Where does Everyday Design Innovation come from?: Case studies in IKEA Product Hacking

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Abstract

Background Design is no longer owned only by skilled designers. Product hacking, which has to emerge as a major phenomenon in industrial and consumer products, is an everyday design activity aimed at remaking and remanufacturing existing products that provide new meanings. This paper aims to contribute to identifying design innovation within cases of product hacking as examples of everyday design.

Methods Product hacking workshops were conducted to explore the potential of conceptual blending as means to identify innovation in everyday design activity.

Results Through a trial and error morphological approach, participants appeared to arrive at Aha! moments that then acted as a catalyst for the identification of a feasible blend possibility. Rather than the explicit operation or application of meaning blends in product hacking, participants relied upon the juxtaposition of existing products as both opportunity and constraint on product combination and meaning change.

Conclusions Conceptual meaning blending may have the potential as means to identify and assess innovation in everyday design activity, including product hacking. However, results indicate that meaning blending and their meanings were not an explicit approach to meaning innovation through the blending of existing products.

Keywords Design-driven Innovation, Everyday Design, IKEA Hacking, Conceptual Blending

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1. Introduction

Product design by users (*Product hacking*), an activity of Everyday Design (ED), is a major phenomenon for both industrial and consumer products (E. von Hippel, & J. A. Paradiso., 2008). A recent study (Kim & Lee 2014) explored ED(Everyday Design) as a design resource, providing designers insights through understanding the needs of users through their ED activities and interventions (ibid). ED has the potential to extend and/or transform the properties, and so meaning, of existing products (Wakkary, R., & Maestri, L., 2008). According to Sleeswijk Visser,F. (2009). Insights from ED activity in the everyday lives of users can provide inspiration and insight to designers, especially during an idea generation phase in product design. Hippel and Paradiso (2008) go as far as to suggest product hacking, as a more complex ED activity, exemplifies user-innovation (2008).

User innovation is defined as a horizontal innovation network such as crowdsourcing or open-source in HCI studies (Von Hippel, E., 2007). Among product hacking, IKEA Product hacking has been studied in the HCI field as a representative example of user innovation in which shared hacking open-source by facilitating re-creation based on the web page of IKEA Hackers (Tanenbaum, J. G., et al., 2013). Also, Rosner and Bean highlight that IKEA hacking is skilled, creative reuse and customization of mass-produced products (Rosner, D. K. et al., 2009).

According to Sleeswijk Visser (2009), examples of the activities of users providing design interventions in their everyday lives can also provide insights into creativity and design innovation. This is because the same novelty in the transformation of existing products to new uses in ED activity, echoes the concept of meaning change in design-innovation, whereby radically transformative changes to an existing product paradigm provide an opportunity for radical innovations (in meaning). Likewise, the activity of *IKEA* hacking as ED drives transformative change in existing products to new uses and meanings.

The current study explores *IKEA* product hacking as means to better understand creativity in ED activity. In particular, we assess the activity and outcomes of IKEA product hacking through a Design-driven Innovation in Meaning (Norman, D. A., & Verganti, R., 2014) lens. We finally discuss relationships between IKEA product hacking and Design-driven Innovation in meaning(DDIM) as an opportunity for DDIM to provide a theoretical foundation for understanding creativity in ED activity.

1. 1. Product Hacking as an Everyday Design activity

Design is no longer owned only by skilled designers (Cross, N., 2006). For example, *Co-design* (Steen, M. et al., 2011) and *Participatory Design* (So, C., 2019) have emerged as design/marketing strategies through users actively participating in the new product development process; previously considered the domain of experts (Sanders & Stappers., 2008).

Unconscious design (Ng'ambi, D., & Brown, I., 2009), which departs from the complexity of a lengthy design process, is positioned as an alternative to understanding true design activity. For example, users modify artifacts and surroundings for new uses such as hanging a jacket on a chair or leaving a heavy box to act as a door-opener. The user is regarded as a type of everyday designer who modifies, re-uses, or remakes a product, appropriating design artifacts and surroundings as novel design resources (Wakkary, R., & Tanenbaum, K., 2009). In both unconscious design and ED(Everyday Design), the user is regarded as a designer, modifying, re-using, or remaking, appropriating design artifacts as novel design resources for transformation (Wakkary & Tanenbaum 2009).

