-based doctoral studies and examines what it tells us about the current state of design research. A previous examination of design PhD case studies has shown that the bricolage approach is evident in a majority of contemporary practice-based design PhDs [1]. The usual academic norm of using an established method or methodology is often discarded in favour of a ‘pick and mix’ approach to select and apply the most appropriate methods. Does it suggest a discipline in crisis, where existing methods are unfit for purpose? Or does this suggest that design as a discipline is maturing and developing a distinct research model? Is design undisciplined? The paper answers these questions by proposing that design researchers navigate a complex, indeterminate and temporal framework where the bricoleur is the best operative.

*Keywords*—methodological bricolage; design research approaches; practice-based design phds

## I. INTRODUCTION

A recent analysis of doctorates in design has identified four common characteristics of research approaches found in the exploration of practice-based design research questions [1]. They are: 1) a ‘bricolage’ approach to research design, 2) reflective practices, 3) the use of visual approaches and 4) thesis-structural innovation. These characteristics have been derived from an examination of a range of design theses and using a number of design research frameworks [2-4] to identify the epistemological and methodological models applied. This paper has chosen to focus on one of the four characteristics, the bricolage approach to method construction, as it is seen to be a common feature evident in all six studies. The bricolage method consists of combining methods from the social sciences, humanities, and hard sciences to derive a suitable model of inquiry.

While we acknowledge that design research investigates different issues that require studies into a range of subject areas such as the material, historical, scientific, social and psychological, the focus of this paper is the exploration of research questions derived from practice-based questions. In other words, it focuses on design activities that are used to generate new knowledge and understanding in and of itself.

We posit that the adoption of methodological bricolage is a necessity in design research due to the indeterminate nature of design. If we assume that this approach is a reflection of a ‘designerly’ way of researching (rather than thinking, based on Cross’s ideas), then what does the adoption of this approach tell us about design? In the spirit of a designerly approach, this paper is about raising questions rather than providing any definite answers. We begin by setting the scene, providing background to the issue of theory construction in design research and specifically describing how a methodological bricoleur operates. The body of the paper is dedicated to the presentation of three probable scenarios that offers insight into the current state of the design field. We conclude by highlighting the importance of indeterminacy as a key condition for design research, and what this implies for the education of the doctoral candidate and design education.

## II. CONTEXT

### A. *Is there such thing as a design research model?*

“The objectives of design research are the study, research, and investigation of the artificial made by human beings, and

the way these activities have been directed either in academic studies or manufacturing organizations” [5:16].

In contrast, the objective of scientific research is the study of the pre-existing natural world, in order to explain it, while the objective of humanities research is to study the human experience. The object of design research is therefore very different from these two dominant approaches, yet the overriding research model for design is still heavily borrowed from these two traditions. The philosophy of a design method has been slow in developing. The design research community initially tried to ‘scientific’ design methods in the 1960s, which they then abandoned by the 1970s, as design researchers were beginning to question the philosophical foundations on which design methods had developed [6-8].

Since the abandonment of the ‘design as science’ approach, the design research community has continued to rely on other disciplinary models to inform and validate its own practices. A possible reason why design research has failed to progress significantly since the 1960s has been due to the lack of practicing designers engaging in critical exploration of the subject. Although designers often understand that what they do at least partially involves research [5], they rarely develop explicit theoretical and philosophical frameworks based on their work. Dedicated research cultures - in the form of stable segments of practice devoted primarily to the exploration of new ideas in the field - remain rare [9].

In the last 10 years the design research landscape has been changing, increasingly populated by researchers trained initially as professional designers, rather than from external fields. This shift from non-designers asking questions of the discipline to designers themselves asking questions is becoming more evident in the way research questions are conceptualised and investigated (for example the increasing use of practice-based research). Durling, Friedman and Guntherson [10] describes practice-led research as ‘a study where practice is used as an interrogative process’ while Rust, Mottram and Till [11] emphasize that design practice has to play an instrumental part in an inquiry. The type of research described here has been described in

various ways, the most popular terms used are ‘practice-based’, ‘practice-led’ and ‘design-oriented’. However models of design research are still poorly defined, with vague characteristics and generalised approaches that borrow heavily from other disciplines. A UK Council for Graduate Education report published in 2000 [12] specifically called for more research models and exemplars to be made available to research students and supervisors. As yet, a critical in-depth investigation has yet to emerge that clearly defines the models of design research, its epistemological positions, methods used and its value to the discipline and beyond.

