Fluidity and legitimacy: designer as minor scientist

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ABSTRACT

In the field of Human Computer Interaction, user experience research has been characterized in two camps, *model-based* and *design-based*. These groups have contrasting approaches to measurement and evaluation. Design-based user experience research is often viewed as a form of bricolage. We find flaws with this means of framing qualitative investigation. We argue that influential research has misinterpreted Levi-Strauss' description of bricolage. Accordingly, we call for a re-evaluation of the use of bricolage as a means of contextualizing qualitative methods. We argue that the model-based and design-based camps can be thought of in terms of the philosopher Gilles Deleuze and the psychotherapist and semiotician Felix Guattari's *royal science* and *minor science* respectively. Through focusing on the commonly used data collection method termed 'cultural probing,' we argue that the relationship between Deleuze and Guattari's philosophies provides insights into how legitimacy is constructed within contemporary Human Computer Interaction research practice. In concluding, we propose that Deleuze and Guattari's idea of *flux* may aid the Human Computer Interaction community to unpick emerging trends and shifts in debates in user experience research.

Introduction

Over the last decade the focus of study in Human Computer Interaction (HCI) has shifted from usability to user experience (UX) (e.g. Bargas-Avila and Hornbæk 2011; Law 2011). Law (2011, 4) has divided UX research into 'roughly' two catchments, 'model-based UX research[ers]' and the 'design-based UX research camp.' Model-based researchers use methods derived from usability practice when interpreting qualitative human data (Law 2011). As such, this camp makes use of statistical analysis to analyze user data (Law 2011). Design-based researchers (who Law also terms the *holistic camp*) tend to criticize scientistic research methods (e.g. Gaver et al. 2004; Sengers 2010). Accordingly, the design-based camp 'defy the measurability of UX' (Law 2011, 1). Researchers associated with the former group 'include Hassenzahl, Mahlke, Sutcliffe, Tractinsky, and van Schaik.' Practitioners grouped with the

latter 'include Blythe, Cockton, Forlizzi, Gaver, McCarthy, Monk and Wright' (Law 2011, 1). Law (2011), along with the majority of UX researchers, belongs to the model-based camp.

Design-based UX research is often contextualized in terms of the anthropologist Claude Levi-Strauss' concept of *bricolage*. Bricolage is a philosophy of science developed by Levi-Strauss. This article rejects existing comparison between design-based UX investigation research and bricolage. Instead, we argue that design-based research can be viewed as form of *minor science*. Minor science is a philosophy of science described by the theorist Gilles Deleuze and the psychotherapist and semiotician Felix Guattari (2004). In parallel, we argue that model-based UX research can be framed as a form of *royal science*. Royal science is an associated philosophy of science developed by Deleuze and Guattari (2004). Viewing model-based and design-based UX practice through a lens created by Deleuze and Guattari provides insight into how legitimacy is constructed in HCI research.

We begin by outlining Deleuze and Guattari's philosophies of royal science and minor science. Parallels with Levi-Strauss' descriptions of *bricolage* and *engineering* are then outlined. We then reflect on influential qualitative research from a diverse range of areas (including HCI design-based UX research) which claims that qualitative approaches mirror bricolage. Comparisons to bricolage are found to be flawed because Levi Strauss' description of bricolage has been misinterpreted in influential qualitative research texts. This article then explores how the model-based and design-based UX camps can be constructed in terms of Deleuze and Guattari's concepts of royal science and minor science respectively. Viewed through a lens provided by Deleuze and Guattari, the commonly used data collection method termed '*cultural probing*' provides insights into how claims for legitimacy are currently constructed in the model-based and design-based UX research camps. In addition, we propose that Deleuze and Guattari's (2004) idea of *flux* may aid the HCI community to contextualize emerging trends and shifts in debates in UX research.

Deleuze and Guattari: royal science and minor science

Deleuze and Guattari's (2004) work covers a vast range of intellectual territory. Their difficult and provocative text *A Thousand Plateaus: Capitalism and Schizophrenia* narrates the relationship between two theoretical models, royal science and minor science. Essentially, these concepts present contrasting 'worldviews,' dichotomous readings of notions as diverse as space, time and matter. The contrasting positioning of royal science and minor science means that problems concerning theory and practice are 'brought out and resolved in an entirely different way' (Deleuze and Guattari 2004, 405) in both concepts.

Royal science is a function and expression of the State. It is therefore the more dominant and legitimate model. Royal science continually attempts to order and homogenize heterogeneous space. In so doing it exists to 'extract […] constants from variables' (Deleuze and Guattari 2004, 407). Royal science measures everything, marking it with increments. Deleuze and Guattari's term for this process is *striation* (in the sense of striking or striping). They state that royal science 'striates all of space in all of its directions' (Deleuze and Guattari 2004, 408). Royal scientists (practitioners of royal science) create these increments by following their own theoretical models. Deleuze and Guattari (2004, 407) term these models *forms* stating royal science's modes signify 'a form that organizes matter.' When matter is homogenized to make it fit into specified theoretic models, this matter becomes 'prepared for the form' (Deleuze and Guattari 2004, 407). Ultimately, royal science aims to construct universal laws through these activities.

The contrasting concept termed 'minor science' works to retain variation, facilitating the existence of heterogeneous space. Minor science therefore occupies an expanse 'without "counting" it' (Deleuze and Guattari 2004, 409, original emphasis). In opposition to striated space, the expanse occupied by minor science is defined as being *smooth*. Unlike royal science, minor science does not reduce matter. And instead of attempting to create universal laws, minor science conveys the singularities of space and matter.

Deleuze and Guattari describe minor science as *nomad* in nature. This is because the flow of matter should be – in Deleuze and Guattari's terms – *followed*. Practitioners of minor science are termed *minor scientists*. The trait of 'following' is expressed through how minor scientists understand the concept of 'space.' Space 'can be explored only by legwork' (Deleuze and Guattari 2004, 409). An artisanal minor scientist wishing to craft a wooden object must 'go to find the wood where it lies, and to find the wood with the right kind of fibers' (Deleuze and Guattari 2004, 451). The act of 'following' continues when the artisan is back in his workshop for he cannot plane across the grain of the timber. He must instead work with it. Therefore, the artisan must 'follow the wood, fibers of the wood' (Deleuze and Guattari 2004, 451).