As a result, during ED activity, the user must perceive existing artifacts/products critically, their potential for reconstruction of meaning and use through modification and transformation. ED is thereby framed as

participatory design, providing a creative perspective to reconsider the interaction and use of the artifacts designed at home (Raff, J. H., & Melles, G., 2012).

ED has been described as existing on three levels, each more sophisticated and complex than the last: *Re-use, Re-make, Re-manufacture* (Sanders 2006). The act of making reveals the user's tacit needs and latent wishes in areas that are superficially invisible (Sanders & Stappers 2012). Product hacking, which is the ED activity explored in the current work, involves more active renovation than simple/mundane ED (i.e. *Re-make, Re-manufacture*). This is because hacking remanufactures existing products to transform their use, and so their meaning. As Desjardins & Wakkary (2013) suggest, 'product hacking as a design process modifying or customizing everyday artifacts with local resources, to improve their fit into the user's environments'.

The relation between DDIM (*Design-driven Innovation of Meaning*) and ED becomes clearer when we posit ED as extending the properties of existing products with new meaning in different contexts (Wakkary & Maestri, 2008). Product hacking appears to rely upon a transformative approach to add new meaning by combining two or more existing products. In this sense, *IKEA hacking* may also be described through the prism of DDIM. That is, through transformation, new meaning is sort and ascribed to product hacks.

1. 2. Design–Driven Innovation in Meaning & Conceptual Blending

Many scholars emphasize the importance of meaning driven by products, services, and experiences (Öberg, Å. 2012; Verganti, 2008; Geels, 2004; Chandy and Tellis, 2000; McCracken, 1986). Especially, Verganti(ibid) investigated design-driven innovation that is based on the possible breakthrough meaning and product language as a management strategy. Furthermore, in order to find the root of DDIM, he presented three elements of DDIM as a 'lever' through the analysis of innovative product cases such as Anna G of Alessi, Swatch, Nintendo Wii and iTunes.: Form, Mode of Use, and Technology (Verganti, ibid). Famous iconic design product companies such as Kartell, Alessi, Artemide, and Bang&Olufsen have design-driven innovation as a core principle in terms of product semantic strategies (Battistella, C. et al., 2012; Verganti, 2003). Design-driven innovation has its roots in Krippendorff's interpretation of design as a meaning-making activity (Johansson-Skoldberg et al., 2014). A conceptual model of design-driven innovation in meaning was later introduced by Verganti (2003) and extended over the years (ibid 2006, 2008, 2009, 2013). Verganti (op cit) defines Design-driven innovation as innovation in which the novelty of message (product meaning) prevails over the novelty of functionality and technology. This innovation is then conceptualized as the radical innovation of a product's meaning (Verganti, 2008). However, the embodied aspects of meaning, which are derived from the users' thinking process as a cognitive, social and cultural experience, are not well described by the existing literature (Waterworth, J., & Hoshi, K., 2016).

According to Markussen, et al. (2012), a cognitive semantic theory has proven useful for understanding how meanings work in product design. They suggested the notion of product blends as a concept for understanding the semantics of ambiguity and contradictory meaning in product design (ibid, p.113). *Conceptual Blending* (CB) is a set of cognitive operations for combining frames from different domains (Coulson, 2001). According to Fauconnier & Turner (2003), CB leads to new meaning, and conceptual compressions useful for manipulation of otherwise diffuse ranges of meaning, "...It plays a fundamental role in the construction of meaning in everyday life, in the arts and sciences, and especially in the social and behavioral sciences..." (ibid, p.57-58). CB has already been applied as a semantic framework to understand meaning innovation (Comacchio & Warglien, 2010).

Building upon the works of Kraszeski (2019) and Warglien (2010), we describe a model of CB as constituting two different input areas: *BASE Concept*, and *CORE Concept*. Figure 1 provides an illustration of the approach adopted from Kraszeski's (2019) original model.

