REVIVING EVERYDAY PRODUCTS BY UNDERSTANDING THE USER BEHAVIOUR OF EVERYDAY DESIGNING

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ABSTRACT

Everyday Designing (ED) involves the re-use of existing products for new purposes. In order to gain an understanding of how people perceive and apply product elements as cues for everyday designing and level of appropriation when reusing product for the new purpose, an experiment was conducted. In the experiment, four everyday products were provided for repurpose. The 40 repurposed products from 10 participants were analyzed with the interviews and questionnaire. ED products were reborn with various purposes beyond the original functions of the products. The results indicate that there is a difference between perceived product elements as usual and product elements as cues for everyday designing. Materials and manipulability plays an important role in ED although form-centred perceptions were mainly observed. It seems that the product elements as ED cue and the prior experience of the product seem to affect the level of the product appropriation. Although this study has an exploratory character, it could provide design practitioners with a better understanding of users' ED behaviour, which could contribute to discovering new insight of product and product sustainability.

Keywords: Experience design, Sustainability, User centred design, Creativity

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1 INTRODUCTION

In our everyday life, it is not difficult to find products used differently from the intended function given by the designer. For example, a mug cup is often used as pen holder on the desk in which pens and pencils are put. A napkin is sometimes used to take a note of our ideas too. An egg box is also used for organizing ketchup or mustard sauce bottles (Figure 1).

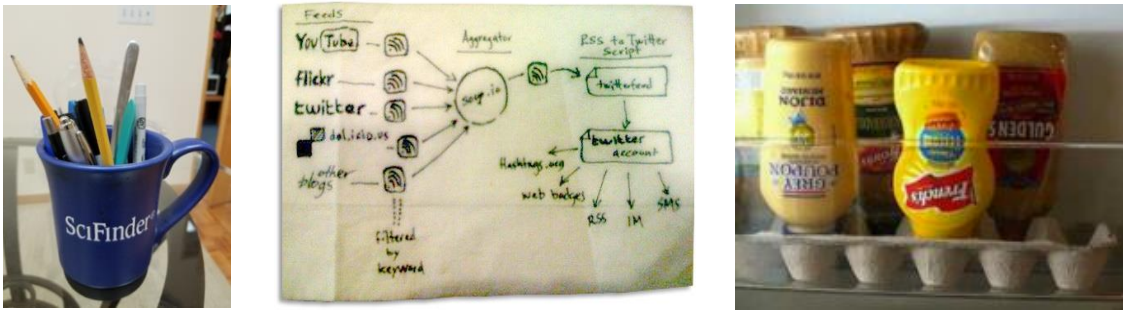

Figure 1. Examples of everyday products differently used than the original function

Considering the everyday phenomenon, users can be seen as designers to create new functions through the new way of product use with existing products. This kind of phenomenon have been called by various terminologies. Alexander (1964) called it 'unselfconscious design', and Brandes and Erlhoff (2006) 'non-Intentional Design'. Kim and Lee (2014) defined this as 'Everyday Design' as a new use of the product by the non-designer, emphasizing the actual interaction between the user and the product in our everyday life. In this study, the behaviour of user is defined as 'Everyday Designing' as the user adds new values and functions to existing products.

It is no longer possible to force or expect users to make use of the product intended by designer (Kanis *et al*., 2000). Rather, Wakkary (2007) has found creativity and interest in the unexpected way that users understand and use objects in actual use. Other researchers have also begun to recognize users as active and creative ones, rather than passive consumers. Maestri and Wakkary(2011) widen the role of the user as a designer and demonstrate that the user properly repaired and modified the products in the home system. Some studies found creative uses of products through unconscious behaviour and unintentional design of surrounding products(Brandes and Erlhoff, 2006; Suri and IDEO, 2005). Dix (2007) supports creative misuse and suggests the proper design of instructions, which somehow prove there is the gap between intended use by designers and actual use by users. DIY (Do It Yourself) communities such as IKEA hacker have redesigned existing IKEA products in a fun but useful way as well (Rosner and Bean, 2009). Thus, our study aimed to encourage designers to understand the phenomenon and take everyday designing into consideration while gaining insight from users' creative activities in the product development process. Moreover, our study could contribute to critical considerations for sustainable design in a way to facilitate reuse of products if an understanding of product elements (e.g. form, material) that act as triggers for everyday designing is provided. Product elements are a means of conveying and expressing meanings about the product to the user (Crilly *et al*., 2004). It would be interesting to understand how the user exploits the meaning of the designer-specified product elements in the new environment.