The intellectual models of minor science are suppressed by the overarching power of royal science. Royal science makes them submit to its own models, 'allow[ing] them to exist only in the capacity of "technologies" or "applied sciences"' (Deleuze and Guattari 2004, 411). Factions of the minor sciences refuse to be internalized by royal science – this notion is significant to discussion related to legitimacy in contemporary HCI discourse and will be expanded upon later on in this article.

Though royal science and minor science operate via dichotomous processes and in oppositional spaces, Deleuze and Guattari do not presuppose the existence of steadfast boundaries between them. Rather, the notion of *flux* between royal and minor science is integral to their description. The idea of flux can be evidenced through the notion that disciplines or methodologies do not necessarily permanently belong to either the royal or minor scientific model. The field of *chemistry* is a case in point. Individuals acting within the royal scientific schema include those usually identified as *scientists*, such as chemists. Chemistry once conformed to the minor science schema and 'became a royal science only by virtue of a whole theoretical elaboration of the notion of weight' (Deleuze and Guattari 2004, 408). The premise of *flux* between Deleuze and Guattari's sciences will become important when this discussion contextualizes shifts in debates in UX research.

There are parallels between Deleuze and Guattari's philosophies of science and the concepts of *bricolage* and *engineering* as developed by the anthropologist Claude Levi-Strauss (1972). HCI qualitative research is often framed as a form of bricolage (e.g. Fincher, Tenenberg, and Robins 2011; Morrison, Viller, and Mitchell 2011; Teoh, Wickramasinghe, and Pan 2012; Yee 2012). This article rejects such comparisons in favor of viewing the HCI UX research in terms of Deleuze and Guattari's philosophies of science. It is important to briefly outline Levi-Strauss' theories in relation to Deleuze and Guattari's.

Levi-Strauss: bricolage and engineering

Claude Levi-Strauss has been called *The Father of Modern Anthropology* (Wilcken 2012). Writing prior[1] to Deleuze and Guattari (2004), Levi-Strauss – in his seminal text *The Savage Mind* (1972, 15) – identifies 'two distinct modes of scientific thought,' *bricolage* and

engineering. Like Deleuze and Guattari, Levi-Strauss does not envisage his two schemas as representing different stages of cerebral development. He instead views them as different methods of conceptualizing problems. Levi-Strauss perceives them as being developed in different eras in the history of humanity: '[i]t is as if the necessary connections which are the object of all science, Neolithic [bricolage] or modern [engineering], could be arrived at by two different routes' (1972, 15).

There are similarities between the methodologies used by Levi-Strauss' engineer and Deleuze and Guattari's royal scientist. Both are reductive in their practice. For example, the chemist (an engineer by affiliation), 'reduces the variety of tastes and smells to different combinations of five elements' (Levi-Strauss 1972, 12). The following short excerpt from Levi-Strauss' text illustrates the engineer's mode of operation. These quotes will also serve to highlight further similarities between the engineer and Deleuze and Guattari's royal scientist. The engineer has a particular process which informs his actions. He creates: '[his] means and results in the form of events, thanks to the structures which [he] is constantly elaborating and which are [his] hypotheses and theories' (Levi-Strauss 1972, 21).

Further into his text, Levi-Strauss condenses the above statement. For Levi-Strauss, the engineer generates: 'events (changing the world) by means of structures' (1972, 22, original emphasis). The engineer's *structures* can be perceived as 'rules' which dictate his actions. To recall, Deleuze and Guattari's royal scientist acts through creating *forms* which inform his actions. On this point, Deleuze and Guattari (2004, 407) argue the royal scientist makes use of his forms to 'organize matter.' The engineer's *structures* therefore parallel the royal scientist's *forms.* And just as the royal scientist's activity culminates in the organization of *matter*, the engineer's actions result in the creation of *events*. The engineer's *events* therefore mirror the royal scientist's *matter*.

There is resonance too between Levi-Strauss' description of bricolage and Deleuze and Guattari's definition of minor science. The act of bricolage is carried out by the bricoleur. Like the minor scientist, the bricoleur works to maintain heterogeneity, for: 'the rules of his game are always to make do with "whatever is at hand", that is to say with a set of tools and materials which is always finite and is also heterogeneous' (Levi-Strauss 1972, 17, original emphasis).

There is also a parallel between how both the bricoleur and the minor scientist use materials. The following quote illustrates how the bricoleur makes use of a piece of timber:

> A particular cube of oak could be a wedge to make up for the inadequate length of a plank of pine or it could be a pedestal – which would allow the grain and polish of the old wood to show to advantage. In one case it will serve as extension, in the other as material. But the possibilities always remain limited by the particular history of each piece. (Levi-Strauss 1972, 18–19)

Therefore, in devising a use for timber, the bricoleur must *follow* the history of the wood just as the minor scientist must follow its grain when planing it.

The influence of Levi-Strauss' work has spread beyond the field of anthropology. A host of qualitative research from a diverse range of areas has claimed that non-empirical approaches to collecting data on humans mirror bricolage (e.g. Carverhill 2002; Denzin and Lincoln 1994; Di Domenico, Haugh, and Tracey 2010; Kincheloe, McLaren, and Steinberg 1994; Riches and Dawson 2002). Bricolage is relevant in this article as it is viewed as a valid approach to qualitative research in design-based UX research (e.g. Fincher, Tenenberg, and Robins 2011; Morrison, Viller, and Mitchell 2011; Teoh, Wickramasinghe, and Pan 2012; Yee 2012).

This article argues that the notion of bricolage does not adequately account for the wider methodological shifts in practice in the field of qualitative research. We instead draw a parallel between design-based UX research and Deleuze and Guattari's minor science. In defending this position, we first sketch the related wider context of shifts in method in the field of qualitative research in recent times. This step helps us to summarize the claimed connection between qualitative research and bricolage. We then justify why Deleuze and Guattari's philosophies offer a more appropriate characterization of shifts in HCI UX research practice than Levi-Strauss'.

Qualitative research

Qualitative research in context

Scientific research principles became established in the physical sciences (Kerlinger 1970). Research methods developed by qualitative investigators either adhere to or react against the values of the physical sciences. These values rest on ideals of neutrality, objectivism, universalism, realism and representationalism (Kincheloe, McLaren, and Steinberg, 2004). Borg (1963) argues quantitative scientific research to be the most successful means of discovering truth about natural phenomena. The objectivity of empirical inquiry is however challenged by influential philosophers of science (Foucault 1971; Kuhn 2012).

