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User research and design creativity: three insights for future studies

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ABSTRACT

Understanding users is central to design and Human-Computer Interaction, both for researchers and for practitioners, who often conduct user research and communicate its value to stakeholders and clients. Despite its praised relevance, we know little about how user research affects design creativity. Our objective is to establish a foundation for answering this question. We first review empirical findings from related domains and examine how the value of user research is linked to design creativity. We then present a pilot study for a large-scale experimental setup to determine how different levels of user research influence design creativity. Finally, we discern preliminary insights on the relationship and provides recommendations for how future studies may investigate the critical and complex relationship between user research and design creativity.

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User research; design; creativity; interaction design

1. Introduction

In this paper, we explore the relationship between two concepts that lie at the core of Human-Computer Interaction (HCI), namely *user research* and *design creativity*. When designing new systems, understanding users and their context is generally considered to be of critical importance, and the benefits of user research have been emphasised in a range of canonical contributions (Holtzblatt and Jones 1993; Löwgren and Stolterman 2004; Ehn and Kyng 1987). While the general consensus seems to favour the deployment of user research in interaction design, this long-lived understanding has been challenged when it comes to designing innovative products such as virtual and physical interactive systems. As a case in point, this stance shines through in the late Steve Jobs' famous quote on Apple refraining from doing market research, 'no market research could have led to the Macintosh or the personal computer' (Steve Jobs 2013; Sheff 1985). Similarly, Norman and Verganti (2014) have argued that human-centred design seldom leads to radical innovation. One way of construing these propositions is by reference to the relationship between user research and creativity. Just as it goes for user research, creativity is acknowledged as an important aspect of interaction design; in part because creativity training and derived skills can be useful for exploring a wide range of potential solutions to a design problem, in part because design is often expected to result in the introduction of something novel into the world. Nelson & Stolterman thus articulate design practice as 'the ability to imagine that-which-does-not-yet-exist, to make it appear in concrete form as a new, purposeful addition to the real world' (Nelson and Stolterman 2003). As a result, there have been several contributions to the HCI community that examine how to foster creativity in design, particularly through the use of specific creativity methods and design activities (for an overview, see e.g. Mose Biskjaer, Dalsgaard, and Halskov 2017). Studies into design creativity have mainly focussed on designing for ideation (Bonnardel and Moscardini 2012), social media as collaboration tools (Alcántara, Markopoulos, and Funk 2015), and tools for creative writing (Gonçalves and Campos 2017; Gonçalves et al. 2017; Biskjaer et al. 2019).

Despite the apparent importance of user research for creativity, we have surprisingly little empirically grounded knowledge about *how* user research influences creativity in design. Does user research lead to higher levels of design creativity? How much user research is advisable in order to attain a certain level of design creativity? How might we measure (if at all) the relevance of user research for design creativity? Exploring such questions is equally relevant for design research and practice. Design practitioners often face important decisions about how much time to dedicate to user research, for instance when scoping and planning projects, and about the type of user research to bring into play in specific activities during a design project. An even deeper understanding of the relationship between user research and creativity in design can,

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therefore, have implications on both a theoretical and a practical level. While this relationship is clearly complex, we find it necessary to begin by casting a sturdier empirical foundation for understanding and discussing it in order to inform future research.

Our long-term agenda is to examine the complex question of *how user research influences design creativity*. However, as we shall examine in more detail throughout the paper, this is a highly complex question, and a necessary first step is to establish the proper grounding, and indeed to examine if and how it is possible to provide answers. Therefore, our objective in this paper is to *explore and establish a theoretical and methodological foundation for studying the relationship between user research and design creativity*.

To this end, we first conducted a review of the related empirical literature and the argued potentials and limitations of user research. We then conducted a pilot of a controlled experiment with design students who were tasked with solving a design challenge based on access to either *high or low amounts of user research*. The design creativity of their solutions were then assessed by expert judges.

In accordance with this bipartite structure, the *main contribution* of this paper therefore consists of *two insights* derived from (1) the literature review, which also serves as the paper's background section, and (2) the pilot study for a large-scale experimental study of how user research affects design creativity. We propose insights as *basic recommendations for future studies* on how to further investigate in depth the critical and complex relationship between user research and design creativity. We end the paper by discussing some of the main implications for design research.

2. Literature review of user research and related work

In this first part, we present a definition of user research, including the one we adhere to throughout this paper. We then provide an overview of existing empirical evidence for the impact of user research. To further contextualise the topic of user research in design, we offer a brief overview of creativity in design. We end this section with a juxtaposition of the potentials and limitations of user research.