### *B. Knowledge from making*

Design provides an alternative approach to the way questions are raised surrounding the perspectives and visions of the future through its ability to make real alternative futures in a tangible and visible way. And yet, within the design discipline, there is a lack of understanding and consensus on the epistemological and methodological framework designers are using. A particular stumbling block has been the epistemological issues around artefacts and their making, which do not tend to sit neatly in academic traditions which favour the written word, see for example Rust’s work on this [11, 13].

The debate whether tacit knowledge (know-how) is equivalent to knowing has been ongoing in design since the academisation of the discipline. Niedderer’s research [14, 15] derived from a study of craft practice has shown that conventional research prioritises explicit and propositional knowledge because of its language-based mode. Research therefore excludes certain kinds and formats of knowledge associated with practice, which are often called practical, experiential, personal, or tacit knowledge and which evade verbal articulation. Her work looks into the role of practice and the design project in the generation of knowledge, in particular research. Her work draws on preceding arguments made by design theorists such as Durling, Biggs and Friedman on the validity of practice-led knowledge in design [16-18], rigour and research in practice [19] and theory construction [20, 21]. Although it is still a heavily debated form of research within

research practice, we would argue that it is one that is closest to the core of design and remains the bridge between design research and design practice.

### III. METHODOLOGICAL BRICOLAGE

The term ‘bricolage’ originated in French and is a modern equivalent to the English phrase of ‘making-do’. In a general sense, a bricoleur (someone who employs the bricolage method) is described as a resourceful and creative ‘fiddler or tinkerer’, and one who out of necessity uses available materials to create new objects from existing ones. This activity of re-appropriating and combining elements into new and original outcomes closely reflects the activities of a designer. The concept of ‘bricolage’ in academic studies has its roots in social research. Claude Lévi-Strauss, a French anthropologist and ethnologist, defines the term in an anthropological sense as a spontaneous creative act that uses whatever is available to reach a desired outcome. In his book, *The Savage Mind* [22], he compares the Engineer (the scientific mind) with the Bricoleur (the savage mind), as a way of depicting two modes of acquiring knowledge (concrete and abstract).

Although Levi-Strauss introduced the concept of bricolage as a mode of acquiring knowledge, it was Denzin and Lincoln’s [23] articulation of it within a methodological context that offered insight into new forms of rigour and complexity in social research. Nelson, Treichler and Grossberg describe bricolage (in the context of cultural studies methodology) as reflecting a choice of practice that is pragmatic, strategic and self-reflexive [24]. While Kincheloe [25] uses the term to describe multi-perspectival research methods, not just as the usage of mixed methods but to acknowledge that using methods from different disciplines enables the researcher to compare and contrast multiple points of view. Just as designed objects have prescribed affordances, methods automatically imply ontological and epistemological affordances. This relationship between inquiry and method affords design a useful indeterminacy, where not-knowing becomes a constructive loop that the bricoleur appears to be exploiting. As questions arise so methods to answer them are sought,

abstracting platforms for design knowledge rather than concrete answers.

Bricolage is a useful and necessary concept for design researchers as it allows them to deploy available and established strategies and methods, but also grants them the license to create new tools and techniques in order to address questions that are beyond the realm of the established discipline. Methodological bricolage permits the researcher to look at the problem we have with problems, as well as their solution. The bricoleur views research methods actively, rather than passively, meaning that the researcher actively constructs methods with tools at hand rather than accepting and using pre-existing methodologies [26].

### IV. THE METHODOLOGICAL BRICOLEUR

If, as we suggest, methodological bricolage is a prevalent and valid approach in design research, what does this tell us about the current field of design? And can we use any observations from the bricoleur’s methods to gain insights into how we should train our doctoral candidates?

To answer these questions this paper is divided into three sections. Each section is dedicated to exploring probable scenarios through a series of expositions and interrogation of current discourse around the topic of design knowledge with insights drawn from other fields (particularly academic and disciplinary studies).

What does methodological bricolage say about design? Does it imply that...

- Design is in crisis
- Design is undisciplined
- Design is maturing

### V. DESIGN IS IN CRISIS

*Assumption: Law and Urry [27] argue that methodological reinvention occurs because the discipline is in crisis. Does that apply to design? Does it imply that design has outgrown its current methods and is incompatible with questions that designers want to address?*

Law and Urry’s paper [27] calls for a re-evaluation of social science methods as they argue that the existing methods are inherited

from a nineteenth century viewpoint of fixing, demarcating and separating social phenomenon. They posit that in order for the discipline to move forward, it needs to re-evaluate the methods used. They argued that the standard social science methods are not well adapted to the realities of global complexity which contains new concepts that they define, such as 'the multiple', 'the distributed' and 'the emotional' [27: 400]. By highlighting these issues, they suggest that current social science methods are unfit for purpose. Law argues [28] that when social science tries to describe things that are complex, diffuse and messy, it tends to make a mess of it.