Therefore, the study attempts to identify what product elements are perceived as cue, and how much appropriation is given in the process of everyday designing.

2 METHOD

In order to explore an underlying mechanism of everyday designing in terms of product element as cue and level of appropriation, an experiment was designed, in which our everyday products are remade for new purpose.

2.1 Participants

A total of 10 people whose ages ranged from 20 and 25 years old at the time of the experiment were recruited. They consisted of 3 male and 7 female students taking an visual design course at XXXXX University. Their majors were diverse ranging from visual design, painting, ceramics to animation, but none in industrial design.

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2.2 Instruments

In order to create an experimental situation, four products were selected among our everyday products: foil plate, plastic water bottle, dust pan and umbrella (see Table 1). Frequency of use (Kim and Christiaans, 2012; Ram and Jung, 1991) and product life expectancy (Broadbridge and Marshall, 1995) were used as the selection criteria because our everyday products can be characterized by the two variables and the products were known to have distinctive characteristics in terms of the two dimensions. For instance, a plastic water bottle is very often used but its product life expectancy is short, while dust pan is only used during sweeping from time to time and product life expectancy is much longer than the plastic water bottle. The four products were used to let the participants observe, experience and appropriate in the study aiming to explore how product elements work as cue and how much level of appropriation is made., A semi-structured interview was designed, in which questions about their prior use experience of the products and visual cues perceived by the participants were included. To gain basic information about their experience after repurposing the products, a questionnaire was also developed. It included questions about demographic information of participants and triggers used for everyday designing (we call this everyday designing trigger).

Table 1. Four products selected based upon characteristics of our everyday products.

		Frequency of use	
		Low	High
Product life expectancy	Short	Foil dish	Plastic water bottle
	Long	Dustpan	Umbrella

2.3 Procedure

An experiment instruction session took place for the participants at the university. First, each participant was provided with a set of the four products after the instruction of the experiment. After the session, we interviewed participants one by one in another place. In the interview, questions such as their first impression and perceived product elements (e.g. form, material, sound, and so on) were asked. Then, participants were asked to use the products in their daily life for a month. In a month, they were also asked to remake the products for new purposes during two weeks and then a questionnaire was provided. The participants answered the questions such as purpose, place of use and reasons regarding the remake in the questionnaire with photographs of the process and final products. Even though the experiment was not conducted in our real everyday context, the overall phases of the experiment were designed to follow phases of everyday designing behaviour in actual context. The procedure is illustrated in Figure 2.

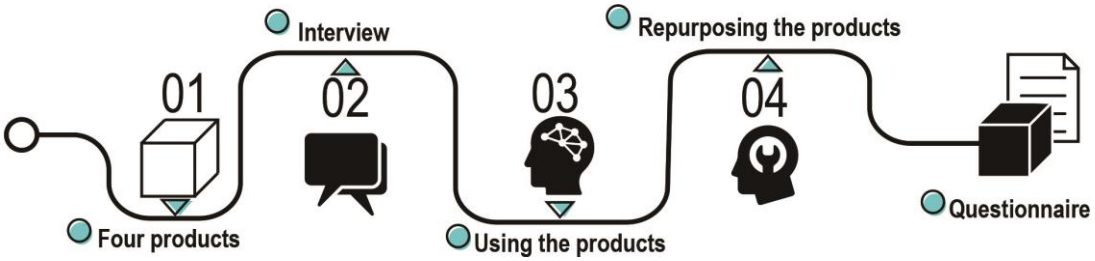

Figure 2. The experimental procedure for the study

2.4 Data analysis

All the interviews from 10 participants were transcribed and the answers to the questionnaire were sorted out. Then, all the data was input into a computer-supported qualitative data analysis software, called Atlas.ti and the data set was micro-analysed using the analysis tool. Because each participant remade four products for new purposes, a total of 40 products were made as the result. The products were analysed in terms of product elements as cue and level of appropriation by three researchers in order to avoid possible bias.

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3 RESULTS

The four products with original functions were repurposed for various products completely different from the original functions. For instance, an aluminium foil dish was redesigned as a reflector to drive birds away in a backyard vegetable garden. A toothbrush holder was transformed from a plastic water bottle. A dust pan was reused as a colander to effectively wash vegetables while the handle of an umbrella was reborn as the hook for jackets (Figure 3). All the products that had remade from the experiment had the different purposes than the original functions of the products.