2.1. Defining user research

In general, and as pointed out by others (Bano and Zowghi 2013) before us, the use of different terms describing the same or related concepts may often complicate the establishment of a solid overview or even a scientific consensus. One reason is the heterogeneity of disciplines that, to a varying degrees, rely on the *consideration of a user*[1] This may result in relevant empirical evidence being scattered across outlets from the *Empirical Software Engineering: An International Journal* (Abelein and Paech 2015) across *Management Science* (Von Hippel 1986) and the *CHI proceedings* (Gray 2016; Gray, Toombs, and Gross 2015) to *International Journal of Technology and Design Education* (Conradie, Marez, and Saldien 2017; Christiaans and Venselaar 2005), to name but a few publication venues. Consequently, different traditions will tend to employ various terms to discuss often overlapping, but slightly different, terms such as 'user involvement' as opposed to 'lead users.' Both denote some user part-taking, but may arguably be distinguishable based on the proficiency or competence exhibited by the user.

Even in HCI as one of the core disciplines to employ user research, the definition of user research is vague or even absent. Lazar et al. state that 'user research is also a broader term that may include elements of design and development, such as personas, user profiles, card sorting, and competitive research that generally might not be considered "research" by those who consider themselves researchers' (Lazar, Heidi Feng, and Hochheiser 2017, p. 143). Although no clear definition is given, Cooper et al. emphasise that 'user research is the critical foundation upon which your designs are built' (Cooper, Reimann, and Cronin 2007, p. 73). A fundamental disagreement is found when comparing user research to the term 'usability testing,' insofar as Lazar et al. state that 'usability testing is often known as "user research"' (Lazar, Heidi Feng, and Hochheiser 2017, p. 263), whereas Cooper et al. argue that 'usability testing is also not the same as user research' since 'user research must occur *before* ideation, usability testing *following* it' (Lazar, Heidi Feng, and Hochheiser 2017, p. 143, orig. emphasis). Consulting other HCI textbooks e.g. Rogers, Preece, and Sharp (2011), Dix et al. (1998) and Shneiderman et al. (2009) does not serve to conclude the discussion as they do not explicitly mention the term 'user research' (based on a full-text search). Therefore, we subscribe to the understanding of user research as implicitly outlined by Cooper, Reimann, and Cronin (2007) since this is also in alignment with the definition provided by the Interaction Design Foundation[2].

2.2. Empirical evidence from related studies

Although the exact definition of user research remains contested, much research has been published on related topics such as usability testing, participatory design, and

user involvement. The reviewed literature comes in the form of both meta-reviews and single studies and arises from various disciplines such as management, design, and HCI research.

Kujala (2003) provided a review of user involvement and its effect on system success (as defined by a broad range of criteria) and concluded that '[u]ser involvement is clearly useful and it has positive effects on both system success and user satisfaction'. Involvement in some cases also comes in the form of usability activities, user participation, and tests, and, as noted, 'it is more difficult to prove empirically the cost-effectiveness of user involvement in gathering user needs before a prototype exists' (Kujala 2003). Subsequent work by Kujala (2008) investigated the role of direct contact with users in relation to requirements quality and project success, underlining that while early user involvement is rare, it seems to be a powerful way of improving requirements quality and project success. Interestingly, the authors found no statistically significant direct relationship between user involvement and project success. A correlation? was only found when the requirements for the project were based on real information on users, which lead the authors to the aforementioned conclusion (Kujala 2008).

Much similar to Kujala (2008, 2003), Bano and Zowghi (2013) provided a systematic literature review of user involvement and system success in software development. They also addressed the inconsistencies in defining user involvement and project success, and how conjugating different terms and practices might render the general image opaque. In total, 87 papers from 1980 to 2012 were reviewed to conclude that overall, 68 percent of the publications seemed to show a positive correlation; however, due to the said issues, the results were not viable for a meta-analysis and a summarising conclusion (Bano and Zowghi 2013). In parallel to Bano and Zowghi, Abelein and Paech (2015) conducted a meta-analysis on literature of the relationship between user participation (and involvement) and system success. They found an overall positive correlation. This analysis was done by collapsing multiple sub-categories of variables such as developers' attitude toward users, users' abilities and involvement in the parent category of Human Aspects (Abelein and Paech 2015).

It is well-established in *innovation* research that users, not manufacturers, are often the first developers of products and services that later become commercially viable (e.g. Shaw Shaw 1985). Here, we subscribe to a general, unifying definition of innovation as proposed by Baregheh, Rowley, and Sambrook (2009) based on their discernment of approximately 60 different definitions of innovation in the period 1934–2008. Their synthesising definition suggests that 'Innovation is the multi-stage process whereby organisations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace' (p. 1334). As an influential contribution to understanding user involvement in innovation, Von Hippel (1986) argued for a special type of user group–*lead users*. This refers to a specialised group of highly skilled users with profound knowledge about a given product. Lead users face needs in the market place months or years before the bulk of general users, and so they experiment with a given product to obtain an individual solution from which they themselves will benefit greatly. Lead users, therefore, are more likely to innovate than any other user group as documented empirically (e.g. Urban and Von Hippel 1988; Morrison, Roberts, and Midgley 2004). Lead users' extraordinary potential for innovation led Von Hippel (2005) to advocate the idea of 'democratising innovation' in the sense that companies and organisations are likely to benefit from involving lead users in the innovation process.