Criticism of empirical methodology comes to the fore in the study of human beings. William Hingest, a character in *That Hideous Strength* (a novel by C. S. Lewis) eloquently summarizes the debate over how best to investigate people's thoughts and actions: 'I happen to believe that you can't study men; you can only get to know them, which is quite a different thing' (Lewis 1996, 69). The study of people is far more difficult to predict and systematize than the study of physical objects. In accordance, many researchers use qualitative practices when investigating human behavior. The lack of associated systematic method often leaves qualitative research open to criticism: '[q]ualitative methods are frequently viewed as failing to achieve or make explicit rules for achieving reliability, validity, and objectivity – criteria of adequacy or rigor in scientific research' (Sandelowski 1986, 27).

Such criticism meant that up until the 1990s, most general books on research methods ignored qualitative inquiry (Bryman and Burgess 1994). During this decade, there emerged a number of texts which focused on qualitative research techniques (e.g. Strauss and Corbin 1990; Bryman and Burgess 1994). Inclusion of qualitative methods did not however entail abandonment of associations with quantitative research. Aware of the criticism of the validity of qualitative study, Strauss and Corbin are careful to underscore the rigor of their method:

> we develop each category (phenomenon) in terms of the causal conditions that give rise to it, the specific dimensional location of this phenomenon in terms of its properties, the context, the action, interactional strategies used to handle, manage, respond to this phenomenon in light of that context and the consequence of any action/interaction that is taken. (1990, 114, original emphasis)

Although Strauss and Corbin concentrate on qualitative rather than empirical investigation, their method recognizes the status of the physical sciences. Strauss and Corbin's claim to legitimacy is underscored by their adherence to *distance* and *neutrality*, both long-established values in the physical sciences: '[o]bjectivity enables the researcher to have confidence that his or her findings are a reasonable, impartial representation of a problem under investigation' (1990, 53).

Similarly observant of physical science research idioms, Bryman and Burgess suggest that qualitative data are open to systematic processing: '[a]ppropriate cases are examined and a possible explanation is formulated and the investigator then examines further appropriate cases to establish how well the data collected fit the hypothetical explanation' (1994, 4).

Not all qualitative research observes the values of empirical science. Indeed, a strand rejects such principles. The last decade or so has seen an increase in the presence of such research within the field of qualitative research. Criticizing scientific research paradigms, qualitative investigators Kincheloe et al. (1994, 168) reject 'the quest for some naive concept of realism.' In a similar rebuttal, Riches and Dawson claim: '[w]e have neither found, nor offer, any single model or foolproof approach to discovering the "correct" explanation […] What we have found is a range of views – conceptual tools – that each contribute something to our understanding' (2002, 210).

Equally, Charmaz argues her approach: 'explicitly assumes that any theoretical rendering offers an *interpretive* portrayal of the studied world, not an exact picture of it' (2010, 10, original emphasis). Indeed, Charmaz criticizes the formulaic nature of Strauss and Corbin's (1990) text on qualitative techniques. Instead, she argues for: 'flexible guidelines, not methodological rules, recipes, and requirements' (Charmaz 2010, 9).

In a push to present a more 'critical' means of studying humans (Kincheloe et al. 1994, 167–173), a body of qualitative research literature has sought to link approaches which reject the values of the physical sciences with Levi-Strauss' concept of bricolage.

The influence of Levi Strauss: qualitative research and bricolage

Advocates of bricolage claim this method of constructing theory and practice is ideally suited to conducting research in the contemporary era: 'our theoretical assumptions, our approach, and certainly our methods of data collection and analysis fully reflect the post-modern condition that we have attempted to explore' (Riches and Dawson 2002, 210).

Several points appear to be important in discourse on bricolage in qualitative research. These areas are summarized below. According to Di Domenico, Haugh and Tracey (2010) 'making do,' 'improvisation' and the 'refusal to be constrained by limitations' underpin the qualitative research bricolage literature. The traits of *making do* and *improvisation* are emphasized in the qualitative-researcher-cum-bricoleur's recourse to use 'whatever is at hand to deal with the current "task"' (Gobbi 2005, 119, original emphasis). Carverhill (2002) highlights the characteristic of *not being constrained by limitations*. Carverhill (2002, 205) argues that the qualitative researcher-cum-bricoleur has 'diverse ways of understanding' at his disposal. Fincher, Tenenberg and Robins (2011, 32) spotlight the bricoleur's *flexibility* by claiming practitioners are able to 'piece together new tools or techniques.' Equally, the researcher-cum-bricoleur's *reflexivity* is underscored in the literature. Denzin and Lincoln (1994, 6) argue the bricoleur's 'reflexive collage like creation […] represents the researcher's images, understandings, and interpretations of the world.' This reflexivity enables bricoleur-like researchers to grow as professionals as it 'promotes the expansion of one's critical consciousness' (Warne and McAndrew 2009, 857). Research also suggests that bricolage-like investigation is characterized by it being *ongoing* in nature. On this point, Riches and Dawson (2002, 210) argue their 'findings are eclectic, partial, and inevitably superficial at times.' For Kincheloe et al. (1994, 171), the ongoing nature of bricolage-style research is reflected in the very definition of the term bricolage, for 'no description [of it] is fixed and final.'

The Handbook of Qualitative Research, edited by Kincheloe et al. (1994), has been very influential in disseminating the idea that qualitative research practice can be viewed as a bricolage. Kincheloe et al.'s (1994) affiliation with bricolage is evidenced in the way these researchers frame the materials with which they work. Before exploring Kincheloe et al.'s claims it is important to return to Levi-Strauss' text. The bricoleur's work is defined by the nature of the material he uses: 'the possibilities always remain limited by the particular history of each piece' (Levi-Strauss 1972, 19). Similarly, the qualitative researcher-cum-bricoleur acknowledges his studies are bound by the situated nature of his research environment: 'the bricolage highlights the relationship between a researcher's way of seeing and his or her personal history' (Kincheloe et al. 1994, 168).

