Reinforcing sustainable practices by sharing cases of appropriation

Hyangah Kim, Woohun Lee[*]

Industrial design department, Korea Advanced Institute of Science and Technology

Background   Sustainability has become a hot issue in recent HCI(Human-Computer Interaction) and interaction design, which has made numerous efforts to enlighten people about environmental issues with the objective of eventually promoting sustainable actions. However, these efforts could have the effect of inducing people to save energy and minimizing waste but revealed the limitations of negotiating people's practices for sustainable purposes. In order to overcome this weakness, it is relevant to investigate practices while respecting them rather than negotiating or intervening. How, then, should HCI and interaction design approach everyday practices for sustainable purposes?

Methods   People appropriate artifacts every day. Therefore, this study first investigates appropriation in terms of everyday practice. We first conducted situated interviews with six residents in dormitories and found that appropriation is a sustainable action which reuses and reinvents uses for possessions. In order to support its sustainability, we designed a socio-technical platform, Wikiuse, as the first prototype of a socio-technical platform that allows people to share their cases of appropriation and to see other people's cases. Wikiuse was developed as a mobile application that runs on iOS4. Users can install it on their iPhone or iPod Touch and can easily connect to its Linux server by running the application.

In order to explore the practical value of using the platform to share cases of everyday appropriation, we recruited sixteen graduate students—seven males and nine females—who live in a dormitory; these students were very similar to the interviewees recruited for the dormitory interviews.

Results   In a field study of sixteen participants, it was found that Wikiuse helped people in two ways: it made them aware of the value of their applications and provided shared cases that helped them to discover more about their own cases.

Additionally, the sharing of cases of appropriation led to the adoption of other people's ways of appropriation, domestication, and sharing, which created a cycle of social appropriation. Participants adopted some of cases because they provided solutions to their problems, gave value to their possessions, and created new and interesting ways to use objects. In addition, satisfaction from helping others motivated participants' sharing as well as supporting the process of psychological bond formation through sharing cases is an emotional value of the cases shared on Wikiuse.

Conclusion   In sum, Wikiuse enables people to adopt others' sustainable actions, domesticate them, and share modified cases of appropriation. In other words, this study revealed that the practice of appropriation can be reinforced and its meaning can be co-constructed through online sharing. Finally, this paper suggests that a new direction for sustainable HCI is to consolidate people's sustainable practices rather than negotiating their practices with the intention of sustainability.

Keyword   Appropriation, Everyday practice, Sustainability, Online-sharing, Mobile design

Corresponding author : Woohun Lee
(woohun.lee@kaist.ac.kr)

1. Introduction

Sustainability has become a hot issue in recent HCI and interaction design, which has made numerous efforts to enlighten people about environmental issues with the objective of eventually advancing people's sustainable actions. However, these efforts could have the effect of inducing people to save energy and minimizing waste but could not change their existing practices (Strengers, 2011; Pierce et al., 2010). People can logically acknowledge the sustainable purpose without negotiating their own practices to achieve the logically assigned purpose. This results in the efforts of sustainable design to be degraded to the status of green campaigns. In order to overcome this weakness, it is relevant to investigate people's practices while respecting them rather than negotiating or intervening in them. How, then, should HCI and interaction design approach everyday practices?

In order to determine the new direction of HCI and design in relation to everyday practices of sustainability, this study investigated people's daily actions of appropriating artifacts under various circumstances. Appropriation has previously been studied in HCI and particularly in computer-supported cooperative work (CSCW) to research how individuals and groups of people understand technology. However, even though actions of appropriation are natural everyday practices, many studies involving a dichotomic view of dividing designers as producers and users as consumers have focused on why these unexpected actions occur according to designer's intent. Suchman (1994) claimed that developers and designers need to encounter unfamiliar areas of users as well as give up control of their designs to solve the problems of "decontextualized and inlocatable users" in design. Greenbaum and Kyng (1991) also pointed out that the dehumanization of users needs to be solved by examining the practices of users. From the users' viewpoint, appropriation is not unexpected actions but rather natural interaction with artifacts and circumstances of dynamic contexts. Situational changes, the complexities of the world, and the diversity of people lead to people continuously appropriating artifacts (Henderson and Kyng, 1991). Therefore, in order to properly understand people's appropriating actions, it is relevant to

first acknowledge that designers and developers are limited to counting all situations and practices of people who will use the design and to reframe users as proactive agents, or protagonists, of their own experiences and lives (Wakkary and Maestri, 2007; 2008). As creators, people are not simply consumers who HCI and interaction design tries to persuade to involve themselves in certain actions such as sustainable consumptions. The reconceptualization of users as proactive agents again inhibits HCI and interaction design from intervening in and negotiating people's practices.