The term '*fuzzy front end*' is often used to describe the early phases of product innovation, but has also been used in the realm of design. In this context, Conradie, Marez, and Saldien (2017) explored the impact of end-user involvement in the earlier stages. Student designers tasked with redesigning a time tracking device in an industrial manufacturing context were allocated to either a control group or a group with a visually impaired end user. Contrary to the authors' expectation, evaluation using the Consensual Assessment Technique (Amabile 1982) on the outcome yielded no difference between the two groups on either of the three criteria (user value, originality, and feasibility). In their discussion of the results, the authors pointed out that the benefit of user involvement has previously been realised directly through the ideas of the user, not through a group of designers translating them into concepts (Conradie, Marez, and Saldien 2017).

2.3. Creativity in design

Arriving at a successful design solution often means attaining some level of creativity in the final design (see e.g. Cross 1997). This makes it highly relevant to explore exactly how user research affects design creativity. The creativity research community generally agrees that creativity requires *originality* and *effectiveness*. These criteria are sometimes also referred to simply as novel and useful (Runco and Jaeger 2012). Establishing a clear understanding of creativity is critical because

'[w]ithout a clear definition, creativity becomes a hollow construct-one that can easily be filled with an array of myths, co-opted to represent any number of divergent processes, and further confuse what is (and is not) known about the construct' (Plucker, Beghetto, and Dow 2004). Consequently, Plucker, Beghetto, and Dow (2004) proposed the following definition, which synthesises most current suggestions in a way that is suitable for both empirical and theoretical studies. This means that we understand creativity as the 'interaction among *aptitude, process, and environment* by which an individual or group produces a *perceptible product* that is both *novel and useful* as defined within a *social context*' (Plucker, Beghetto, and Dow 2004, p. 90, orig. emphasis).

Given the detailed, yet aptly generic view on creativity that this definition suggests, we argue that this understanding is equally appropriate in design. Design can be construed as an inherently creative activity in that it is concerned with bringing something novel and useful into the world. In the words of Löwgren & Stolterman, 'To design is to create something new.' Löwgren and Stolterman (2004). Creativity is not only a concern when it comes to the product of design, but even more so when it comes to the process of designing. Design processes typically encompass the development and exploration of a range of ideas for potential outcomes, as designers shift between divergent and convergent modes of thinking and acting to understand and explore the opportunities and constraints of the design space as they move towards a final product. Although the relevance of creativity in design is well-established (see e.g. Daley 1982; Christiaans 2002), it is often seen as rather difficult to articulate clearly. To help elucidate this complexity, Askland, Ostwald, and Williams (2010) proposed (at least) two competing conceptualizations of design creativity. The first is a positivist paradigm largely based upon Simon's (?)eminal work on design as a rational problem-solving process, and another paradigm informed by Schön's (?)ork on reflective practice in the sense that design is a 'reflective conversation with the situation'. Informed by these two main traditions, Askland, Ostwald, and Williams (2010) argued for two conceptualizations of the design process-a descriptive, linear model (e.g. Howard, Culley, and Dekoninck 2008), and an integrative systems view in which problems and solutions co-evolve (Dorst and Cross 2001). Rather than adopt either of these positions unconditionally, we find it more relevant for the present paper to direct attention to the outcome of the creative design process. Consequently, and based on the above definition of creativity by Plucker, Beghetto, and Dow (2004), we understand design as 'the ability to imagine that-which-does-not-yet-exist, to make it appear in concrete form as a new, purposeful, addition to the real world' (Nelson and Stolterman 2003).

2.4. Revisiting the debate on user research

The empirical evidence for the impact of user research on design has contributed to, but not settled, the debate about to what extent user research is useful for design creativity. To provide a more in-depth outline of the motivation behind this paper and highlight the importance and complexity of the the relationship between user research and design creativity, we revisit the two dominating perspectives and their arguments either for or against the value and relevance of user research in design in general and its impact on design creativity in particular.

2.4.1. Potentials of user research

'The group splits into pairs to find out first hand what people who use, make, and repair shopping carts really think,' the speaker announces, accompanied by the pictures of two designers listening, observing, and taking notes in front of shopping carts in a mall setting (ABC Nightline/IDEO n.d.). This snippet stems from a famous clip from ABC Nightline's segment on IDEO's so-called 'secret weapon for innovation' and demonstrates in an entertaining manner the striking appeal of understanding the users and the context for which one is designing. This idea of understanding the users definitely goes beyond the design industry, here exemplified by the influential Palo Alto-based design consultancy firm that is perhaps most widely known for inventing the first Apple Mouse. The wider relevance of user research in academic and educational contexts is evident from Preece, Sharp, and Rogers' canonical book *Interaction Design: Beyond Human-Computer Interaction* (Preece, Rogers, and Sharp 2015), which clearly states the first of four basic design activities to be Establishing Requirements. This involves 'understanding people and what they do' (Preece, Rogers, and Sharp 2015). One of the rationales behind this particular phase is to get the design *right* and to minimise the cost of errors later in the creative design process. The activities in this phase most commonly take the form of questionnaires, interviews, focus groups, and direct observations, etc. (Preece, Rogers, and Sharp 2015).