What about design? Is evidence of methodological reinvention a reflection that design is a discipline in crisis? Are current methods still fit for purpose?

Design research has always relied on established methods from other disciplines due to the lack of an established paradigm. Has that model outlived its usefulness? Is this due to the realisation that what we don't know overwhelms what we do know? Finding the most appropriate methods to help us discover 'what we don't know' will always be challenging. Recognised scientific methods have always been used to study and explain existing phenomena in order to precisely predict the future rather than to suggest possible futures and address indeterminate possibilities. The predictive quality of established methods seem to contradict the purpose of design which is to create unpredictable, novel and innovative outcomes.

We recognise that there are a multitude of methods available for a design researcher to choose from, and so far this has served design well. However, the issue is not so much to do with the variety of methods available, but as argued by Law, in the 'hegemonic and dominatory pretensions of certain versions or *accounts* of method' [28:4]. Law acknowledges that while standard methods are often extremely good at what they set out to do, they are often not appropriate to study the ephemeral, the indefinite and the irregular [28:5]. He also suggests that established methods have normativities attached to them that suggest a 'correct' way of how we must see and what we must do when we investigate.

This goes back to the question of methodological affordances described in the previous section and questions whether the method we use produces the social reality it studies. Studies conducted in the philosophy of science and social sciences seem to suggest that this is the case, and Law uses this as a central argument to his thesis that heterogeneity and variation is needed in the development and adoption of methods. If we assume that methods not only describe but produce a reality that they are trying to understand, what methods should designers use to ask questions about the future?

Design has undergone several transformations, from craft based design, to applied aesthetics, to applied (human and social) science, to a more involved science [29:7-9]. However, in the last 10 years, it can be argued that design is undergoing a re-evaluation of its identity and role in society. The emergence of service design, as a subset of other more traditional domains of design presents a clear indication of the changing scope and ambition of the problems that designers are now willing to tackle. Along with questioning the existing role of design as a servant to industry, designers are much more willing to use design to address social, economic and political issues than before. The increasing popularity of 'designing for debate' projects as seen in Dunne and Raby's work illustrates an alternative approach to design that uses design research as 'a space for designers to reflect upon the ideas, theories, logics and implications of design in and through design practice' [30-32].

If design is in crisis, what implication does this have for design education? The realization that design has to be partly responsible for the creation of some of the world's problem (for example the proliferation of unwanted things, the unsustainable mode of consumption, to name but a few) has resulted in a refocusing on understanding how design can address social, economic and political issues; in short it is about asking what kind of future world we want to live in. It is about predicting an undetermined future, exploring unknown questions and using a non prescribed way of looking at the world. Where past design researchers sought to understand (*into*),

improve (for) or apply (*through*) the practice of design, contemporary doctoral candidates seek to question the nature of design but also use design practice to question existing social conditions.

In positioning design as not just the creator of artificial objects, but as an engagement with materials in order to 'guide' the creation of an artificial environment, it allows us to conceptually reconsider the act of designing and in how we should teach it.

## VI. DESIGN IS UNDISCIPLINED

*Assumption: Design transcends disciplines, acting as a bridge to other disciplines [33]. It also moves beyond its disciplinary boundaries in its interrogation of complex problems [34, 35]. Methodological bricolage is evidence of design moving beyond its disciplinary framework, having to combine, adapt and create new connections between disciplines.*

Design as a discipline according to Cross is defined as design studied on its own terms, within its own rigorous culture and based on the 'reflective practice' of design [36:96]. Cross [36:96] also quotes Gasparski and Strzaleckis' [37:1186] description of the design discipline as 'a federation of sub-disciplines having design as the subject of their cognitive interests'. The understanding of design as a discipline is considered in two ways. Firstly, design as a discipline (a body of knowledge consisting of activities, practices, approaches, methods and philosophies) is presented as a meta-discipline. Secondly, design is seen as a third way of thinking and is used to address complex social problems.

Design as a meta-discipline is embedded within a context and draws from many other disciplines in order to perform its function. Design as McKay and Marshall [33] defined it is regarded as a domain-independent, meta-discipline which subsumes domain-specific knowledge of design and design practice.