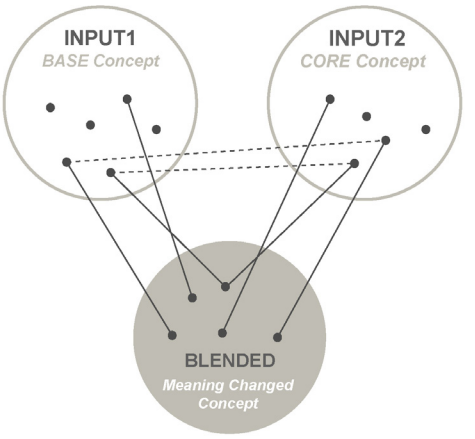

Figure 1 Blended Theory in meaning change

As shown in Figure 1 (left circle), the foundation of the meaning change is established by the *BASE Concept*, while *Input Space 2* is named as *CORE Concept*. These two conceptual spaces are interconnected with a dashed-line from the inputs into the blended space, indicating implicit conceptual projections of structures (Comacchio, A., & Warglien, M., 2010). These inputs selectively project to a *BLENDED* area through structural relationships (ibid, 2010). The solid lines between input elements represent conceptual blends, which may operate along these lines, but with clashes between inputs (Fauconnier and Turner, 2002). Blending implies a process of similarity detection based on the relationships between the *BASE Concept* and *CORE Concept* (Fauconnier G., Turner M., 1998). One or more *CORE Concepts* are combined and connected to the *BASE Concept*, which is the fundamental concept in meaning change. New relationships among the input spaces and blended concepts are identified through blending (ibid, 1998).

The current work applies CB as a framework for measuring DDIM(*Design-driven Innovation of Meaning*) within cases of *IKEA* product hacking. In product hacking, a continuous combination of meaning attribution occurs between the activated *Base Concept* and the subsequently activated *Core Concept*, because activated conceptual associations can take different forms and may prime the following associations to be activated in product use (Markussen, T. et al., 2012). We assume CB is an appropriate theoretical approach to identify and measure DDIM in ED(Everyday Design). We posit this assumption due to CB's interest in the transformation of meaning through the combination of concepts, which has a relation to the transformative nature of hacking as ED activity. Building upon the position of design meaning as derived from semantic blending (Markussen, et al. 2012, Kraszewski 20019), we identify CB as a possible lens to better understand moments of meaning change in the activity and outcomes of *IKEA* product hacking.

1. 3. Aims

The current work aimed to explore innovation and creativity in product hacking. To achieve this we evaluated the activity and outcomes of *IKEA* product hacking through the lens of *Conceptual Blending*. The following research question was addressed:

· Can DDIM(Design-driven Innovation of Meaning) defined as CB(Conceptual Blending) be used to identify creativity and innovation in the activity and outcomes of IKEA product hacking as ED(Everyday Design) activity?

In the process of IKEA hacking as an ED activity, this work grasps the moment, barrier, and trigger of meaning change conceptual blending. Through this, it identifies the factors that stimulate design-driven innovation and contributes to inspiring professional design and marketing practice through the found

creativity. However, the experiment conducted in this paper limited the students with design backgrounds to the scope for a smooth understanding of the concept of design-driven innovation within a given short time.

2. Methods

The study utilized IKEA product hacking workshops to respond to the research question above. In adopting a workshop approach, we focused upon the activity of ED(Everyday Design), as well as the assessment of outcomes.

2. 1. Participants

IKEA hacking often requires manual tools and making skills. Hence, access to hand tools, drills, drivers, and power tools was provided to participant groups within a workshop setting. All participants were graduate students majoring in industrial design at the authors' home institution. The scope of this experiment was set by participating design students who are good at understanding the concept of Design-Driven Innovation and are proficient in making or handling tools to control for the influence of disciplinary differences or the cultural background because the range of *IKEA* hackers is very broad. Participants were recruited through the school community, with subjects volunteering freely for the study. No reward was provided. Six (*n=6*) subjects (*5 male, 1 female; age range 24-30*) were randomly divided into two groups. In order to provide similar conditions to each group, a single session with two groups of 3 was scheduled within the same space.