A similar, well-known example of this perspective is that of Contextual Design, which is an 'approach to designing products directly from a designer's understanding of how the customer works' (Holtzblatt and Jones 1993). This is important because '[g]reat product

ideas come from the marriage of a designer's detailed understanding of a customer's need and his or her in-depth understanding of the possibilities introduced by technology' (Holtzblatt and Jones 1993). The first step of Contextual Design is Contextual Inquiry, which seeks to establish reliable knowledge about the customers' field through interviews and team interpretation sessions, eventually forming the ground for inventing new solutions (Holtzblatt and Jones 1993).

Despite their explicit focus on design process reflection, Löwgren and Stolterman presented five central activities with the first being inquiry, which 'corresponds to the aspects of design work that are mainly oriented toward finding out about a design situation' (Löwgren and Stolterman 2004). Furthermore, the authors argued that the study of a present design situation, typically in a workplace, is essential for providing initial understanding of both existence and potentiality (Löwgren and Stolterman 2004). However, the potential benefit of this activity is lost if current practices are either mediated directly, thereby under-exploiting the transformative potential of technology, or if insensitive interventions break with the qualities of current practices (Löwgren and Stolterman 2004).

While these (and many similar) research contributions come with nuanced, relevant modifiers for the concrete applicability of user research, the essence remains. Taken as one general perspective, it is noticeable how such influential contributions to the HCI and interaction design literature not only present early user research as pivotal, but indeed emphasise it as a sturdy foundation for innovation and thereby for design creativity.

2.4.2. Limitations of user research

This overwhelming consensus notwithstanding, the value of user research has been brought into question for different reasons and from various perspectives in the design and HCI literature. Some of these concerns have challenged the underlying rationale, the practical aspect, or the empirical results and derived value of user research. Norman and Verganti presented one example of this when they stated that '[e]very radical innovation he [Norman] investigated was done without design research, without careful analysis of a person's or even a society's needs' (Norman and Verganti 2014). In their work, human-centred design is scrutinised for its (presumed) ability to produce innovations by studying people and discovering hidden, unmet needs based on an analysis of prior cases of inventions in society. The authors' rather bold conclusion is that design research is unlikely to produce radical product innovation through human-centred design. Radical innovations are much more likely to be driven by technology development and specific types of meaning change that avoid being trapped into existing technological and socio-cultural paradigms (Norman and Verganti 2014).

This perspective is also somewhat related to the long-standing discussion of the relationship between ethnography and the design of interactive systems. Randall and Rouncefield provided a good overview of this discussion in the *Encyclopedia of Human-Computer Interaction* where the precarious relationship is addressed from a multitude of angles and where the authors state their own summarized view as 'no strong relationship between ethnography of whatever kind and design has ever been established in the workplace or elsewhere for the simple reason that this relationship is always and everywhere contingent' (Randall and Rouncefield n.d.). What 'no strong' implies is perhaps less clear, but Plowman, Rogers, and Ramage (1995) seem to share this opinion in stating that at least the majority of designers are not able to implement findings from workplace studies into the design of virtual and physical interactive systems.

These two cases present knowledge on the logical rationale and, to some degree, empirical evidence as to the generally presumed, but by some contested, intrinsic value of user research. Recently, however, Gray et al. presented work on the experience and practicalities of design practitioners, which is relevant to the current discussion (Gray 2016; Gray, Toombs, and Gross 2015). Both publications provide examples of problematic situations for conducting user research, e.g. being a designer in an engineering culture such as in this example, '[i]n his work, Martin focuses on "pure interaction design wireframes," with no substantial user research' (Gray, Toombs, and Gross 2015), or when design practitioners report on which methods they use, '[r]emarkably few explicit user research methods were shared' (Gray 2016). Indeed, it would seem that large companies may have less inclination toward user research, which 'likely reflects not only a lack of access to users, but also a company culture that does not value this kind of access' (Gray 2016). While practical problems of conducting user research may not necessarily be a good argument against it, from an industry perspective, it nevertheless contributes to the overall decision of whether to include or exclude it.