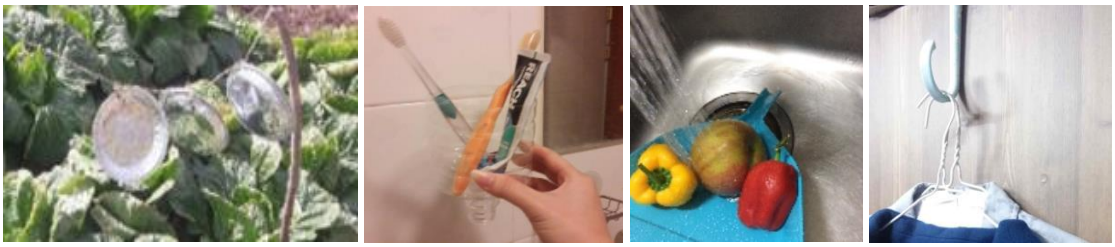

Figure 3. Examples of products repurposed by participants

3.1 Products repurposed in the context of everyday designing

We classified all the products on the basis of the product category in Amazon.com: consumer electronics, service, cosmetics, sports, computer accessories, home appliance, home decorations, stationaries, fashion, hobby and tool. The four products were repurposed to a variety of product categories ranging from computer accessories to tool to consumer electronics, service, cosmetics, sports, and home appliances. It is because the products that had provided as experimental stimuli belonged to a low-tech product category. 37.5% of everyday designing (ED, hereinafter) products were converted to Home decoration. For example, one participant created a sparkling window shade with a foil dish. The second largest product category was tools (22.5%). For example, the duster was used as a scraper. This was followed by stationery (15%), hobby related products (12.5%), accessories (7.5%) and clothing (5%). The four products were used in various places after converted into ED products. Interestingly, it was used in places where participants mainly stay. The most often mentioned space for use was 35% of participant's room. This was followed by portable products (17.5%), living rooms (12.5%), kitchens (7.5%), workshops (7.5%), restrooms (7.5%) and the entrance (2.5%).

3.2 Perceived product elements and cues in everyday designing

Participants' perceived elements of original products were divided only into three types among product elements when the products were given them: form, material, and manipulability(Kim and Paulos, 2011). The outstanding element of the original product was form (72%). This was followed by material (18%) and manipulability (10%). However, it showed different percentages between the product elements when they reported product elements as cues for the everyday designing assignment. Form radically decreased to 42% while material radically increased to 45%. And manipulability slightly increased (13%). A clear difference is observed between perceived product elements and product elements as cue for everyday designing. It is interesting that perceived product elements and product elements as cue for everyday designing are different. Thus, we analysed the relationship between perceived product elements and the cues for each product. In the foil plate, 70% of the participants recognized the round shape when it was given, 20% is the flat form, and 10% is the reflective characteristic of the material (Figure 4). However, participants did not utilize these elements at all during everyday designing. Almost most of the participants initially referred to the form elements of the foil dish, but a majority of the participants repurposed the dish by utilizing the material. For example, one participant initially recognized the dish shape, but he created a cell phone camera reflector using the reflective property of the material. Another participant who was aware of the shiny and sound property during everyday designing repurposed the dish to the scarecrow.

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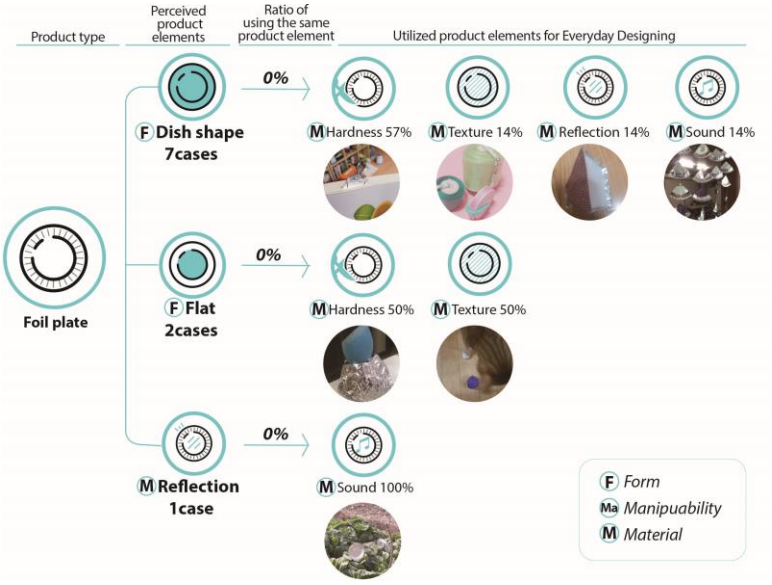