Therefore, this study first investigates appropriation in terms of everyday practice through situated interviews with residents in dormitories and found that appropriation is sustainable action to reuse and reinvent uses for possessions. In order to support its sustainability, we designed a sociotechnical platform, Wikiuse, where people shared their own experiences of appropriating artifacts and viewed other people's cases of appropriation. In a field study with sixteen participants, we found that Wikiuse helped people acknowledge their experiences of appropriation and share them with others. Additionally, the sharing of cases of appropriation led to people's adoption of other people's ways of appropriation, domestication, and sharing, which created the cycle of social appropriation. In other words, this study revealed that the practice of appropriation can be reinforced and its meaning can be co-constructed through online sharing. Finally, this paper suggests that a new direction for sustainable HCI is to consolidate people's sustainable practices rather than negotiating their practices with the intention of sustainability.

2. Appropriation as a sustainable practice

Appropriation refers to the creative ways in which people adapt and repurpose technologies in order to achieve their own goals, occasionally doing this in a different manner than what was intended by designers (Salovaara et al., 2011). Appropriation itself shows how people interpret their contexts and artifacts, construct their own logic for

them, and use artifacts according to the logic in their everyday lives (Jelsma, 2006).

2.1 Appropriation in dormitories

In order to understand appropriations in terms of everyday practices, we first investigated the features of appropriation. We choose a particular user group and a circumstance, a dormitory. A dormitory is an appropriate place to study appropriation because (1) it provides similar circumstances for its residents—interestingly, though, dormitory residents do not interact with the environment in similar ways; (2) it has more limited spaces, resources, and facilities than other residences, which causes more appropriations; and (3) dormitory residents easily share their practices with other residents who have similar circumstances and practices (i.e., all residents need to do laundry, try on clothes, sleep, etc.).

(1) Situated interviews in the dormitory

We interviewed six graduate students—three males and three females, 22–27 years old—who were living in a dormitory. One interviewer visited each interviewee's room in the dormitory. At the beginning, the interviewer explained the purpose of the interviews and asked for permission to record the participants' uses for the purposes of this research paper.

The interviewer then explained the concept of appropriation and asked if participants could provide any examples relevant to the idea of appropriation. Since most of the interviewees had no idea what appropriation was, the interviewer suggested several possible situations, such as seated work, lying in bed, or doing the laundry, and asked the interviewees to explain how they performed those activities in their everyday lives. Whenever a case of appropriation was discovered during the interview, the interviewer took pictures of the appropriation and asked the interviewee to explain in detail why it had occurred and how he or she had chosen this action.

(2) Cases of appropriation observed in the dormitory

We discovered 108 cases of appropriation during the 6 interviews.

Even though there are not many differences between the dormitories visited, we observed very diverse appropriations for the same purpose of using the same or different artifacts (Figure 1). For example, in order to secure space to dry clothes, all participants had appropriated their possessions differently. Although they had used the same artifacts, such as drying racks and wire hangers, different appropriations were observed, as seen in the first row of Figure 1. Using a drying rack, U01 put it on the bed to secure more space during the daytime, while another participant put it in the gap between the bed and a wardrobe, keeping it half folded. Using wire hangers, U02 created room to hang clothes by placing folded boxes on top of the wardrobe, while two other participants, U05 and U06, hung their laundry in places that are physically appropriate to hang things. In addition to these actions, U04 connected hangers to hang more items together.

Excluding the one dormitory in which U06 lives, all the rooms visited in the interviews had automatic locking doors. Although the purpose of this is security, it creates an inconvenience when people frequently enter and exit the room. If residents forget to bring a card key, they cannot enter the room without asking the superintendent of the dormitory to unlock the door. Therefore, five interviewees implemented their own methods to prevent the door from being locked, as seen in the second row of Figure 1. Interestingly, U02 used a shoe, but U03 mentioned that he had used a shoe and the door had crushed his shoe; thus, he is now using a wire hanger instead. U04 said that she used a belt, an idea she had borrowed from her roommate. Interestingly, her roommate had learned about it from an ex-roommate.