2.5. Summary

As this part shows, the relationship between user research and design creativity is as critical as it is complicated. Some canonical works praise the importance of a thorough understanding of users and their context, while others question the definitive importance for

innovation, or even the direct link to design itself. Within the empirical work, diverging terminology hampers the synthesis of evidence across multiple disciplines, with some studies (Abelein and Paech 2015; Kujala 2003; Von Hippel 1986) finding positive relationships while others (Conradie, Marez, and Saldien 2017; Bano and Zowghi 2013; Kujala 2008) find no such relationship. If we return to the most widely accepted criteria for creativity, namely that it refers to an outcome that is perceived to be both novel and useful (Runco and Jaeger 2012) within a given context, we may arrive at a more nuanced understanding: while results are as of yet inconclusive in terms of assessing the extent to which user research influences novelty, there is consensus that user research can generally increase the likelihood of developing products that are useful in a given context. As such, user research is likely to at the very least contribute to the latter half of the creativity equation.

3. Pilot for experimental study

Building on the insights from the previous section concerning the discrepancy between user research as described in the HCI textbooks and the lack of clear empirical evidence as well as how it is considered anecdotally, we wanted to explore if the degrees of user research in a design process may somehow affect the design creativity of the final design. In other words, could it be argued that higher degrees of user research actually lead to higher degrees of design creativity as assessed by domain experts? This was the motivation behind the study. Given the undisputed complexity of this question, we underline that we do not consider this study exhaustive or conclusive in any way. Rather, our ambition has been to take a first step toward a more comprehensive empirical research study design. This means that we consider this study a pilot study aimed to inform future work.

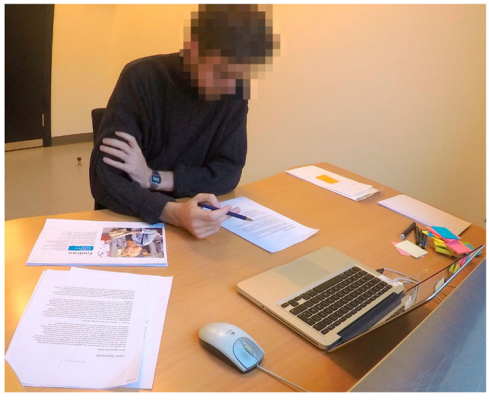

Figure 1. Setup from Go-Pro point-of-view.

3.1. Method

For this study, we devised a *between-subjects experiment* based on a *design challenge* to test whether the amount of user research might have any discernible influence on the creativity of the design outcome. This means that the amount of user research serves as the independent variable while the dependent variable is this manipulation's effect on the degree of *design creativity* of the ensuing design solution (Figure 1).

3.2. Participants

A total of 12 students participated in the study. The average age of the participants (six female, six male) was 23.4 (SD = 1.35) with eight second-year undergrads, one third-year undergrad, three second-year grad, and one in their final year. All participants were screened for experience with interaction design. All had completed at least one full university course on Interaction Design. All participants were compensated the appropriate wage determined by the National Labour Agreement (approx. EUR 19/USD 21 pr hour).

3.3. Procedure

The study was conducted in person in the same designated room. Each individual participants first read and signed a consent form before being handed an envelope and a note describing its contents and the duration of the experiment from this point onward (approximately 50 minutes). At the 45-minute mark, the participants were informed that they had five minutes to finish the task.

3.4. Materials

The experimental setup included pen, paper, sticky notes, and a computer for submitting the solution (the computer was running a Google Form with the instructions as shown in Figure 2. A Go-Pro camera recorded the participants' interaction with the materials during the study. The envelope necessary to complete the experiment was handed to the participants, containing the following three documents:

(1) *A unique number* to ensure anonymity and avoid the participants being identified as belonging to either condition,
(2) *The design challenge* to be addressed, including four top-level requirements for the design challenge
(3) *User Research materials* in the form of three documents: *Personas*, *photos* from related contexts, and

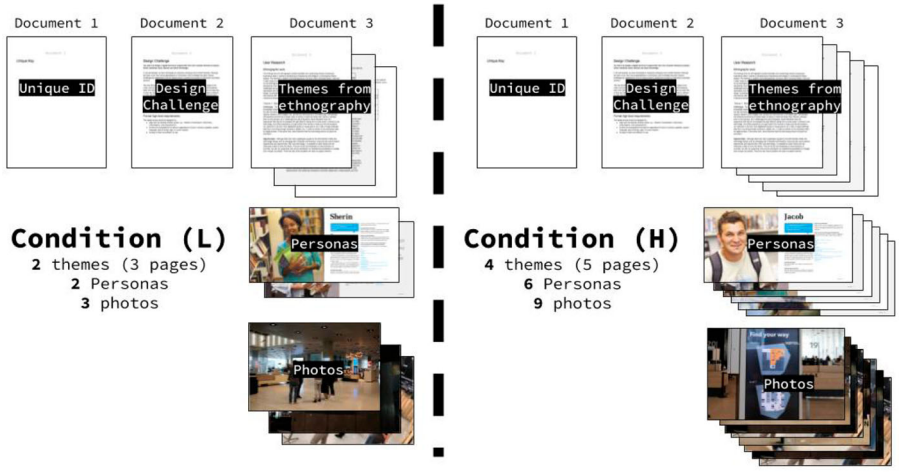

Figure 2. The content of the envelope in either condition.

themes from ethnographic work highlighting both challenges and opportunities.