This transgression of discipline boundaries can be seen in design education, design research and in design practice. For example, there has been a proliferation of postgraduate design programmes in the UK emphasizing and exploiting the interdisciplinary nature of design as a response to the Cox Report [38], commissioned by the Treasury Department to

review the creativity of British businesses. Design research has always had to draw knowledge from other disciplines, initially through a lack of existing subject knowledge and lately due to a refocusing on larger, more difficult social issues. A trawl through existing research topics with a design component funded by two 'design-friendly' Research Councils in the UK (Engineering and Physical Science Research Council and the Arts and Humanities Research Council) indicates that a majority of the research projects are interdisciplinary in nature, either combining engineering expertise or digital technology for a social need. This might be due to the fact that these two council's remit is to encourage interdisciplinary research but it also means that design is unable to address larger social issues without the involvement of other disciplines. The interdisciplinary or undisciplinary nature of design is even more evident in design practice, where the blurring of graphic, interior, product, service, fashion and interaction design is a common occurrence in the work of Hella Jongerius [39], Marti Guixé [40], Kenya Hara [41] and Pentagram [42].

Buchanan [43] has suggested that design is the "last liberal art" implying that we need to sustain its breadth and applicability to many contexts in order for design to be effective, rather than seeking to close it into a disciplinary boundary. He uses the term "liberal art" to mean a 'discipline of thinking that may be shared to some degree by all men and women in their daily lives and is, in turn, mastered by a few people who practice the discipline with distinctive insight and sometimes advance it to new areas of innovative applications' [43:8]. He goes on to suggest that design is an 'integrative discipline' needed to complement the arts and sciences in order to extend knowledge beyond the library and laboratory.

A second understanding of design disciplinarity is that it offers a non-discipline specific approach, comparable to the scientific or humanities approach in areas of scholarship. Cross positions it as a third way of knowing, distinct from a Scientific or Humanities approach. He uses a simple model to highlight the various philosophical differences between the three disciplines. Cross differentiates

[44:222] them by contrasting the phenomena of study as:

- in the sciences: the natural world
- in the humanities: human experience
- in design: the man-made world

The role of science is to understand natural phenomenon in order to more accurately predict future events. However the role of design is to draw on existing knowledge (scientific, technological and sociological) to suggest future events. Design's role is to present alternative ways of living, where the quality of not-knowing has to be inherently built in to open the designer/researcher to as many solutions as possible.

Banerjee [34] and Fry [35] have described how design can offer an alternative approach in addressing complex problems beyond the domain of design. Banerjee positions the designer as a unique agent of change due to the range of skills, cognitive processes, design methodologies, attitudes, and structural aspects that designers possess. He posits that it is this unique 'gestalt' set of skills that can offer a new approach towards complex problems such as sustainability. Fry [35] calls for a complete reconceptualisation of the practice of design and to use design as a means of political activation and achievement in order to respond to ethical, political, social and ecological concerns. Both authors suggest that design acts as an agent of change due to design's ability to synthesise understanding from the natural world (science & technology) with understanding of the human condition (humanities & social science) in order to derive a better future world.

The idea of design being positioned as an agent of change is not merely a rhetorical claim used to increase the worth of the designer (although there is an element of this within design discourses) but is also evident in the expanded roles that designers now play within professional practice. Lauren Tan's PhD research (to be completed in 2011) is based on understanding the emerging roles of designers in Dott 07<sup>1</sup> public design commission projects.

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<sup>1</sup> Design of the Times 2007 (DOTT07) was a programme of public design commissions situated in the North-East of England, co-sponsored by UK's Design Council and the regional development agency OneNorth East. Its aims were to demonstrate how design and designers could tackle social issues in five broad areas of: health, education, transport, energy and food.

Her preliminary findings [45] strengthen the notion that new emerging roles are required in the development of complex systemic solutions required at social and policy level. Seven roles have emerged from her analysis on the service design projects which indicate that designers act as: facilitator, researcher, co-creator, communicator, strategist, capability builder and entrepreneur. Tan's findings are also echoed by Inn's analysis of interdisciplinary projects delivered as part of the Designing for the 21st Century Research Initiative funded by the UK government which identified additional roles of designers. These roles were that of the designer as negotiator, facilitator, visualiser, navigator, mediator and coordinator [46: 24-6].