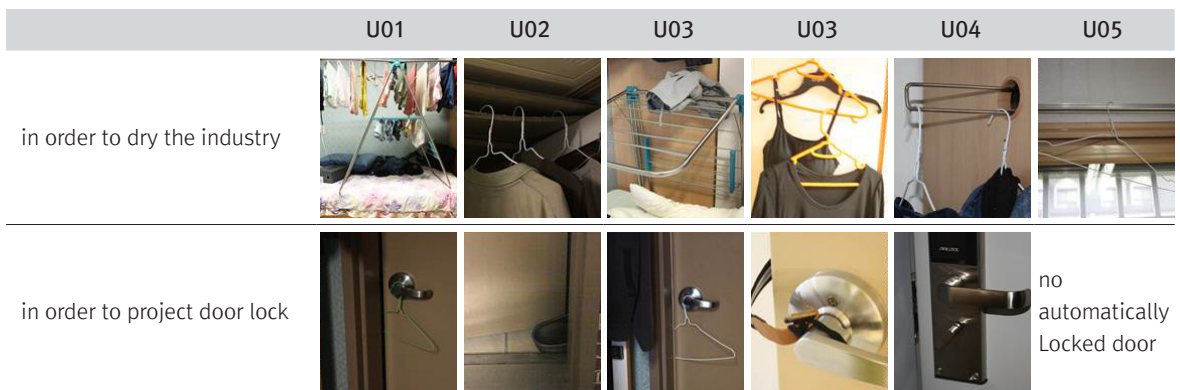|	U01	U02	U03	U03	U04	U05
in order to dry the industry						
in order to project door lock						no automatically Locked door

Figure 1. Diverse cases of appropriations observed during dormitory interviews

2.2 Appropriation as practice

(1) Nexus of activities

Rechwitz (2002) explained practice as a "type" of behavior and understanding that can commonly be observed through different locations, times, and by different people. This sense of practice does not understand social phenomena by sectionalizing body, mind, things, knowledge, discourse, process, and individual but by the nexus of doings and sayings (1996). These cases of appropriation also cannot be understood by analyzing body, mind, things, knowledge, discourse, process, and individual of the appropriation separately (Rechwitz, 2002; Schatzki, 1996). For example, the case of using a belt as a door stopper consists of bodily activities and their processes: holding the belt buckle to the inside of the door handle, holding the belt to the outside when leaving the room, and removing the belt that is held outside when re-entering the room; mental activities: thinking if leaving this time requires locking the door or if I should take a door key; things: the door handle and belt; knowledge: that the shape of the belt buckle is appropriate for holding it to the door handle and that the belt is thick enough to prevent the door from locking; and individual: my roommate or I. However, investigating things such as the belt separately have no meaning in this case. As theories of practice have claimed, the practice of appropriation includes all these things but should be understood as a whole.

(2) Mediated by artifacts

Practice is also dealt with as the relation between humans and the world (Heidegger, 1962; Latour, 1992; Verbeek, 2006). According to Verbeek's definition (2006), inheriting Heidengger's terms (1962), there are three relationships between humans and technology. First, in embodiment relation "readiness-to-hand" from Heidegger's term, the artifact is used and exists between humans and the world, but it does not garner attention from the user. Second, in alterity relation, the used artifact is consciously recognized. In this relation, since the artifact receives attention between a human and the world, technology obstructs users' eyes to the world. In the last relation, background relation, the artifact simply creates the context of the person's

experience. From the cases of appropriation observed in the dormitory, artifacts have mediating roles in the relationship between people and circumstances. For example, in the case of using a curtain rod to hang laundry, the artifact of a curtain rod did not garner U06's attention, although U06 might recognize that she found the space around the window to dry the laundry. According to Verbeek's definition (2006) for human-technology relationships, this case shows embodiment relation. Further, alterity relation is also found in the cases of appropriation. U03 had used his shoe to keep the door open, but he experienced having the shoe crushed. This experience constructs an alterity relation between him and the door by his paying attention to his shoe, which led him to use other artifacts. Therefore, appropriation indicates that artifacts are mediators of human-world relationships.