The *user research material* was developed by design researchers and design practitioners for an unrelated real-life design project. This material was considered well-suited for this study for the following reasons. First, both the design challenge and the user research are non-fictitious, thereby ensuring the highest level of *ecological validity* of the materials. Second, for assessing the design creativity of the design solutions, we recruited expert judges who where either familiar with or actively taking part in the design project. This ensured a high level of *domain expertise*. Finally, this unrelated design project had collected an extensive amount of user research of very high quality. This eased the construction of two identical conditions, which only varied in the amount of user research, thereby ensuring high levels of *internal validity*. The varying degrees of user research in the two conditions essentially contained the exact same types of documents (personas, ethnographic themes, and photos), but with the *low user research envelope* containing a smaller quantity based on a randomly selected subsample of the *high user research envelope* as illustrated in Figure 2.

As illustrated, the low user research envelope contained two themes, two personas and three photos in contrast to the high user research envelope's four themes, six personas, and nine photos, which is roughly equivalent to twice the amount of themes and three times the amounts of personas and photos. These ratios were actively selected by the research team in consideration of the amount of time required to, for instance, look at photos and read light personas descriptions compared to reading full pages of text.

3.5. Analysis

Video-recordings of all sessions were used to determine when the participants began and stopped reading and familiarised themselves with the user research material. A simple qualitative assessment of the participants was carried out, looking for specific actions resembling appropriation of the user research material such as reading through the final page of the user research and taking out a new sheet of paper to write/sketch on, etc. Still-images from these activities are supplied in Figure 3.

3.5.1. Consensual assessment technique in design creativity

To evaluate the design creativity as evaluated by expert judges, we deployed the *Consensual Assessment Technique* (CAT) first introduced in 1982 by Amabile (1982). This method is now well-established as a powerful tool used by creativity researchers in a diverse set of domains. In its basic form, it relies on a panel of judges with substantial domain expertise who rate the creativity of a given outcome or product (Kaufman et al. 2008). The CAT has been referred to as the *gold standard* for

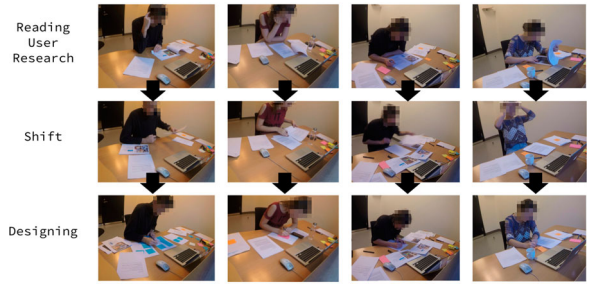

Figure 3. Examples of the qualitative shifts in work by the participants.

evaluating creativity (Baer and McKool 2014; Kaufman 2016) because it measures the actual creative performance or outcome rather than possible traits, skills, or processes correlated with creativity, and because it is so well-validated. It does, however, come with certain drawbacks since it is 'very resource intensive: assembling groups of expert judges is not simple and it may be expensive' (Baer and McKool 2014).

The CAT has already been employed in different design domains, for instance by Christiaans (2002) who tested whether creativity is actually a good value criterion for engineering design to begin with, as it was hypothesised that it might be difficult to distinguish the creative aspects of the solutions from other aspects such as technical quality. Data from the investigation, however, showed that using a homogeneous group of judges alleviates this issue and that 'creativity is a separate construct that can be distinguished from adjacent constructs' (Christiaans 2002). Within graphic design, Jeffries (2017) recently found that inter-rater reliability between judges was improved by including instructions to discount technical execution from the assessment of creativity.

In our use of the CAT, we closely adhered to the procedure described in the literature (Baer and McKool 2014; Amabile 1982; Jeffries 2017), almost replicating the instructions and setup used by Kaufman et al. (2008) in their study of a comparison between experts and non-experts. We did, however, follow Jeffries' (2017) recommendations to explicitly ask the judges to exclude technical execution in their evaluation of the criteria, and while Amabile's (?)arliest presentation of the CAT called for an assessment of multiple dimensions, we followed the protocol used by Kaufman et al. (2008) focussing solely on creativity, as this was the exclusive scope of our study.