Figure 4. Perceived elements of the foil dish and cues for everyday designing

Regarding the plastic water bottle, 60% of the participants perceived the cylindrical form at first while 30% the rounded form and 10% the solid material. However, the cylindrical form worked as a trigger for 33% of participants who first recognized the cylindrical form (Figure 5). For example, the upper part of the plastic water bottle was cut and the cylinder form was used as a flowerpot. Material and manipulability that the participants had not perceived were utilized as cue for everyday designing. One participant remade a recycling cap using the twist operation of the plastic bottle cap. Also, the transparent characteristic of the bottle reminded of a light function. 33% of the participants who had perceived the funnel form used the funnel form as cue for everyday designing. For example, the upper part of the plastic water bottle was cut and turned over for using as a funnel for baking. Participants who had initially recognized the funnel form remade cat toy by utilizing the solid characteristic of the plastic bottle material. Another participant created a paper container with the waterproof characteristic of the material. Participants who had perceived durability of the plastic water bottle remade a light, which was triggered by the texture of the bottle. Various elements of the plastic water bottle were used while the plastic bottle was appropriated for everyday designing.

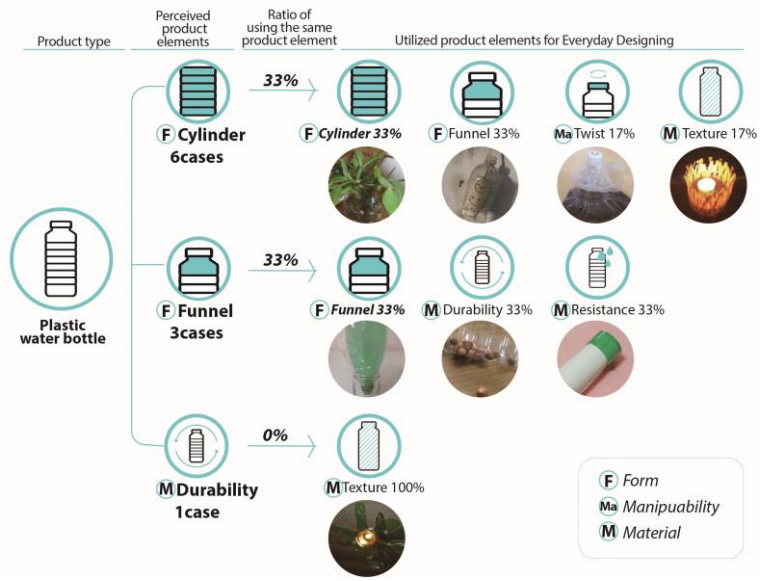

Figure 5. Perceived elements of the plastic water bottle and cues for everyday designing

In case of dustpan, the half of the participants recognized the trapezoidal form when they first saw the product. 30% of the participants recognized the flat bottom part and 20% recognized the dustpan handle (Figure 6). However, there was no case that the handle had been used as cue for everyday designing. The participant who had initially perceived the handle utilized the hole to create a lecture

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room sign. Participants who had recognized the trapezoidal form created a colander to wash fruits. In this participant's colander, the water flows from the trapezoidal form toward the handle. Although the participant perceived the trapezoidal form as a cue for the colander, the participant also could considered the dustpan handle probably. 33% of the participants who had recognized the flat form of the dustpan utilized the flat form for their everyday designing of the product: they used the flat form as a tool for gluing a piece of paper onto the drawing panel. Only 20% of participants who had perceived the trapezoid form used the form element in everyday designing. A participant who utilized trapezoidal form was also remade a tool for gluing a piece of paper onto the drawing panel. Because the dustpan has a similar form of the gluing paper tool, it seems to lead to the result in the context of everyday designing.