(3) Reconfiguration of meaning

The actions of appropriation are also found as context-dependent. U03, who had used the half-folded drying rack, mentioned that he uses the entire drying rack when he and his roommate are not in the room. However, this causes an inconvenience for him and his roommate in that it takes up space between the rack and the door. As this case shows, the context provokes different methods of appropriation even when it is for the same purpose, using the same artifacts by the same agent. This accords multistability of practice (Ihde, 1990). Additionally, other people can change their ways of appropriation. U05 mentioned that her use of a belt as a door stopper was an idea inherited from her roommate's appropriation because it was deemed safer and more convenient than her former method of using a plastic stopper. Interestingly, her roommate had also learned this from her ex-roommate. From her experience, appropriation is reshaped through sharing, and consequently the meaning of artifacts in appropriation is also reconfigured. This also indicates reconfiguration of meaning of practice (Shove, 2003).

Through the investigation of appropriation in the dormitory, we reached the conclusion that appropriation is a practice that is a unit of inquiry to examine human activities and to show the dynamic roles of artifacts in shaping human-world relations and reconfiguring its

meanings according to dynamic contexts.

2.3 Appropriation as sustainable action

In dormitory interviews, residents were found reusing the artifacts and also inventing new uses for existing artifacts. U06 uses plastic bottles to hold detergents in an effort to reduce the volume and weight of her laundry hamper (Figure 2). She puts all the laundry, detergents, and other necessary items for doing laundry together in the hamper to enable her to transport them together to the laundry room. As shown in Figure 2, she reused mineral water bottles.

Figure 2. Appropriation of plastic bottles for laundry use

Moreover, appropriating artifacts also indicates inventing a new use for design artifacts. U02 used cardboard boxes to expand the space of his wardrobe (Figure 1). He discovered a new use for boxes—holding clothes—that were a nuisance, taking up space, and serving no purpose until he had appropriated them. We found that reacquisition occurs not only after dispossession (Pierce and Paulos, 2011) but also during possession of the artifact. Such reacquiring definitely leads to sustainable use of artifacts.

The circumstance of the dormitory has more limited spaces, resources, and facilities than other residences. This was found to be a factor that resulted in appropriations as well as led to residents maximizing the use of their possessions and consequently achieving sustainable use. However, this does not mean that the appropriations only in limited circumstances are sustainable. Wakkary and Tanenbaum (2009) identified users as sustainable actors on the basis of their

everyday designs, which form "the basis of renewal and reuse." Their ethnographic study with four families found three examples of people appropriating and adapting design artifacts, which indicated that users are not just consumers but also creators who renew, reuse, or invent their artifacts.

In summary, appropriation is a sustainable action that occurs in everyday practices. However, appropriation should not be investigated by generalizing people's actions, intentions, and knowledge of cases of appropriation, as general HCI approaches do for users. Therefore, this study seeks to reinforce the appropriations in people's everyday lives rather than analyzing its components or hastily defining its nature for HCI researchers or interaction designers.

3. Sharing appropriation

Appropriation itself is so dynamic that it is reorganized by social norms, inscriptions in artifacts, technology, and other social practices. We questioned why the actions of appropriation have not yet been influenced by other actors. From the dormitory interview, interviewees developed their own methods of appropriating artifacts in order to achieve certain goals by finding better ways than those used previously. They solely depend on themselves, although other people, such as roommates, influence this process. However, this influence is limited in practice because people do not even acknowledge what they are doing unless a critical problem arises and garners people's attention. This means that artifacts involved in the appropriation usually create the embodiment relation for a human-technology relationship. Only after this relation is changed to an alterity relation can people recognize their actions and artifacts. Moreover, recognition of the action does not directly lead to sharing the action. With regard to sharing, the protagonist of the action needs to acknowledge its value to others, which will motivate him or her to share. Therefore, in

practice, intentionally sharing the experience of appropriating artifacts rarely happens and is occasionally only possible if a direct observer, such as a person who shares the space with the protagonist, witnesses the appropriation. This contrasts with DIY practice, which creates prosperous communities, such as Instructables (2012), where authors vigorously document their works and people influence each other.