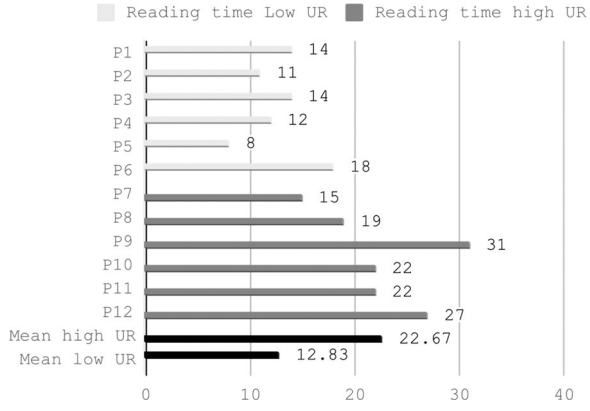

Figure 4. Time spent on reading and familiarising with user research in minutes. Total session lasted 50 minutes as indicated.

The practical setup of our use of the CAT included an envelope including all 12 design solutions, which had first been randomised before being individually stapled together (with sketches) before being packaged. Together with the envelope, the expert judges received one page of instructions that asked them to rate the solutions in two rounds; first in *low-medium-high*, then in *1–6*, where 1 indicates least and 6 most creative. The three expert judges (two full professors and one associate professor) had several years of expertise in design and a thorough knowledge about the particular domain.

3.6. Results

3.6.1. Descriptive findings

Out of the 12 submitted designs, seven also had one or more sketches attached. The average length of the textual description of the ideas was 1,308 characters (SD = 1, 030). The video recordings revealed an expected difference in how participants allocated their time in the study. The low user research group spent considerably less time ($M = 12.83$, SD = 3.37) on reading and familiarising themselves with the user research compared to the high user research group ($M = 22.67$, SD = 5.68), $t(10) = -3.65$, $p = .0044$, $d = 2.11$. The activity by the participants during the experiment is illustrated in Figure 4.

The difference between times spent on getting to know the user research material and designing is unsurprising given the clear difference in the amount of user research material available to the two groups. This is nonetheless an important detail, since points to the manipulation of the independent variable as mentioned above.

3.6.2. Creativity assessment

We evaluated the consistency between the expert judges using Cronbach's coefficient alpha as proposed by Baer and McKool (2009) and found it to be 0.734. According to Kaufman et al. (2008), a score of > .90 is excellent, > .80 is good, and 0.70 is seen as sufficient. For creativity studies, Bear & McKool found the generally reported range to be between 0.70 and 0.90. This indicates that our proposed assessment procedure is adequate for measuring the dependent variable: the degree of design creativity in the final design solutions.

While the inter-rater reliability (or consensus) between the expert judgments was within the sufficient range, the difference between the two conditions, however, was too small in this pilot study to be considered significant in terms of the effect that could be measured on the dependent variable. The low user research condition scored slightly lower $M = 3.14$, SD 1.28 compared

to the high user research condition $M = 3.36$, SD = 1.37. This may be seen as unsurprising, since it yields an insignificant result at an independent samples t-test $t(10) = -.289$, $p = .779$, (95% CI = −1.49 − 1.93) $d = 0.18$, and the pilot study does not lead to a rejection of the null hypothesis.

Considering the limited available data from this study, we cannot say anything definitive except that with 95 percent certainty, more user research may lead to both *lower levels of design creativity* (−1.49 on a 0–6 point scale) as well as to *higher levels of design creativity* (1.93 on a 0–6 point scale). Despite this reservation, we stress that, to the best of our knowledge, this pilot study is the first experimental investigation of the effect of user research on design creativity. This leads us to assert that although the results cannot be deemed statistically significant, the research design devised here and the found standard deviations and approximate levels of design creativity are nonetheless able to inspire and inform further, more in-depth experimental studies of how varying degrees of user research (seem to) affect the design creativity of the final design as assessed by expert judges using the CAT. In other words, the experimental setup is viable, but it is necessary to run the experiment with a larger number of participants in order to achieve statistically significant results (Figure 5).

3.7. Summary of insights

This pilot-study demonstrates how user research may be controlled as an independent variable in an experimental setup. It was established that user were engaging considerably more with the user research in the high user research condition, and that the assessment of the creative outcome was feasible using the Consensual Assessment Technique. An addition insight from this study was the preliminary data on variation and possible differences in groups, which serves as a valuable foundation for future experimental studies.

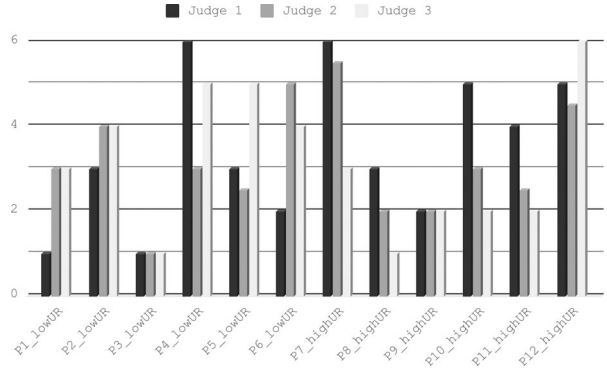

Figure 5. Distribution of ratings by judges across conditions and participants.