Qualitative researchers' interest in bricolage is linked to the notion of *unexpectedness* (Kincheloe et al. 1994). To reflect on this idea, it is first necessary to turn to Levi-Strauss' etymology of the term 'bricolage:'

> In its old sense the verb 'bricoler' applied to ball games and billiards, to hunting, shooting and riding. It was however always used with reference to some extraneous movement: a ball rebounding, a dog straying or a horse swerving from its direct course to avoid an obstacle. (Levi-Strauss 1972, 16, original emphasis)

Bricolage then is historically bound with what might be termed *unexpected movements*. Indeed, compared with those of a craftsman, the bricoleur's actions are 'devious' (Levi-Strauss 1972, 16). Similarly, *unexpectedness* is integral to Kincheloe et al.'s (1994, 168) description of the researcher-cum-bricoleur's approach to practice: '[r]esearchers' interaction with the objects of their inquiries, bricoleurs understand, are always complicated, mercurial, unpredictable.'

The community of qualitative investigators identifying with the bricoleur contains researchers from a broad range of disciplines. HCI design-based UX research practice is one such area (e.g. Fincher, Tenenberg, and Robins, 2011; Morrison, Viller, and Mitchell 2011; Teoh, Wickramasinghe, and Pan 2012; Yee 2012). This article moves on to discuss problems with the link between qualitative research and bricolage.

The rejection of Levi-Strauss' philosophies of science in qualitative research practice

Kincheloe et al. (1994, 167) 'identify the bricolage as an emancipatory research construct' as it can disrupt the dominant empiricist investigatory paradigm. Kincheloe et al. promote the bricolage as a means of affecting political change in the following statement:

> bricoleurs attempt to remove knowledge production and its benefits from the control of elite groups [….] Rejecting this normalized state of affairs, bricoleurs commit their knowledge work to helping address the ideological needs and informational needs of marginalized groups and individuals. (1994, 169)

To reflect on Kincheloe et al.'s (1994) claim of the potential influence of bricolage in qualitative research it is necessary to expand on Levi-Strauss' (1972) characterization of the bricoleur and his contrasting protagonist, the engineer. When it comes to undertaking his activities, the bricoleur is limited by the materials at his disposal:

> His first practical step is retrospective. He has to turn back to an already existent set made up of tools and materials, to consider or reconsider what it contains and, finally and above all, to

> engage in a sort of dialogue with it and, before choosing between them, to index the possible answers which the whole set can offer to his problem. (Levi-Strauss 1972, 18)

Similarly, the actions of the engineer are also affected by resource-related limitations: '[t]he engineer no doubt also cross-examines his resources […] his means, power and knowledge are never unlimited and that in this negative form he meets resistance with which he has to come to terms' (Levi-Strauss 1972, 12).

Both the bricoleur and the engineer are therefore met with challenges. The availability of technological or physical tools does not account for differences in aptitude between Levi-Strauss' protagonists. Instead, their respective *mind-sets* differentiate them from one another:

> It might be said that the engineer questions the universe, while the 'bricoleur' addresses himself to a collection of oddments left over from human endeavours […] the engineer is always trying to make his way out of and go beyond the constraints imposed by a particular state of civilization while the 'bricoleur' by inclination or necessity always remains within them. (Levi-Strauss 1972, 19, original emphasis)

From Levi-Strauss' description it is evident that the *engineer's* approach is *more suited* to precipitating positive change in society than the methods employed by the bricoleur. Kincheloe et al.'s (1994) claim of the potential influence of the bricoleur is therefore at odds with Levi-Strauss' description of bricolage. Paradoxically, the *engineer's* position has more in common with the aims of qualitative researchers-cum-bricoleurs than does the locus of Levi-Strauss' bricoleur. As noted earlier, Levi-Strauss' engineer is a physical scientist. Qualitative research which adheres to the aims of Levi-Strauss' engineer while concurrently rejecting empiricist values may ultimately find itself in a position which lacks a means of resolution.

This article calls for a re-evaluation of the use of bricolage as a means of contextualizing qualitative research practice. We move on to spotlight important differences between Levi-Strauss' (1972) philosophies and those of Deleuze and Guattari (2004). These differences provide justification to construct design-based UX research through a lens created by Deleuze and Guattari (2004).

UX research practice: Deleuze and Guattari vs Levi-Strauss

An important divergence between Deleuze and Guattari's theories and those of Levi-Strauss is to be found in their respective thoughts on chronology. Levi-Strauss (1972) claims that human advancement involved a linear progression from bricolage to engineering:

> [Bricolage] was necessarily restricted by its essence to results other than those destined to be achieved by the exact natural sciences but it was no less scientific and its results no less genuine. They were secured ten thousand years earlier and still remain at the basis of our own civilization. There still exists among ourselves an activity which on the technical plane gives us quite a good understanding of what a science we prefer to call 'prior' rather than 'primitive,' could have been on the plane of speculation. (1972, 16, original emphases)

Deleuze and Guattari (2004, 262) criticize a focus on linearity in the philosophical study of human development, claiming 'to become is not to progress or regress along a series.' Deleuze and Guattari and Levi-Strauss also differ in their respective view on the *structure* of their philosophies of science. Levi-Strauss was a leading structuralist thinker (Smircich 1983). Structuralists believe that humans are too entrenched in their existence to subject it to objective philosophical scrutiny (Barthes 2000). Because of this, structuralists create

simulacra of existence, making it open to intellectual examination (Barthes 2000). Structuralist activity proceeds through the comparison and contextualization of similarities and differences between simulacra (Barthes 2000). To make assessments viable, structures (simulacra) must have distinguishable boundaries. Indeed, Barthes (2000, 216) argues: simulacra 'have no significance existence except by their frontiers: those which separate them from other actual units of the discourse.'

Levi-Strauss develops the simulacrum of *bricolage* in relation to its binary Other, *engineering*. Deleuze and Guattari on the other hand operate in a tradition termed *post-structuralism* (Dillon 2000). Poststructuralists critique the rigidity of boundaries to simulacra. Indeed, poststructuralism 'offers the last word, not in terms of definition, but in terms of irresolution' of philosophical concepts (Miller, Whalley, and Stronach 2005, 313). Deleuze and Guattari's (2004, 261) frustration with structuralism is illustrated here: '[w]hen structuralism encounters [...anomalies...] pervading a society, it sees them only as phenomena of degradation representing a deviation from the true order.' Deleuze and Guattari claim structuralism's tendency to delineate simulacra compromises philosophical enquiry: '[i]t is always possible to try to explain these [...anomalies...] by a correspondence between two relations, but to do so most certainly impoverishes the phenomenon under study' (2004, 262).