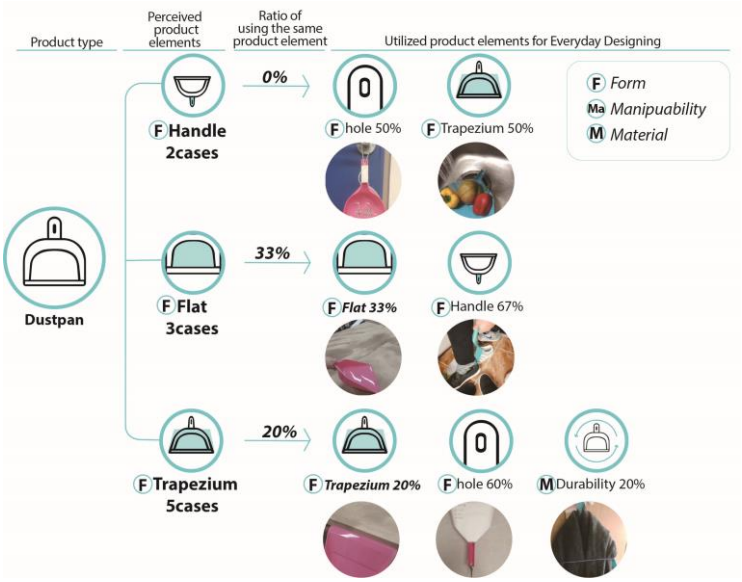

Figure 6. Perceived elements of the dustpan and cues for everyday designing

In umbrella, participants mentioned the handle, the folding operation, and the waterproof characteristic of the material as initially perceived elements of the umbrella (Figure 7). The folding manipulability is referred to 40% and the waterproof property 50%, which is similar to the primary function of using the umbrella. 50% of the cases utilized the folding manipulability and 40% of the cases the waterproof characteristic for everyday designing. However, the form of the handle was not associated with the result of everyday designing. The folding manipulability was most frequently mentioned as trigger of everyday designing throughout the entire experiment. For example, the folding manipulability is useful to hang laundry on the umbrella frame unfolded. in a small room.

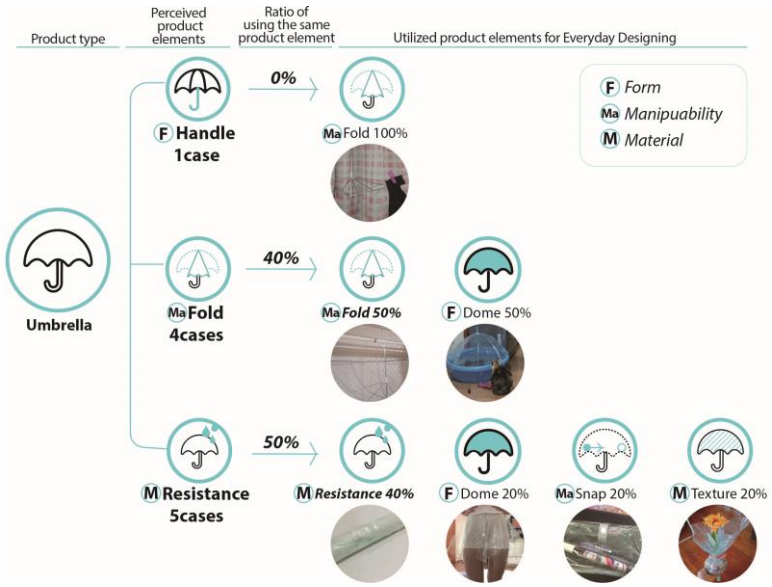

Figure 7. Perceived elements of the umbrella and cues for everyday designing

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In terms of perceived product elements, participants were sensitive to the form of the products. However, during everyday designing, strong cues were derived from material and manipulability rather than form. In case the manipulability of a product is initially perceived, it is most likely to directly apply the manipulability to a repurposed product in the context of everyday designing.
Product elements for ED also differed depending on the original characteristics of the products (Figure 8). In the short lifespan products, material was mostly used as cue (14 cases). In the long lifespan products, on the other hand, form was mostly used as cue (12 cases). For the frequently used products, form was the most used (8 cases) while for infrequently used products, material was mostly considered as cue (11 cases). Unlike form and material, manipulability was found in only 5 cases among often used products.