From the situated interviews in the dormitory, we found that the cases of appropriation benefit other people, particularly those who live in similar circumstances and have similar practices. In addition, as evident from a participant who inherits her roommate's actions and incorporates them into her own appropriation, we found the likelihood of people's collective participation in the practice of appropriation. With the expectation of a way to reinforce the actions of appropriation in everyday life, we designed a sociotechnical platform that would enable people to acknowledge their action and its value as well as share it with others. This study investigates whether this platform reinforces the "social" aspect of appropriation by enabling people to co-create the practice of appropriation by sharing cases of appropriation.
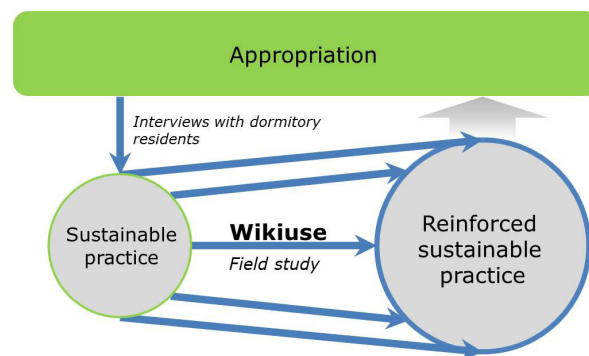

Figure 3. Study Outline

3.1. Wikiuse

Wikiuse was designed as the first prototype of the sociotechnical platform that allows people to share their cases of appropriation and to see other people's cases. Wikiuse was developed as a mobile application that runs on iOS4. Users can install it on their iPhone or iPod Touch and can easily connect to its Linux server by running the application. There are three reasons for building Wikiuse on a mobile phone

platform: (1) Most users carry their mobile phones at all times, which means that the mobile phone is the most universal platform; (2) since a user can capture the moment of use with a mobile phone, pictures are easily uploaded from the phone without transferring them to a computer; (3) as smart phones are becoming more common and their application market is expanding, the mobile application will be one of the easiest ways to provide a new service.
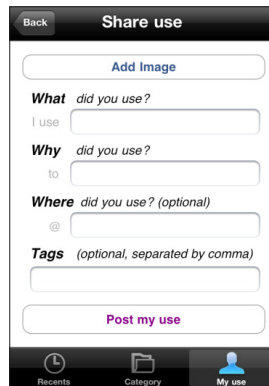

Figure 4. Share a case on Wikiuse on the basis of an item–function–picture framework
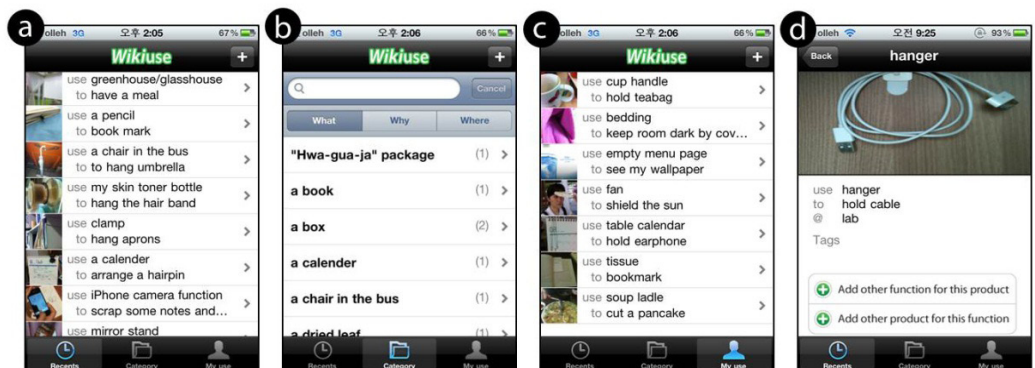

Figure 5. View others' cases on Wikiuse. (a) Recent view listed chronologically; (b) category view listed alphabetically by item, function, and location; (c) my use view; (d) a detailed view of each use

Wikiuse enables users to share their uses through the (+) button in the upper right corner of (a), (b), and (c) in Figure 5. Wikiuse is based on the item-function-picture framework (Kim and Lee 2012) that has been proven capable of representing cases of appropriation with less loss of information as well as with simple and easy input in our preliminary study. Within the framework, people can share a case by inputting what they use and why they use it as well as by adding a picture (Figure 4). Here, the picture enriches the contextual information, including implicit information that does not need to be described as explicitly. In addition to item, function, and picture, people in Wikiuse can add

optional information, location, and tags. These optional fields can be left blank if they are useless or if users do not want to add more input, but they provide additional cues to find certain appropriation cases. In order to reduce the effort required to share a case, users can inherit an item or function that was used in another case through two buttons "add other function to this product" and "add other product to this function" at the bottom of (d) in Figure 5.