As poststructuralists, Deleuze and Guattari propose a continuous transition between the spaces occupied by minor science and royal science. As such they propose a blurring between the smooth (unstriated) space of minor science and the marked (striated) space of royal science: 'smooth space is constantly being translated, transversed into a striated space; striated space is constantly being reversed, returned to a smooth space' (Deleuze and Guattari 2004, 524).

Deleuze and Guattari's position is important in justifying the choice of theory underpinning the analysis in this article. In HCI research, there does not appear to be a linear chronological 'evolution from' one of Law's (2011) UX research camps 'into' the other. This observation is at odds with Levi-Strauss' explanation of the development of bricolage and engineering – namely that the latter grew from the former. It is however consistent with Deleuze and Guattari's (2004) description of the non-linear relationship between minor science and royal science.

UX research practice framed in terms of Deleuze and Guattari's philosophies of science

There follows an exploration of how model-based UX researchers can be constructed as royal scientists and how design-based UX researchers can be framed as minor scientists. These constructions can be achieved through spotlighting the areas of '*reduction*,' '*re-prioritizing*' and '*following*.'

Reduction

In the 1980s and 1990s, the notion of 'usability' grew in influence in design research and practice (Koskinen et al. 2011). Norman (2002, 38) argues that the usability movement was underpinned by a focus on empiricism: '[usability] takes root in the cognitive sciences [...and...] prides itself on its scientific basis and experimental rigor.' This stance is derived from evidence that measuring human data leads to successful design interventions. Dix et

al. (2004, 24) for example, note that 'the human ear can hear frequencies from about 20 Hz to about 15 kHz.' For Dix et al. (2004), design failure stems from a lack of consideration of such human factors. While accepting that differences exist in levels of cognition inside a population, Dix et al. recommend that categorizing humans results in designs which are, on the whole, more usable. This is because 'the majority of people' fall within a certain range of observed values (Dix et al. 2004, 52).

The philosophy of the usability movement can be viewed through a lens created by Deleuze and Guattari. To recall, in measuring and marking all space, Deleuze and Guattari's (2004, 407) royal science 'extract[s] constants from variables.' Royal scientists use their own theoretical models – termed *forms* – to create these increments. Royal science's models therefore signify 'a form that organizes matter' (Deleuze and Guattari 2004, 407). The process of homogenizing matter to make it fit into theoretic models means that matter becomes 'prepared for the form' (Deleuze and Guattari 2004, 407). In Deleuze and Guattari's terms, for the usability movement, human data can be viewed as *matter*. The usability model is concerned with measurement, statistical analysis and 'organizing' human data into its constructs of 'normal' and 'abnormal.' These constructs can be thought of as *forms*. In the usability model, *matter is prepared for the form*. The precepts of usability can therefore be seen as being analogous to those of royal science.

In design research, the shift toward UX followed criticism of usability. Usability designers were accused of ignoring emotional factors in the creative process. In so doing they were said to have tolerated the development of unattractive objects (Norman 2002). The 'Experience Economy' (Pine and Gilmore 1999) has greatly influenced the shift away from a concentration on pure functionality in user-centered design (Jetter and Gerken 2006).

UX research claims to consider felt aspects of interaction such as enjoyment or fulfillment (Sharp, Rodgers, and Preace 2007). Much qualitative UX research incorporates qualitative methods in the attempt to elicit more relevant user data (Bargas-Avila and Hornbæk 2011). The evaluative methodology employed by UX investigators is predominantly derived from usability models (Sengers 2010; Tullis and Albert 2008). Therefore, the model-based UX research camp uses measurement-based intellectual methods derived from usability practice when interpreting qualitative human data for measurement. Sharp, Rodgers and Preece (2007) for example, promote the value of cognitive science in describing the capabilities and limitations of users. Indeed, model-based UX researchers claim it is possible to measure 'ambiguous' qualities such as *beauty* (Lavie and Tractinsky 2004; Hassenzahl 2004) and *trust* (French, Liu, and Springett 2007). Beyond this, Law (2011, 6) claims that all 'qualitative [human] data can be coded, counted and, so, quantified, being conducive to computational manipulations.'

The philosophy of the model-based UX community can be viewed through a lens created by Deleuze and Guattari (2004). Deleuze and Guattari's (2004) royal science aims to create constructs with universal applications. The model-based camp's belief in the measurability of all human data suggests a parallel with royal science. To recall, Deleuze and Guattari (2004, 407) claim that royal science specifies a 'form that organizes matter and a matter that is prepared for the form.' Royal science's model therefore relies on the reductive processing of data (Marks 2004). For model-based UX researchers, human experiences can be perceived as *matter*. In model-based research, the method of reduction through quantification can be considered as the *form* responsible for organizing this matter. In Deleuze and Guattari's terms, for model-based researchers, human experiences are *prepared for the form of reduction*

via *quantification*. Thus, the precepts of the model-based camp can be considered as being analogous to those of Deleuze and Guattari's royal science.

Evaluative techniques which use 'rationally deduced metrics' dominate in HCI research (Sengers 2010, 4). Their efficacy is questioned by the design-based UX community. Examples of such criticism are presented below. McCarthy and Wright (2004, 24) query the elevation of *rationality* in the study of UX above 'being and participating.' Gaver et al. (2004, 56) caution against scientific analysis of user data for fear of 'blunt[ing]' the connection between designer and user. Koskinen et al. (2011, 42) reject reductionism, arguing that 'design and design research will fail if they are reduced to a formula.' For Forlizzi and Battarbee (2004, 265), human emotions are 'hard to understand, let alone quantify.' Swallow et al. (2005, 92) argue quantitative measures 'can miss some of the insights available in accounts that resist such reduction.' Similarly, Olivier and Wallace (2002) suggest that reducing users' experiences to a set of immutable data can diminish the value of human heterogeneity. Going further, Matthews et al. (2008, 59) claim felt experience contains 'no core platonic essence' and is thus irreducible to evaluation via rationally deduced metrics.

Such perspectives suggest that human experience cannot be '*boxed in.*' Applying Deleuze and Guattari's (2004) terminology, for design-based researchers, human experience is matter that is *not prepared for the form of reduction* via *quantification*. For design-based researchers, human experience is therefore not describable through a royal scientific perspective. It is however definable through a minor scientific lens. Unlike the homogeneous space of royal science, Deleuze and Guattari (2004, 409, original emphasis) argue 'heterogeneous…space' is open to a 'nonmetric' construction for it inhabits territory 'without "counting" it.' Design-based research can be thought of as claiming to *preserve the singularities and heterogeneity of human experience*. In this sense, design-based researchers can be considered – in Deleuze and Guattari's terms – as minor scientists.