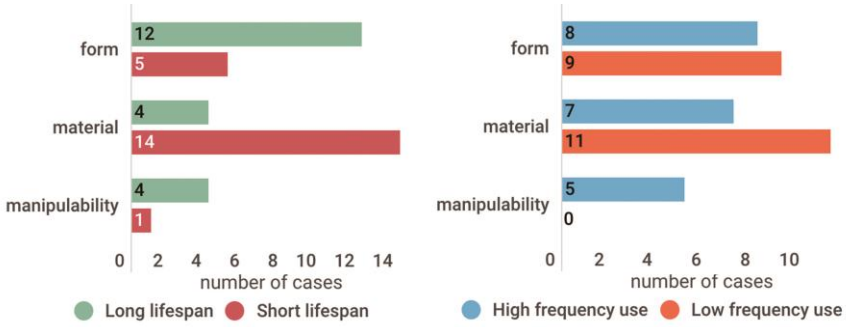

Figure 8. The frequency of the relation between product life expectancy and product elements (left), the frequency of the relation between frequency of use and product elements.

3.3 Level of appropriation in everyday designing

In the experiment, participants were free regarding the extent to which the original product was appropriated. Based on the level of appropriation, we classified the repurposed products into three categories: 'As is', 'Assemble', and 'Disassemble'. 'As is', the product is used without any processing. 'Assemble' is the case where ED product is created by adding other products to the product. 'Disassemble' means a disassembly of the product or the partial use of the product. 47% of the products was disassembled and 32% of them was assembled with other products or parts. Only 21% of product is as-it-is (Figure 9). Considering each product and the level of appropriation, 50% of the dustpan was remade by adding other products parts, and only 10% was disassembled. 40% of the foil dish was used without processing, and both assembled and dissembled 30% respectively. 60% of the plastic water bottle was utilized with disassembly and 40% was assembled with parts from other products. Umbrella was 100% disassembled and only a part was used for a new purpose. For the products with high frequency of use 'disassemble' was most observed. For those with short life cycle, the participants adopted 'disassemble' and 'assemble' for appropriation. In case form and material were used as cue, no level of appropriation was involved. Interestingly, manipulability led to appropriation of 'dissemble' level.

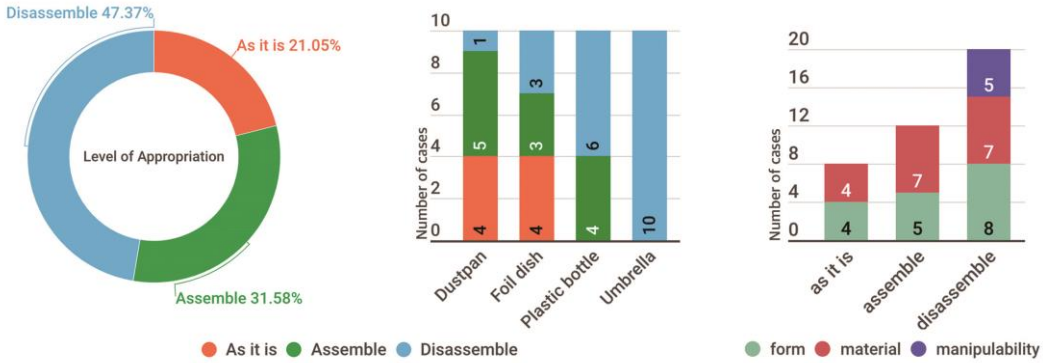

Figure 9. The percentages of the level of appropriation of all four products (left), the frequency of the level of appropriation for each product (middle), and frequency of relation between level of appropriation and product elements (right).

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4 DISCUSSION AND CONCLUSIONS

The product elements are the means by which the user can expand the functionality of the product and the possibility of human activity through everyday designing. Thus, we explored in the experiment how product elements enable the meaning and functionality as cue in the context of everyday designing and how much appropriation is given in the process of everyday designing. The results were discussed and conclusions were drawn in the following.

4.1 Integrated and extensible trigger

From the experimental results, we confirmed that perceived product elements and product elements as cue for everyday designing work differently. When participants received products, 72% of the participants perceived the form element at first. This means that people are the most sensitive to form among design elements(Janlert and Stolterman, 1997; Schifferstein and Desmet, 2008). Analyzing the cases that form was initially perceived, it was discovered that the form cases were highly related to the purpose of the product or focused on the archetype (van Boeijen, 2015; Maestri, 2007; Shieh *et al*., 2016). For example, 70% of the participants mentioned that the form of the foil dish was dish-shaped and it was related to the function. Also, 50% of the participants answered that the elements of the dustpan are trapezoidal form. In addition, it is on the same line as the previous results that high frequency use products utilized form more when they switch to ED. This results show that the participants has a mental model associated with the product form (Grèzes and Decety, 2002; Norman, 1988).