3.2. Field study

In order to explore the practical values of using the platform to share cases of everyday appropriation, we recruited sixteen graduate students—seven males and nine females—who live in a dormitory; these students were very similar to the interviewees recruited for the dormitory interviews. Additionally, all participants are iPhone users, so it was easy for them to install Wikiuse on their cell phones.

Before beginning the study, we collected dozens of cases through pilot tests with five people in order to provide participants with examples of what to share. The pilot test was also used to debug Wikiuse prior to the study. We used iPhone ad-hoc distributions over the air because the present version of Wikiuse is the very first version and cannot be made publically available through the App Store.

Participants were asked to use Wikiuse every day for two weeks and to share their cases of appropriation as much as possible. A simple manual of Wikiuse, including what it consists of, its method of input, and the function of buttons, was given to all participants before the study. We guided the participants, telling them that they could share whatever they wanted to share with others within the given framework.

After two weeks, we conducted interviews with the two participants who shared the most cases as compared to all the others. Interviews were 30 minutes long and focused on the advantages and disadvantages of using Wikiuse. From the findings of the two interviews, we constructed a questionnaire that asked how Wikiuse had helped them discover cases of appropriation from their everyday lives; if the use of Wikiuse was entertaining; if they had discovered any cases in which Wikiuse could be applied to their own appropriations; and if they had any ideas for improving the application of Wikiuse. All questions

requested descriptive answers in order to receive richer feedback from the participants. Excluding the two participants who had already been interviewed, fourteen participants completed the questionnaire.

During the 2 weeks of the study, we collected 245 cases from the participants. Most of the cases occurred in their dormitory and laboratory and involved the use of everyday products, such as a cup or a computer monitor.

4. Finding cases of appropriation

Finding sharable cases of appropriation from everyday life is the starting point for participating in the Wikiuse platform. Recognition of the actions of appropriation requires mediating roles of artifacts to be changed from "readiness-to-hand" to "presence-at-hand" (Heidegger, 1962). Furthermore, people are only motivated to share when they acknowledge the value of what they will share. As found in the dormitory interviews, the limited sharing of appropriation is caused by people's ignorance of their actions and the value of the appropriating artifacts. Therefore, in order to construct a platform where people enthusiastically share cases of appropriation, first it is necessary to help them discover their own cases from other people's lives.

Interestingly, helping people discover cases of appropriation can be achieved without any effort exerted to design a particular function. All participants answered that they had more or less received help from Wikiuse in finding their cases of appropriation. According to their answers, Wikiuse helped them in two ways: it made them aware of the value of their uses and provided shared cases that helped them to discover their own cases.

4.1. Makes people aware of the value of their uses

Wikiuse was found to make users aware of the value of their uses, which they thought of as run-of-the-mill. Participants emphasized that

they had not recognized the cases of appropriation before.

"Wikiuse makes me review my uses, which had seemed too ordinary to discover earlier."

"I never realized that I had appropriated this much."

This also means that Wikiuse broadens participants' perspectives on appropriation. Many participants mentioned this change in their view of appropriation.

"What I had carelessly seen and thought of as useless became valuable."

"Since using Wikiuse, I have begun to believe that sharing is valuable, which makes me want to discover cases."

Therefore, Wikiuse itself made people recognize the value of their appropriations, which changed people's perspectives toward appropriation. This change helped all participants find their cases of appropriation without any problem.

4.2   Other people's cases that link to my cases

Wikiuse allows people to view other people's cases from the lists of cases in chronological order, in alphabetical order by item, function, and location, and by keyword search. Dozens of the collected cases from the pilot test and from cases that were continuously uploaded by participants during the study were discovered to help all of the participants recall their own cases.

"The cases in Wikiuse prevent me from being at a loss about what to share."

"I have learned how to rethink and have gained ideas from other people's cases."

"Other people's cases broaden the scope of my cases."

Some participants mentioned that other people's cases enhanced their ability to think of similar cases.

"I reviewed a case in which a person had hung his umbrella on a bookshelf. From this, I recognized that I hung my umbrella on the chair. I think cases from others can be links to discovering my own cases."