Applying Deleuze and Guattari's characterizations to model-based and research-based practices is of more than academic interest. For a number of academic and industrial researchers, royal science tends toward determinism which conceives of progress primarily in terms of technological advances. Efforts to alter these *priorities* are discussed below.

Re-prioritizing

The approach to product or service or development termed 'technological determinism' privileges the position of technology (Matthews et al. 2008). Calling this an 'invention-centric approach,' Prestero summarizes the process as follows: 'the inventor begins by specifying the technology that they think will solve the problem […] they then go in search of a specific user group or market segment for which the product is a match' (Prestero cited in the International Council of Societies of Industrial Design N.D., unpaged).

The usability model in HCI is often argued as being unpinned by technocentric values. Sengers (2010, 4) for example claims that 'technoscientific reasoning' is prevalent in HCI and argues that the field still perceives progress in terms of technological advancement. The dominant technocentric model in HCI can be viewed through a lens created by Deleuze and Guattari (2004). In Deleuze and Guattari's terms, people (users of design technology) can be perceived as *matter*. Rules concomitant with a technocratic approach to product development can be thought of as *forms*. Users can be considered as being *fitted* into the stipulations generated by technocratic rule. Consequently, HCI's technological determinism precept

mirrors the description of royal science as a model which 'implies a form that organizes matter' (Deleuze and Guattari's 2004, 407). Indeed, in Deleuze and Guattari's (2004, 407) terms, users of products developed through a process of technological determinism can be thoughts of 'matter that is prepared for the form.'

Research suggests that technological determinism does not optimally benefit users. Green (1997, 10) argues the process has contributed to a reduction in 'personal happiness' in society. Sengers (2010) questions its legitimacy. Sengers (2010) also criticized the validity of the measurement-based universalist models used to characterize humans which predominate in HCI research. According to Bardzell (2010), dominant HCI models have produced artificial notions of the '*ideal user*.' 'Ideal user' models pressurize people into adopting identities they do not want in order to use design interventions successfully (Bardzell 2010). For Satchell (2010), the model-based approach denies the heterogeneity of female users of digital technology. In 'making people unhappy,' 'pressurizing users' and 'denying difference' the above arguments suggest HCI – through privileging technology over people – has got its priorities wrong.

Research suggests that design-based methods can provide a more beneficial way of viewing users. Dunne (1999) believes that design can disrupt the technocracy consumers find themselves in. This process can re-humanize users (Dunne 1999). Good design, according to Wright and McCarthy (2008), does not begin with precepts. Rather than being initiated through specifying technology, Prestero (the International Council of Societies of Industrial Design N.D.) claims that good design 'starts with the user and then goes in search of the technology.' Similarly, according to Holt (2011, 153), the process of beginning with users challenges the model-based approach and 'de-institutionalizes' the design process. In claiming that people should come first in product development, design-based researchers suggest a need for re-prioritization in HCI.

The above calls suggest that dominant measurement-based HCI models are 'artificial' and exist to institutionalize users. Design-based research can however free users from this mode of operation. Such calls from the design-based can be perceived in terms of Deleuze and Guattari's (2004) description of minor science. Minor science is a model that recognizes: 'the vital state of matter…[]…a material vitalism that doubtless exists everywhere but is ordinarily hidden or covered unrecognizable, dissociated by the […royal science…] model' (Deleuze and Guattari 2004, 454).

The design-based camp's notion of putting people first *and then hunting* for appropriate technology necessitates methods of collecting human data which differ from those used in the dominant measurement-based HCI model. Through a lens created by Deleuze and Guattari's (2004) language, design-based researchers can be perceived as employing an approach termed 'following.' 'Following,' as already noted, is important to the call driving minor scientists (Deleuze and Guattari 2004).

Following

The design-based UX researchers Gaver et al. describe the process for recruiting participants for a research study:

> We made no attempt to control demographics, but our volunteers came from a wide range of circumstances: from ages 18 to 80, rich and poor, families, single people, and housemates; they represented a wide range of the home lives of people in today's society. (2004, 54)

The above quote indicates that Gaver et al. (2004) have not marked out specific boundaries with regards to their intended demographic. In Deleuze and Guattari's terms, Gaver et al. (2004) can be thought of as rejecting the principles of royal science, a practice which persistently strives to 'striate all of space in all of its directions' (Deleuze and Guattari 2004, 408). In discussing the rationale for their study, Gaver et al. (2004, 54) criticize 'researchers' inclination to apply their own conceptual frameworks to the phenomena they observe.' In so doing Gaver et al. can be posited as opposing royal scientists' tendency to both create 'a form that organizes matter' and to understand matter as being 'prepared for the form' (Deleuze and Guattari 2004, 408). Gaver et al.'s stated unwillingness to dictate the demographic of participants or to impose order over the evaluative framework suggests an interest in pursuing the heterogeneous flow of matter. Their philosophy can thus be compared with that of minor scientists who operate through 'following a flow of matter' (Deleuze and Guattari 2004, 451).

The premise of 'following' can be applied more generally to the qualitative study of humans in HCI. The process termed 'Ethnography' is one such qualitative process. Ethnographers witness and record human events in the attempt to record and describe the 'irreducibility of human experience' (Willis and Trondman 2000, 5).

Ethnography has been practiced in design agencies since the 1970s (Wasson 2000). It was introduced to counteract the reductionism which is synonymous with quantitative research (Suchman 1995). Ethnography is used in the quest to enable designers to get closer to users, for it lessens: 'the distance of professional designers from the sites and activities that are the subjects/objects of their work' (Suchman 1995, 59).