In this section, we suggest that design is undisciplined, transgresses the arts and sciences, and has the capability to be an agent of change as a response to social conditions. As a result, a design researcher has to be not only methodologically flexible (hence the adoption of a bricolage approach), and be able to 'make-do' with established research tools (with existing preconditions and affordances), but also have the ability to create new tools that enable them to explore questions that are indeterminate, complex and abstract. In fact, questions which may not have an answer but must be broached. The challenge for doctoral students is to recognise the dialectical nature of disciplinary and interdisciplinary relationships. Students have to engage with a range of different subjects without losing sight of their disciplinary focus. A bricoleur must be able to grasp the different theoretical, philosophical and methodological understandings of different disciplines encountered in the act of researching. The ability to select appropriate methods requires intellectual clarity of their various ontological and epistemological bases and an evaluation of whether it is sympathetic to their own epistemological framework.

## VII. DESIGN IS MATURING

*Assumption: Design is achieving academic maturity and reaching a level of disciplinary confidence in bringing practice-based approaches to the domain of 'scientific' research. Methodological bricolage IS the design research paradigm.*

How do we evaluate whether design is a maturing discipline? Kernan [47] identified three key characteristics that point towards a maturing discipline in relation to Marketing. He posits that a maturing (marketing) discipline requires that:

- The study of the discipline is scientifically based, and the accumulated knowledge is subject to public criticism both for its findings and methodology.
- The practice of the discipline is unrestricted as to the area of application; the disciplinary knowledge should be applied wherever it can be useful—within or outside corporate walls.
- Both the study and practice of the discipline give active consideration to the social problems and ramifications its application inevitably entails.

We would argue that on all three points, design has achieved these criteria. Firstly, design research has an established 50-year history within the academic environment [see 5, 48]. There are numerous peer reviewed, academically valid publications related to design. Between January 2010 to January 2011, there have been over 150 calls on the Design Journal and Conference Call website (<http://designcalls.wordpress.com>) for conference and journal contributions in the area of design. Rodgers [49] positions design as a central component of contemporary praxis backed by other subject specialist areas such as fine art, engineering, anthropology, business, computer science and business. Increasingly, design is actively addressing social problems through the rise of ‘issue-based’ design [50].

Throughout its history, design research has gone through various incarnations where different areas of the discipline have been studied and varieties of techniques adopted. For example, the study of design methods can be traced back to the 1960s, and grew out of a need to understand and describe the process of designing. At that time, the discipline lacked any body of knowledge to call its own, and design researchers had to continually borrow from other disciplines. A review of design methodology literature seems to indicate that there was no definitive approach to understanding design methods. Initially there

was a desire to ‘scientise’ design and, according to Cross [36], this can be traced back to the 20th century Modern Movement in design.

The view that design should be acknowledged as its own discipline, separate from scientific research, does not suggest a complete abandonment of scientific enquiry in design research. Instead, these views suggest that the field requires a wider use of methods and approaches outside of the scientific model. Cross [36] calls for a balanced approach to the development of a design discipline, on the one hand recognising that design has its own culture but on the other hand not completely disregarding other cultures.

The growing awareness and confidence in the methods used in design practice can be evidenced in the increased number of design doctorates awarded, which has more than doubled over the last 20 years [51]. In addition, the emergence of a number of design related international academic conferences and journals reflects a growing maturity within the field. There is a sense that design research is reaching an intellectual maturity and confidence in its own research paradigm. Increasingly this confidence is a direct result of the academisation of the discipline in educating a new generation of designers who see themselves as design researchers as well as designers. The gulf between research and practice is lessening and this we believe has led to an increasing application of practice-based design methods in design research.

Examples presented in the previous section have shown that design is transcending disciplines, being applied outside its disciplinary boundaries. In fact, design can only exist outside its disciplinary boundary in order to be effective. In recent years, the proliferation of the term ‘design thinking’ in large multi-national organizations indicates a growing awareness of design and its value in generating innovation.

The use of design-led approaches in the development of public services was pioneered initially through the RED group set up by the UK’s Design Council [52] and later formalized into the Design of the Times (DOTT) public commissions project funded by the UK government. RED ran from 2004-2006 and was set up to develop new thinking and



practice on social and economic problems through design-led innovation while DOTT is a programme of events developed by the Design Council to apply design-led solutions to economic and social challenges throughout the UK. Recent work in South Australia by the Australian Centre for Social Innovation (<http://taksi.org>) is using ethnography and design approaches to transform family care through a participatory approach. The growth of socially motivated design teams like Participle, Think Public in the UK and MindLab in Denmark are further evidence that design-led approaches are seen to be an integral part in the development of social policies (although it remains to be seen how effective these alternative approaches have been).