This was also proven through the relationship between the cases in which two participants shared, as seen in Figure 6. These participants

logged in and used Wikiuse simultaneously. The cases that they alternately shared show the similarity in the type and shape of the artifacts as well as in the purpose of the appropriation.
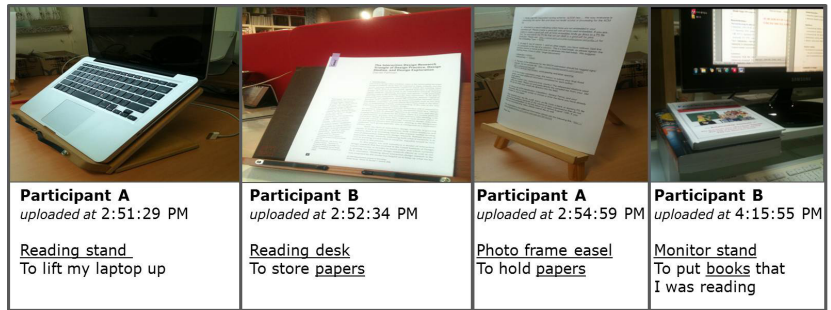

Participant A	Participant B	Participant A	Participant B
uploaded at 2:51:29 PM	*uploaded at* 2:52:34 PM	*uploaded at* 2:54:59 PM	*uploaded at* 4:15:55 PM
<u>Reading stand</u> To lift my laptop up	<u>Reading desk</u> To store <u>papers</u>	<u>Photo frame easel</u> To hold <u>papers</u>	<u>Monitor stand</u> To put <u>books</u> that I was reading

Figure 6. Cases from two participants using Wikiuse simultaneously

Additionally, the cases in Wikiuse do not appear to be specialized and do not seem to contain expertise. This eases participants' minds about what is appropriate to find and share.

"The cases shared by others seemed very light and humorous, so I had no burden in finding my own cases."

Therefore, we concluded that simply viewing the cases of others can allow people to easily think of their own cases of appropriation in that the viewing triggers people's own experiences. In addition to this, the lightness of the cases in Wikiuse eliminates the burden of finding valuable cases.

5. Influence of cases of appropriation

The cases of appropriation shared through Wikiuse not only help people find cases worthy of sharing but also may influence the viewer's practice of appropriation. In order to understand how cases of appropriation on Wikiuse affect future actions of appropriation, this study investigated, through the post-interview and questionnaire, why people adopt other people's ways of appropriation into their own lives as well as how similar the shared cases appeared.

5.1. Adopting other people's ways of appropriation

First, in order to understand the reason for adopting others people's cases of appropriation, we appraised the answers to the question to determine if any of the other cases were applicable to their own appropriation, and, if so, why it is applicable. Other than one participant who answered that he had no cases to apply, all the participants mentioned that they would apply some of the cases to practical uses because the cases provided solutions to their problems, gave value to their possessions, and created new and interesting ways to use objects.

(1) It provides solutions to my problems

The cases worthy of being applied provide certain solutions to the participants' problems.

"Since my power cables used to be messy and were lying on the floor, the case of using a table calendar to organize the cables (left in Figure 7) helped solve my problem."

"I had been disturbed by cluttered wires on my desk. Using a table calendar to organize the wires (left in Figure 7) is a very simple and easy way to solve this problem, which I didn't know about before."

Some cases of Wikiuse not only provide a solution to the problems but also provide a way to meet people's latent needs.

"These days I would like to grow plants. Using a Hwa-gua-ja* package can be a good way to do this" (* Japanese plastic packaged cookies).

From these instances, it was discovered that people are willing to adopt other people's ways of appropriation to solve their own unsolved problems and to meet latent needs from other cases. This willingness is remarkable when they specifically know the problem and the solution does not require much effort.

(2) I possess the resources

When participants possess the resources in the cases, they answered that they would apply them even if there were no need for the functions of the cases.

"I never knew that there was a magnet on the side of my iMac. The case of using it to hold earphones (middle in Figure 7) is a good idea

and led me to use it."

The participant has an iMac but did not realize that it had a magnet on its side. Even though he had not mentioned that he needed to find a way to hold his earphones, he thought it was useful to utilize his resource, the iMac.

"I usually throw out old umbrellas, but I discovered the case of using an umbrella to carry many things at one time (right in Figure 7), which looks useful."