2. 2. Workshop Set-up

The workshop was conducted in the open studio of the author's university, and a large space was provided for use of manual tools and disassembling/assembling products. A large square table with a size of about 2mx3m was provided to facilitate making and communication. The same set of 15 *IKEA* products were provided to both groups (Figure 2). Additionally, papers, markers, pens, and post-it were prepared for sketches and ideation. The presentation material was also prepared to help the participant understand the workshop aims. The presentation was composed of: a definition of IKEA hacking, a design assignment, workshop aims, procedure, and hacking example images (Figure 2).

The hacking design assignment was as follows: *Make at least one hacking design using the provided IKEA products*. After this instruction, the session was broken down into four steps: *exploring materials & Ideation* (20 minutes), *Idea development* (15 minutes), *Making* (20 minutes), and *short presentation* (5 minutes). The whole process was recorded, and the participants shared their thoughts, opinions, and A-ha moments throughout the hacking process through the Think aloud method. Also, this qualitative research data are analyzed by data-driven encoding using the NVIVO program. All the scripts in the whole workshop process are organized, divided and encoded into each characteristic moment such as material exploration and analysis, decision making, A-ha moment, etc. by applying the affinity diagram method.

Figure 2 IKEA workshop materials: 15 IKEA Products (top), Presentation material image (bottom left), and the instruction (bottom right).

3. Results

3. 1. Hacking Process

Product hacking proceeded in the order shown in Figure 3. Each process stage was carefully examined for what the participants thought at the time and why. First, the *IKEA* products, as product hacking materials, were provided, and the participants were given time to freely explore and analyze these materials. Afterward, the participants decided on some candidate product choices. Decisions appeared to be made based on practical and functional factors. The process then proceeded to implementation through making, before final review (and refinements) of product hack.

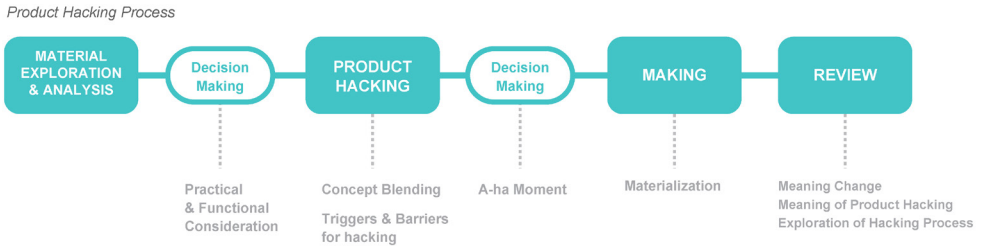

Figure 3 IKEA Product hacking process

IKEA product or product part. For example, through the combination of FROSTA stool's leg parts, participant A said, *"...The stool legs were combined in various shapes and finally made into a 'tree' shape..."*. This association process was actively carried out at the very beginning of the identification of the hack. The image on the left (Figure 4) shows the progress of the material exploration through discussion between team members. Participants explored the existing products and parts with others, discussing what forms are associations they made or reminded them of.

After exploring the provided IKEA products, participants turned towards a discussion of how to combine them. The image on the right (Figure 4) provides an example of attempted product combinations in pursuit of a *Concept Blend*. In this process, blending attempts were mainly based on the commonality of the existing product form. For example, with a semi-circular shelf, participants attempt a combination of different flat shaped materials to match the shelf's flat edge. Ideas towards a blend of existing products (i.e. *Base* and *Core Concept blending*) emerged through a more ad-hoc process of trial and transformation using the provided products, rather than participants pursuing opportunities for blending ideas at a conceptual level.

Figure 4 Material Exploration: Discussion with team(left), and A trial for combining product(right)

3. 2. Product Hacking

The physical properties, dimensional proportions and hard-transformable materials of existing *IKEA* products acted to frame potential blending possibilities. Participants didn't use any drawing or writing materials. Instead, they appeared challenged by an inability to identify ideas towards potential combinations, much less explore possibilities towards conceptual blends more explicitly. Rather, possibilities for blending emerged as 'A-ha' moments, rather than planned designs (G. V. Georgiev et al., 2017).