However, more than half of the product elements that had triggered everyday designing were material (45%) and manipulability (13%). The form element was significantly reduced in everyday designing. Taking it into account that the provided products are not much related to manipulability, 13% is not a low ratio. Compared to initially perceived product elements, product elements for everyday designing have diversified. In particular, perceived product elements were 12 while product elements as cue for everyday designing were expanded to 20. Based on the results, we believe that product experience extends the ability to recognize and utilize the specific product elements in the context of everyday designing. Material and manipulability are more perceptible elements considering the product in the everyday designing. This result supports that the material of the reusable product has been mentioned as an important product element for recycling in previous studies. (Blevis, 2007; Wakkary, 2007).

When a product was provided, in most of cases the form initially perceived and utilized for everyday designing again. For example, a dustpan was used for baking paper as a scraper. Scrapers have trapezoid and flat-end form.

However, we could confirm the extension of manipulability in form. For example, although the participants answered cylinder form as perceived product characteristic, the cylinder form of the plastic water bottle is deduced as a storage-shaped. Probably storage-shaped plastic water bottle entices people to keep something in there. For example, the bottles in the experiment were converted to diverse storage purposes. Originally, the purpose of the plastic water bottles was to store liquid, but it was changed to store a variety of things such as plants, underwear, multi-tap, and so on in various contexts. Although the form of plastic water bottle was the primary cause of this transition, the level of form appropriation varied. The multi-tab cover was inspired by the funnel shape of the plastic water bottle. The cover is designed to safeguard the multi-tab and keep the multi-tab line easy to maintain. Another participant used a long cylinder form to store her underwear. Participants use various levels of forms, but a simple manipulability called ‘Put’ was replicated in the case. We confirm that form and manipulability of the product is a crucial factor as trigger in everyday designing. This finding is in line with the result of Kim and Lee study (2014), in which the relation between interaction and trigger was identified. However, segmenting the interaction into form and manipulability was not considered in their study although manipulability could provide more detailed information to the designer as more a specific design element.

4.2 Unexpected discrepancy of product elements

In the study, we found out unexpected but interesting results in terms of familiarity. Let say, some of the ED products repurposed by the participants were what we are familiar with in terms of form and function while others were quite unfamiliar, which never seen in our everyday life. For example, a foil dish was used as scarecrow in a field. It shows a mismatch between the expectations intended by the designer with product element and the role of the product element determined by the user.

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Interestingly, the unpredictability of the meaning of the product element can lead to pleasure. Probably, this results from meaning discrepancy, which is consistent with Ludden's study (Ludden *et al*., 2008). The sound that the foil dish makes in use is not something that the designer intended. Also, the sound has nothing to do with the intended function of the dish. These meaning discrepancies are found in various ways regardless of the degree of processing in the study: dustpan as a colander without processing, and plastic water bottle as a light shade by melting the bottle. We believe that prior experience of people has given them the ability to use everyday product elements effectively in the context of everyday designing. Thus, the study implies that the user's ability to repurpose products through everyday designing activity tends to be creative and per se designers need to consider how everyday designing happens and how to support users through such phenomenon.

4.3 Mediated product trigger

The appropriation of products is done in various levels according to the results of the study. Many participants in the experiment disassembled the products in the process of everyday designing. Therefore, designers need to pay more attention particularly to cases of disassembly rather than merging with other products. Even if a part of the product is broken, the possibility of using the rest of the product and reusing it for other purposes would increase. Furthermore, the more complicated product is more likely to be disassembled and also the more likely to be attached to a simple product. Thus, the life expectancy of the product may increase if it is easily disassembled. This could make a significant contribution to the sustainability of our everyday life.

4.4 Design implications and limitations

The overall findings of the study indicate that repurposed products though everyday designing were reborn with various purposes beyond the original functions of the products. Also, it was revealed that cues for ED are not necessarily in line with what we perceive in products and level of appropriation varies depending on the cue of everyday products and prior experience of the user.