4. Discussion

Our approach in this paper highlights possible implications for future research on the relationship between user research and design creativity. Specifically, we argue that *four basic recommendations for future research* may be derived from the work presented here.

First, the discussion of *what is to be considered high or low levels of user research* is important for further research on this topic. The user research utilised in the experimental setup in study was ecologically valid since it is actual user research from an actual project produced by professional designers; however, we still do not know exactly what a realistically 'low' level of user research might look like. In study, one of the conditions is just considerably 'less' user research material, but still the same type. We speculate that an even more realistically 'low' condition could instead be a survey, whereas the 'high' could be interviews and observations. To address this, we propose *additional qualitative observations* and *interviews with professional designers* specifically for uncovering the different types of user research across different design projects; not just in interaction design, but across design disciplines.

Second, in dealing with the notion of something being the 'ideal' or correct design process, we have discerned an inherent problem that future studies should address, namely that the *definitional value of user research is presumed a priori*. While we were able to run a randomised experiment for the participants in the lab when assigning them to either high or low levels of user research, a potential effect found in a lab study (regardless of direction) might not carry over to the actual design practice, as the *placebo effect* might have already been irreversibly established. In other words, if a designer, for any reason, does not conduct user research in a project, the performance of the designer might automatically decrease due to that person not receiving a placebo effect. Future studies of this issue should *qualitatively examine professional designers not formally trained within the context of user research* (such as human-centred design) as a means to bring to the fore new understandings of the value (or lack thereof) of user research.

Third, as we might hypothesise that *the type of design challenge or project plays an important role in the need for user research*. The design challenge used in the experiment thus comes into question. If the design brief outlines a project, which could be qualitatively categorised as 'consumer-based' or within a universal (non-expert)

design domain the need for user research might already have been exceeded with our low user research condition. For future studies, a straightforward way of dealing with this may be to *include scores of the complexity of the design brief* in the ratings by the expert judges.

Fourth, our experiment demonstrated the *experimental feasibility of actively manipulating degrees of user research material* (as the independent variable) as well as *using CAT for measuring design creativity* (as the dependent variable). This means we now have an empirical foundation for informing future studies. Using the observed standard deviation and absolute mean difference between the two groups, we argue that we may use this pilot study to *inform a large-scale experimental study*, whose results will have more statistical and inferential power than what we have presented here. However, if we accept our current improvement in design creativity (from 3.14 to 3.36) as our expected real improvement, our follow-up study would have to enrol about 1,040 participants at alpha = .05 and 80 percent power.

We speculate that such an extensive research setup might be difficult to implement, albeit a hypothetical improvement of about on point on the 6 point likert scale (from e.g. 3.14 to 4.14) would be detectable using only around 30 participants. This raises the question of what would be a practically important increase for a practitioner, and whether an alternative approach than the consensual assessment technique would allow for a larger sample size in the study. One alternative would be to use quasi-experts (people with more experience in a domain than novices but who are also not recognised as expert), as Kaufman et al. (2013) has demonstrated this as a viable path for at least some domains. Eventually, the value of this piece is not to provide a definitive answer to the role of user research in design creativity, but to inform the decision whether to conduct a confirmatory study as well as how to design of the larger confirmatory study (e.g. with no, low or high levels of user research). Interpreting the results of this study should be done with a disclaimer that the study is not adequately powered.

5. Conclusion

In this paper, we have presented two types of insights, which in sum aim to challenge some of the rather tenacious assumptions that seem to characterise (much of the) current understanding of user research. Most notably that user research is always valuable and relevant and that it serves as an integral part in most design processes. In the first part, we reviewed existing empirical evidence related to the relationship between user research and design creativity. The study highlighted how diverging terminology clouds the possibility to synthesise empirical evidence, and, further, how some cases (e.g. Von Hippel 1986; Abelein and Paech 2015; Kujala 2003) report positive relationships between analogous terms such as *involvement* and *innovation* or *system success* while others (e.g. Bano and Zowghi 2013; Kujala 2008; Conradie, Marez, and Saldien 2017) were not able to demonstrate such a relationship.

Perspectives from the first part provided critical theoretical nuances to the following experimental setup, were we explored how the impact of varying amounts of user research affects the design creativity of a design solution. By comparing two degrees of user research material, we proved the feasibility of conducting a controlled experiment (a pilot study) to investigate a potential causal relationship between the degree of user research material (how much/little) and the degree of design creativity (how high/low). The manipulation of the amount of user research material as the independent variable appeared to work, and the assessment of the creativity of the final design was appropriate as assessed by domain expert judges using the CAT. Although our findings were not statistically significant due to the small sample size, which was to be expected, the data provides a foundation for estimating a research design for future experimental investigations into how and to what extent user research affects design creativity.

Notes

1. To put it as inclusively as possible.
2. https://www.interaction-design.org/literature/article/user-research-what-it-is-and-why-you-should-do-it

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