Through a trial and error morphological approach, participants appeared to arrive at A-ha moments that then acted as a catalyst for the identification of a feasible blend possibility. The A-ha moment appeared to be derived from the identification of similarities between two or more products' form, with relationships emerging from the trial and error approach. These attempts were then also used to stimulate discussion and ideas towards potentially viable combination possibilities. Figure 5 to 7 shows the hacking design process for three cases: A stand light (Figure 5, A), a dog accessory holder (Figure 6, B), and a stand light for the workstation (Figure 7, C).

The *A stand light* hack was derived from the group's discussion around the provided product, *BITTERGURKA plant pot hanger*. Adopting this as a combination possibility, the group discussed opportunities for alternative uses through the reorientation of the pot (Figure 5, A2). They then shifted their attention to the body part of the flowerpot (A2), exploring the pots' potential by attaching pieces of wood serving as a pedestal. During this process, the participants identified a small hole in the middle of the pot (A3). This hole then became a focus as an opportunity for combination with other products. At this point, a member of the team picked up a *STRALA* cord set and *RYET LED* bulb and shone it under the pot (A4). This led to the idea of threading the bulb cord through the stork in the center of the pot. This then acted as an A-ha moment to derive the final A *stand light* hacking blend (A5). The final hack was refined through the application of a *KAFFEBONA plant pot* as a light cover (A6).

Figure 5 Hacking Design Process: A stand light

A second hack (*a dog accessory holder*) was stimulated by two dog-related, provided products: a set of *SMASKA training beaker* and *BASTIS hooks* (Figure 6, B1). These existing products appeared to stimulate fixation on a dog-related (i.e. *Base Concept*) for the hack. However, the participant then struggled to identify a possible opportunity for combining with other products to produce a satisfactory blend (Figure 6, B2/B3). Lacking a clear direction for the hack, the participant decided to simply join the blue board taken from a *FLISAT book display* to a blue dog face and blue puppy hook (B4). Finally, the concept of a dog accessory holder was proclaimed at the end of the session (B5).

In the hacking case above, early fixation on a *Base Concept* of dog, derived from provided products exhibiting dog-like characteristics, appeared to act as a barrier to the type of trial and error identified in other cases. Although a possible base was identified, the hack was unable to find an appropriate Core Concept or blend. This then appeared to result in a make that was less convincing in its ability to achieve DDIM(*Design-driven Innovation of Meaning*) through a clearer blend of a Base and Core Concept(s).

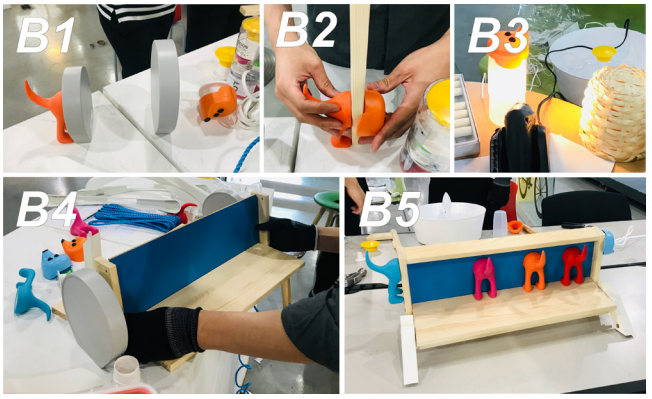

Figure 6 Hacking Design Process: a dog accessory holder

Hacking process C's (a stand light for the workstation) process was similar to hacks A and B, with participants concentrated on the wood material as a driver to identify possible opportunities for product combinations (Figure 7, C1). For example, subjects attempted to identify functional relevance through a combination of forms by joining two shaped materials (C2 & C3). At this point, the workstation emerged as a blending possibility, derived from the participants' occupation with provided *IKEA* products. Step C4 (Figure 7) shows they are struggling to find some relationship with different shaped materials after combining the same stool legs. Interestingly, two different approaches to the same shape are found in this process. The participants felt 'A-ha!' in the same shape that is composed of several stool legs, but they tried in different ways: one is as a hanger(C5), and another is as a table leg(C6). Starting from this time, the bundle of stool legs that has the same shape evolved into a totally different result. Participants who accepted the bundle of legs as a hanger tried to avoid the repetitive purpose of using the existing stool leg as a "leg" of something again. A participant who accepted it as a table bridge said that he used the stool leg as a leg again, but the combination of the legs was rather interesting because it doesn't give any reminiscent of the existing legs.