The final indicator of a maturing discipline is for the study and practice of the discipline to be actively conscious of its impact on social problems. Papenek's [53] seminal text written in 1972 is still unparalleled in its attack on the economic and social irresponsibility of design. Garland's First Things First Manifesto (written hastily in 1965 out of frustration) was a challenge to visual communicators to question their role in helping sell more stuff, design as persuasion rather than design as communication. Van Toorn [54] highlights the uncritical acceptance of a designer's role in society in a capitalist culture in which every product and service is commodified. Even within design education, an area traditionally slow to respond to the zeitgeist of the times, sustainability and ethical content are being integrated in undergraduate design programmes. Additionally, the creation of specialist programmes like Bournemouth University's BA in Sustainable Graphics and Packaging Design and the University of the Creative Arts's BA in Product Design Sustainable Futures is further evidence that design as a discipline is considering its role and effect towards social problems related to its application.

In this section, we presented evidence to support our claims that design is a maturing discipline. However, the gulf between design research and design practice is still difficult to bridge. In a sense, design research and design practice have always been uneasy bedfellows. Design research as an activity has even been

described as an oxymoron [55], implying that it conforms to a scientific model of research. Applied this way, traditional design research questions have struggled to find relevance in design practice due to differences in purpose and applications [55:69-70]. However, we believe this to be changing, and that questions now being asked by design researchers are increasingly reflective of design practice concerns due to an increasing sense of confidence in practice-based methods and the shift in the types of questions design has to address. The movement towards practice-based questions, suggesting possible future scenarios requires methods and approaches sympathetic to how design is practiced. We believe that the bricolage approach enables the design researcher to explore questions in a space that allows for indeterminacy but provides enough confidence in the value of its outcomes.

If methodological bricolage is the design research paradigm, can it be taught or even achieved within a time span of a doctoral programme? Universities in the UK are under tremendous financial pressure to ensure that their candidates complete within the allocated three years of study. This might result in more standardized approaches that have been tried and tested, rather than studies that actually challenge the boundaries of accepted methods. Kincheloe acknowledges that such a daunting task cannot be accomplished within doctoral training, but at least 'the process can be named and the dimensions of a lifetime scholarly pursuit can be in part delineated' [25:681]. He suggests that an accomplished bricoleur is related to the maturity and experience of a researcher, but that it is important to continually challenge, clarify and add to the dominant discourse of the discipline. As a bricoleur has to become familiar with many various disciplines, we suggest a practical way to facilitate this is to encourage direct interactions with as many disciplines as possible, either through research projects, attendance in conferences or simply by attending lectures in a different subject area. Understanding how methods have arisen and being able to situate this in history is important to facilitate the multi-perspectival approach of a bricoleur.

## VIII. SUMMARY/CONCLUSION

This paper presented three interpretations of the current state of the design field in an attempt to raise questions relating to the education of the doctoral candidate and design education. The imagined possible futures that characterise design have (due to these three conditions), become a test of our capacity to imagine a future at all. This reversal requires new methods of thought and action and perhaps the doctoral bricoleur points the way forward.

The adoption of the bricolage method and the questions it raises highlights the value of indeterminacy as a key condition to design research. This factor seems paradigmatically opposite to a fundamental tenet of scientific research, the focus on repeatability and predictive power. Indeterminacy (not-knowing) is important as both the beginning and end point because of the nature of design, which is to project possible future scenarios based on past and present conditions. It requires a platform or model from which to operate within an area of indeterminacy but also a structure that will ensure an end result. This temporal collision between past, present and future scenarios is risky and indeterminate but is mitigated through design practice, using the bricolage approach.

Knowing the end-result of all design thought and action (referred to as the modern project<sup>2</sup>) frames the design platform and gives it its stability. However knowing the end-result does not prescribe how design will arrive at this result, making 'not-knowing' (indeterminacy) an operational reality.

The indeterminacy characteristic is increasingly present in design research and as a result draws the practice and research of design closer. The temporal collision raises the importance of design history in providing context to future projections, making the disciplinary crisis an ever-present reality and at the same time a necessity. Design will be continuously challenged to move beyond its post-industrial identity to one that is equipped

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<sup>2</sup> The accumulative affect of the ineluctable process of change is described in some literature as the 'modern project'. Therefore, the project of modernity will always be an incomplete project [56] presenting design with both infinite possibilities and infinite responsibilities.

to assume the responsibilities of the modern project.

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