However, ethnographic practice is only partially successful in reducing the distance between researchers and users. It is criticized for creating an opposition between researcher and studied subjects with the result of Otherizing the latter (Suchman 1995). The shortcomings of ethnography can be viewed in terms of philosophy developed by Deleuze and Guattari (2004). A minor scientific researcher may use ethnography to follow users *up until a certain point* where upon his ambitions are curtailed by what might be termed an impenetrable 'terminal distance' between himself and his human subject(s). At this point it is necessary to further expand on Deleuze and Guattari's description of the process of following:

> [Minor scientists]… are obliged to follow in another way as well, in other words, to go find the wood where it lies, and to find the wood with the right kind of fibers. Otherwise, they must have it brought to them: it is only because merchants take care of one segment of the journey in reverse that the …[minor scientists]… can avoid making the trip themselves. But…[minor scientists]… are complete only if they are also prospectors; and the organization that separates prospectors, merchants, and artisans already mutilates artisans in order to make 'workers' of them. (Deleuze and Guattari 2004, 451–452)

To be a more *complete* minor scientist then, an individual cannot be thwarted by a terminal distance between himself and the matter he is pursuing. With regards to HCI UX research, to be framed as a more complete minor scientist, a researcher must strive to overcome the terminal distance between himself and the people he is studying.

Strategies employed by design-based researchers attempting to reduce distance between themselves and study participants are outlined below. Gaver et al. (2004, 55) acknowledge the existence of distance between themselves and their research participants, stating the latter are 'inescapably…[ ]…different' from them. Gaver et al. identify the need to reduce

this distance to gain better insights. In an attempt to comprehend data provided by participants, Gaver et al. (2004, 56) claim '[we had to] see the volunteers through ourselves.' Gaver et al. (2004, 55) argue their method precipitated the creation of a 'dialectic' between themselves and their study group. This in turn reduced the distance between these parties to an 'intimate' one (Gaver et al. 2004, 55).

In a similar way, Light (2010) identifies distance between researcher and study participants. Indeed, Light (2010) highlights the oppositional roles adopted by both parties. Light (2010, 5) suggests UX researchers would benefit from perceiving their interaction with study protagonists as a 'meeting place.' For Light (2010, 5), this stance counteracts the tendency for researchers and participants to Otherize one another, for 'unlike an opposition, [it] doesn't need a One to respond to.' Light's 'meeting place' can also be seen as a strategy to reduce the distance between researcher and participant. Equally, executives at the leading design consultancy IDEO (Brown and Wyatt 2010, N.P.) identify a requirement for researchers to reduce distance between themselves and participants, stating 'design thinkers become embedded in the lives of the people they are designing for.' Holt (2011) echoes the need to bring designers and users closer together. Holt suggests design-based research is ineffective if investigators remain distant from study participants. This is because user-centered practices are unsuccessful if left to 'occur solely on the level of representation' (Holt 2011, 152). Successful UX practice necessitates reduction of distance as the 'designer absorbs and is absorbed by the user's own situation' (Holt 2011, 152). In a parallel manner, the UK Design Council (Burns et al. 2006, 18) argues that UX design necessitates that practitioners 'immers[e] themselves' in the lives of users. This act of immersion also signifies the need for design-based researchers to reduce the distance between themselves and participants. The requirement for design-based researchers to reduce distance between themselves and users parallels the need for Deleuze and Guattari's (2004) minor scientist to erase distance between himself and the materials he works with.

There are then a number of ways in which the practices of the model-based and design-based UX research camps mirror those of Deleuze and Guattari's (2004) royal science and minor science respectively. UX research was not in existence at the time Deleuze and Guattari were scripting their philosophies of science. The comparisons therefore illustrate that current debates in HCI are by no means new. Instead, according to Deleuze and Guattari (2004), the tension between royal science and minor science has always been intrinsic to the development of human civilization.

A lens provided by Deleuze and Guattari also serves to provide insight into the nature of legitimacy within contemporary HCI research practice. A reflection on shifts in the use of the qualitative data collection tool termed 'cultural probing' illustrates how legitimacy is constructed in HCI.

On legitimacy: cultural probing

'Cultural probing' was invented by Gaver and his team of design-based UX researchers (Boehner et al. 2007). 'Cultural probes' denote a collection of objects designed to engage users early on in the design process (Boehner et al. 2007). Objects are often quite low tech and may include 'maps, postcards, cameras, and booklets' (Gaver et al. 1999, 22). Users' interactions with these objects provide researchers with qualitative data. The method was conceived as a means to subvert dominant measurement-based HCI research practice (Boehner

et al. 2007). Indeed, the tool was created to purposefully provide *uncertain* and *ambiguous* data (Gaver et al. 2004).

The popularity of cultural probes grew rapidly because they enable the efficient collection of 'broad and rapid data' (Paulos and Jenkins 2005, 342). They became so commonly used in HCI that they are almost the default mode for gathering qualitative data. For example, cultural probes have been used to investigate the lived experience 'elderly people in diverse communities' (Gaver et al. 1999, 22); they have aided the creation of innovative educational software for children (Wyeth and Diercke 2006); and been used to investigate cultural aspects of on-line video sharing (Oumard et al. 2008).

Cultural probes are however seldom deployed as they were initially conceived, but rather adapted in some way (Boehner et al. 2007). Their reworking has led to unease in the design-based research community. Gaver et al. (2004) warn that their adoption by the model-based research camp has led to the loss of key attributes such as uncertainty and ambiguity. Going further, Boehner et al. claim the adaptation of probes can easily dismantle the true purpose of these tools: The subversive nature of the original probes is often lost, however, when they are seen as a reproducible method and explained within traditional accounts of knowledge production in user-centered design. What we see, then, is the probes being adopted within the frame of existing HCI approaches, and particularly in light of a traditional conception of the relationship between users, requirements, designers, and designs. (2007, 1081)

In Deleuze and Guattari's (2004) terms, the model-based camp's tendency to remove 'uncertainty' and 'ambiguity' from the probes process parallels royal science's fondness for 'extracting constants from variables' and the subsequent 'homogenization' of space and matter. As probes become a less ambiguous method, they can be considered as becoming *forms*. Probes then take on a royal scientific description, becoming 'a form that organizes matter' (Deleuze and Guattari 2004, 407).

Deleuze and Guattari (2004, 411) claim that royal science always appropriates and 'formalizes' the inventions of minor science to enforce its dominance. In so doing, royal science allows these inventions to 'exist only in the capacity of "technologies" or "applied science"' (Deleuze and Guattari 2004, 411, original emphasis). The 'reinvention' of cultural probes is an example of a minor scientific methodology re-conceptualized as a royal scientific 'technology.' For design-based researchers, this process robs probes of their legitimacy. However, the opposite is true for their model-based counterparts – for it is only by making probes submit to their model that it can become a truly legitimate tool.