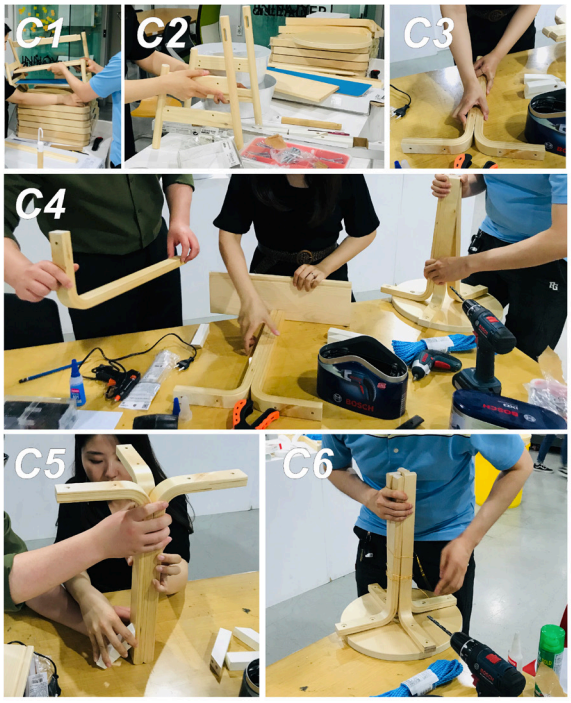

Figure 7 Hacking Design Process: A tea table and A stand light for the workstation.

3. 3. Outcomes

A total of four hacking design outcomes were obtained through the design workshop (Figure 8). In Figure 8, A stand light (a), a dog accessory holder (b), a stand light for the workstation (c), and a tea table (d) were made through the workshop session.

Figure 8 Hacking design outcomes: (a) A stand light, (b) a dog accessary holder, (c) a stand light for the workstation, (d) a tea table

4. Discussion

Through this hacking design workshop, it is identified drivers for and barriers to DDIM(Design-driven Innovation of Meaning) in a process of *IKEA* hacking. One thing to note was how participants employed a trial and error approach to combining the product provided in attempts to explore blending possibilities. For example, workshop groups were observed to physically juxtapose products in an attempt to stimulate ideas towards possible combinations. It appeared the products provided had a critical influence upon the types of combinations achieved due to their influence upon the process. However, this may be in contrast to both *IKEA* hacking and everyday design, with both directed towards a more specific purpose, than that presented to our workshop participants (i.e. use provided *IKEA* products to produce a blended hack). A barrier then, to DDIM in *IKEA* hacking specifically, and ED(Everyday Design) more generally, could be the ways in which existing materials (products), and their associated opportunities for combination, are employed. Unlike design expertise, where a more open approach to exploring possible solution candidates is adopted as part of a process of design thinking, hacking, and the innovation achieved therein, is critically tied to the local affordances and possibilities presented by the objects and products being combined and transformed.

The insight into the process of hacking was the identification of A-ha moments. These moments constituted the participants framing of the particular hacking situation in a similar way to Dorst's (2015) notion of problem framing in design. For this workshop participants, A-ha moments appeared to derive from the juxtaposition of two or more existing products to offer a potential design direction for the hack.

Using the same product repeatedly made it easier to find morphological commonality as a trigger for blending. However, the use of the same product also made blending difficult. This is because the blurring of the base and core concepts makes it difficult to find a clear meaning change in the blended concept. As a result, participants were initially interested in the duplicate use of the same product but did not choose this approach as the final blended concept. Instead, it was the starting point for synthesizing relevant products.