Although the study has an exploratory character, it encourages designers to understand the phenomenon and take everyday designing into consideration while gaining insight from users' creative activities in the product development process. Furthermore, this study could contribute to critical considerations for sustainable design in a way to facilitate reuse of products if an understanding of product elements that act as cues for everyday designing is provided. However, the experiment was conducted not the natural context where everyday designing generally happens and also with a small sample size, which are limitations of the study. In addition, we only studied simple products as experiment stimuli although our everyday products can be characterized by the level of complexity. Therefore, it is necessary to consider the natural context, bigger sample size and the level of complexity in follow-up studies in order to generalize the findings.

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REFERENCES

Alexander, C. (1964), *Notes on the Synthesis of Form, Harvard Univ. Press*.

Blevis, E. (2007), "Sustainable Interaction Design : Invention & Disposal , Renewal & Reuse", *CHI*, pp. 503–512.

van Boeijen, A. (2015), *Crossing Cultural Chasms towards a Culture-Conscious Approach to Design*, Delft University of Technology.

Brandes, U. and Erlhoff, M. (2006), *Non Intentional Design*, Daab Pub.

Broadbridge, A. and Marshall, J. (1995), "Consumer complaint behaviour: the case of electrical goods", *International Journal of Retail & Distribution Management*, Vol. 23 No. 9, pp. 8–18.

Crilly, N., Moultrie, J. and Clarkson, P.J. (2004), "Seeing things: consumer response to the visual domain in product design", *Design Studies*, Vol. 25, pp. 547–577.

Dix, A. (2007), "Designing for Appropriation", *Proceedings of the 21st BCS HCI Group Conference*, Vol. 2, pp. 27–30.

https://doi.org/10.1017/dsi.2019.405 Published online by Cambridge University Press

Grèzes, J. and Decety, J. (2002), "Does visual perception of object afford action? Evidence from a neuroimaging study", *Neuropsychologia*, Vol. 40 No. 2, pp. 212–222.
Janlert, L.-E. and Stolterman, E. (1997), "The character of things", *Design Studies*, Vol. 18 No. 3, pp. 297–314.
Kanis, H., Rooden, M.J. and Green, W.S. (2000), "Usecues in the Delft Design Course", *Contemporary Ergonomics*, pp. 365–369.
Kim, C. and Christiaans, H. (2012), "Soft' usability problems with consumer electronics: The interaction between user characteristics and usability", *Journal of Design Research*, Vol. 10 No. 3, pp. 223–238.
Kim, H. and Lee, W. (2014), "Everyday design as a design resource", *International Journal of Design*, Vol. 8 No. 1, pp. 1–13.
Kim, S. and Paulos, E. (2011), "Practices in the Creative Reuse of e-Waste", *CHI*.
Ludden, G.D.S., Hendrik, N.J. and Hekkert, P. (2008), "Surprise As a Design Strategy", *Design Issues*, Vol. 24 No. 2.
Maestri, L. and Wakkary, R. (2011), "Understanding repair as a creative process of everyday design", *ACM SIGCHI Conference on Creativity & Cognition*, pp. 81–90.
Maestri, L.A. (2007), *A Study of Everyday Repair : Informing Interaction Design By*, Simon Fraser University.
Norman, D. (1988), *The Design of Everyday Things*, *Basic Books*, *New York*.
Ram, S. and Jung, H.S. (1991), "'Forced' adoption of innovations in organizations: Consequences and implications", *The Journal of Product Innovation Management*, Vol. 8 No. 2, pp. 117–126.
Rosner, D. and Bean, J. (2009), "Learning from IKEA hacking", *Proceedings of the 27th International Conference on Human Factors in Computing Systems - CHI 09*, Vol. 09, pp. 419.
Schifferstein, H.N.J. and Desmet, P.M.A. (2008), "Tools facilitating multi-sensory product design", *Design Journal*, Vol. 11 No. 2, pp. 137–158.
Shieh, M., Hsu, F. and Tian, J. (2016), "A Study of Product Form Design Using the Theory of Archetypes", *UAHCI*, Vol. 9737, pp. 327–339.
Suri, J.F. and IDEO (2005), *Thoughtless Acts?: Observations on Intuitive Design*, Chronicle Books, Available at: https://books.google.co.kr/books?id=r8gIHFia3iYC.
Wakkary, R. (2007), "The Resourcefulness of Everyday Design", pp. 163–172.
Wakkary, R. and Tanenbaum, K. (2009), "A Sustainable Identity : The Creativity of an Everyday Designer", *CHI*, pp. 365–374.

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