UX research practitioners are not necessarily lifelong members of either the model-based or design-based camps. According to Law (2011, 4–5), the movement of individuals does not occur with equal frequency in both directions: 'migration between the two camps, especially from the former to the latter, seems on the rise.' It may be that large numbers of design-based UX researchers have, upon studying disinterested, evidence-based observations, realized that their philosophy is incorrect and accordingly switched sides. There may however be other explanations for this phenomenon. UX researchers are concerned with disseminating findings. The majority of papers in leading HCI conferences and journals feature the presentation of empirical data (see Law 2011). It is not unreasonable to suggest this may lead design-based researchers' decision to incorporate traditional HCI data evaluation methods into their repertoire and thus to move toward affiliation with the model-based camp.

This interplay between UX camps parallels the interaction seen between royal science and minor science. The dominant status of royal science can be evidenced by its tendency

to 'continually impos[e] its form of sovereignty on the inventions of [minor] science' (Deleuze and Guattari 2004, 400). Furthermore, royal science 'deprives […] [the minor sciences] of their own model, submit[ting] them to its own model' (Deleuze and Guattari 2004, 411). Through setting parameters for dissemination, the model-based camp may be 'imposing their sovereignty' and requiring design-based researchers to 'submit to their own model.' In HCI then, an overarching sense of legitimacy is dictated by the model-based camp. Though writing before the advent of UX research, Deleuze and Guattari (2004, 400) may have foretold the predicament for design-based 'minor scientists' in HCI UX research practice: '[i]t is as if the "savants" of nomad science were caught between a rock and a hard place, between […what…] nourishes and inspires them and the State that imposes upon them an order of reasons' (Deleuze and Guattari 2004, 400).

The parallels between the models of royal and minor science and Law's (2011) camps in UX research practice highlight difficulties faced by design-based investigators.

On fluidity

Despite its dominance, royal science cannot dissuade all minor scientists from their practice (Deleuze and Guattari 2004). In some instances it acquiesces, 'even going so far as to propose a minor position for them within the legal system of science and technology' (Deleuze and Guattari 2004, 411). Does this mean that methods such as cultural probes have given design-based researchers a high level of legitimacy in the eyes of the dominant model? Deleuze and Guattari's work suggests that the answer is not at all straightforward. It is worth returning to their claim that: 'smooth space is constantly being translated, transversed into a striated space; striated space is constantly being reversed, returned to a smooth space' (Deleuze and Guattari 2004, 524). The example of cultural probes is emblematic of this. Through applying Deleuze and Guattari's (2004) terminology, the formation of cultural probes as a method of subverting dominant empirical-based HCI practice can be seen as a type of smooth (minor scientific) space emerging from a striated (royal scientific) one. Cultural probes have been translated in to a 'striated space' through their appropriation by model-based researchers. It is therefore understandable that the design-based camp is making efforts to 'smoothen' the space associated with them. It is possible that the continued appropriation of cultural probes by model-based researchers may result in a time when it is impossible for design-based researchers to reclaim this tool. In this case, it may not be possible for the model-based camp to 'smoothen' the space occupied by probes to a desirable degree. Consequently, it is conceivable that design-based researchers may focus on emerging tools which occupy 'unmarked' territories. A lens provided by Deleuze and Guattari's philosophy enables us to hypothesize that such tools will give rise to new vehicles through which the notion of legitimacy in HCI can be debated.

Finally, if Law (2011) is correct in arguing that the UX field is becoming populated with model-based practitioners, then one cannot escape the implication that the UX research space is becoming increasingly striated. In such an event, the design-based contingent may ask 'what smooth space lies beyond UX?' Conceivably, this may precipitate the emergence of new areas of research in HCI.

Conclusion

This article has argued that *model-based* and *design-based* UX research camps can be constructed in terms of Gilles Deleuze and Felix Guattari's *royal science* and *minor science* respectively. In defending this position, this research has also found flaws with design-based UX researchers' attempts to identify with Claude Levi-Strauss' bricoleur. In so doing, we have called for a re-evaluation of the use of bricolage as a means of contextualizing qualitative research practice. Qualitative researchers in a range of fields commonly claim there is a link between bricolage and qualitative methods – as such our call is important beyond the area of HCI investigation.

In viewing the model-based and design-based UX research camps through a lens provided by Deleuze and Guattari, it is important to note that we have not attempted to present an easy caricature of the two fraternities of UX research. Model-based researchers are quick to point out that they are well aware of the difference between 'the map and the territory,' 'the menu and the meal.' Similarly, design-based researchers know very well that the world in which they live and the technologies they use depend on model-based development.

We have used cultural probes as a vehicle to demonstrate how legitimacy is currently constructed in HCI research. Research on legitimacy may enable the community to explore the manner in which important issues are framed in design. *Sustainability* is one such issue. Essential elements used in the manufacture of computerized technology often come from unsustainable sources. Research on legitimacy may enable insight into how unsustainable manufacturing practices may be legitimized in design. Research on legitimacy may also enable the community to unpick how users are constructed in design.

We have also noted the lack of a rigid dichotomy in HCI research practice. We have instead argued for the existence of a flux between the model-based and design-based areas of UX investigation. The notion of flux allows insight into a wider context in HCI research. Three decades ago an overarching concern with the *functionality* of technology prevailed in HCI. The functionality movement drew inspiration from engineering and computer science. As the dominant model, functionality could be thought of as the royal scientific approach of its era. In the 1980s, the usability movement inspired researchers to focus on how easily human beings could operate computerized technology. Consequently it presented a human-centered challenge to the overarching approaches drawn from engineering and computer science. At the time, the usability movement had minor scientific traits. However, for contemporary holistic UX researchers, usability itself seems like a royal science.

The notion of flux is intrinsic to the relationship between Deleuze and Guattari's sciences. Debates precipitated by the continuous flux between model-based and design-based researchers will continue to emerge in UX research. The use of Deleuze and Guattari's philosophies may enable researchers to contextualize these shifts in discussion and to unpick the discourse surrounding emerging tools and methods.

Note

1. Levi-Strauss' *The Savage Mind* first appeared in French in 1962. It was first translated into English in 1966. Deleuze and Guattari's *A Thousand Plateaus: Capitalism and Schizophrenia* was published in French in 1980. The first full translation into English was published in 1988.

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