Second, through the short presentation part in this workshop, participants explain their hacking product's functional motives related to their personal context as a common point. We tentatively draw the assumption that this indicates a subject's personal background and experiences, as a CB(Conceptual Blending) factor, have an impact to measure DDIM in ED. Especially, in the case of ED that is related to daily context deeply, the current needs and personal background of subjects influence to identify the meaning. When identifying meaning in ED, not only the objective information of each original product but also the personal product experience affects it as another input in the CB process. Design scholars (Norman, 2013) describe it as a meaning level product experience, whereby the user's response is influenced by and exists within the context of one's own life experiences, idiosyncrasies, autobiographical memories, tastes, political views, etc.

5. Conclusion

The current article has explored innovation in Everyday Design(ED). To achieve this we adopted an Innovation in Meaning approach to the analysis of higher-level cases of ED identified as IKEA product hacks. Our analysis has been underpinned by CB(Conceptual Blending) as a theoretical construct to measure innovation in ED.

ED has often been described within the literature as responding to practical necessity emerging from users faced with utilitarian problems (Wakkary & Maestri, 2007; Kim H, Lee W., 2014). A ubiquitous (low-level) ED example is the placing of a pen in a book to keep one's place. What Kim & Lee (2014) describe as Re-use ED. From this frame of reference, ED innovation will always be derived from higher-level ED activities (i.e. Re-make, Re-manufacture).

Our study of *IKEA* hacking workshops aimed to explore the potential of DDIM(Design-driven Innovation of Meaning) as CB to identify innovation and creativity in *IKEA* hacking. One thing to note was how participants employed a trial and error approach to combining the products provided in attempts to explore blending possibilities, rather than adopt an explicit process of conceptual blending. For example, workshop groups were observed to physically juxtapose products in attempts to stimulate ideas towards possible combinations. It appeared the products provided had a critical influence on the types of combinations achieved. This may be in contrast to both *IKEA* hacking and ED, with both directed towards a more specific purpose, than that presented to our workshop participants (i.e. use provided *IKEA* products to produce a blended hack). It appears, then that hacking activity and outcomes were strongly framed by the existing products.

Unlike design expertise, where a more open approach to exploring possible solution candidates is adopted as part of a process of design thinking, hacking, and the innovation achieved therein, is critically tied to the local affordances and possibilities presented by the objects and products being combined and transformed. However, this study was conducted by design-based participants. These participants who have specific majors may have some biases in innovation or meaning. Their perception of the world, culture, and hacking of products differs from students from other disciplines. In addition, the students in this study are recruited from the same university hence they represent a similar cultural background.

In further research, other departmental or cultural-based participants should be considered, because it is identified that the background knowledge and experiences affect the conceptual blending process.

In conclusion, in order to be used as a metaphor for meaning, the abstract but common form is a trigger of hacking that makes meaning change rather than detailed and concretely defined artifacts through A-ha moments. Also, personal background and experience such as culture, lifestyle, memories, and tastes have an impact on the functional conceptual blending in the hacking process. Returning to our CB(Conceptual Blending) approach to identify DDIM(Design-Driven Innovation in meaning) in ED(Everyday Design), in the hacking process, A-Ha moments and background knowledge acted as blending triggers. Also, this hacking design workshop was conducted in the open studio setting in the university. This contextual setting is also one of the experimental elements that need to control for the influence of the product hacking results. However, this controlled context can influence the hacking result and behavior in the content indicated in this workshop as a limitation.

More work is required to build upon these findings. For example, how can a meaning level of experience be better represented within a CB approach to DDIM in ED? As DDIM is first and foremost about changes to product meaning, this is a critical issue to be explored. Our study also took as a starting point the shared objectives of ED and DDIM in their pursuit of transformative change. Although the current study has gone a way to indicate blending as core to DDIM in ED, the study of ED process did not explicitly indicate the presence of conceptual analysis and integration described by CB – although cases of IKEA hacking.

It may be interesting to investigate if design expertise has any relationship to an ED process that might better reflect (implicitly or explicitly) conceptual blending theory. That is, to what extent does the trial and error/A-ha moment process identified in the current study exist in hacking processes of subjects with more, less or no design experience? Further work is now required to provide a theory of innovation in ED specifically, and design more generally. This may then also be of practical use for both experienced and inexperienced (ED) designers in their pursuit of design-driven innovations.

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