This participant discovered the value of a resource that he had thought of as useless. Therefore, it indicates that other people's cases can help people recognize the value of their resources. This reason also particularly identifies the value of appropriation as sustainable actions.
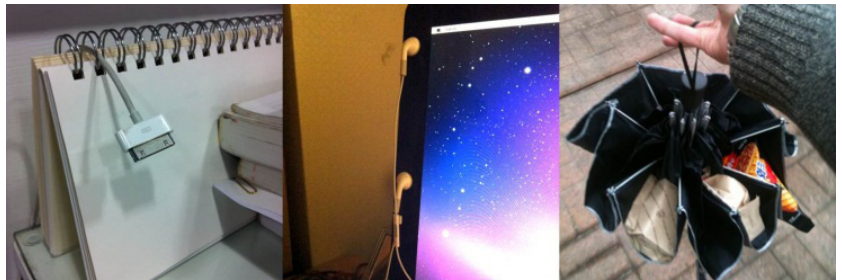

Figure 7. Selected applicable case examples

(3) It is creative

Another reason to apply the cases of others is simply that such cases are creative. Even though the cases might not be those that require the necessity of the function, the novel uses were impressive to many participants.

"Preventing neck wrinkles by using a towel is something I had never thought of, so it was impressive."

"Organizing wires with scissors is fun and is something that I had never thought of even though I have used both together."

5.2. Relations among cases of appropriation

Cases collected through Wikiuse are similar in terms of type, materials, properties (such as magnetic property), and shapes of artifacts as well as actions performed with the artifact. The following were the most frequently used artifacts: twenty cases used packages from goods, such

as tin cans or mineral water bottles; twelve cases involved the use of an umbrella; more than twenty cases used container-shaped artifacts, such as a cup or flowerpot (Figure 8); and thirteen cases involved the use of magnetic artifacts. Hanging was the most common action, as it was involved in twenty-seven cases of appropriation.

The similarity among cases does not always mean that the cases influenced each other. However, we found the potential of shared cases to influence and be influenced by each other from similarities as well as from people's willingness to adopt other people's ways of appropriation.

Figure 8. Cases of using container–shaped artifacts

6. Motivation for using the platform

Even though the shared cases on Wikiuse help people to find cases of appropriation and acknowledge their value, they are not enough to motivate people to endeavor to describe the experience as a case to share. The willingness of adopting other people's ways of appropriating artifacts implies the value of the cases of appropriation; however, there is no way for people to know how valuable each case is in this version of Wikiuse. Therefore, people need to be more convinced that their experience is valuable to others through any means.

"No feedback from other users made it difficult for me to know how

I was helping them by sharing my cases. This has further decreased my interest in using Wikiuse."

This comment indicates that recognition from other users can motivate people to share. In the same vein, ranking and comments features, which most participants requested for in the next version of Wikiuse, can be effective in generating feedback from other users as well as in finding other people's valuable cases.

6.1. Satisfaction from helping others

Even though there is a limitation to convincing people of the value of their sharing, satisfaction from helping others motivated the participants' sharing, as mentioned in the following statements.

"It was a pleasure to imagine that other people might apply my cases and experience them."

"It is good for me to help people think in better ways."

According to Torrey et al. (2007), people derive the pleasure was from the thought that sharing helps other users and that they themselves are participating in the exchange of knowledge. From above statements, it is found that people gained self-satisfaction in sharing their experience with other users as well as in sharing the knowledge.

From the above account, it is evident that a sociotechnical platform like Wikiuse has the potential to serve as a sustainable platform that will attract voluntary participation from people.

6.2. Emotional bond

The reason why people are willing to adopt other people's ways of appropriation implies functional values of participation. However, this does not mean that people find the value of the platform only from the usefulness of the cases. We found that many participants had developed a kind of camaraderie with the people who shared cases that were the same as their own cases. The cases people had already known about and experienced did not provide actual help for their anticipated appropriation; however, most of the participants emphasized the fact that this camaraderie led to an emotional bond with Wikiuse.

"I frequently use my monitor as a mirror, so I could relate to the idea of using the monitor case and it abides in memory."

This implies that acquainted cases also have meaning in that they facilitate attachment among users. If we compare this to the other values of the shared cases, such as usefulness and creativity, a certain commonality of thought process leads to involvement in social interaction with other users. One participant complained about the lack of a feature to strengthen interaction with other participants.

"I felt a sense of closeness with the people who shared cases that were the same as mine. However, in Wikiuse, I and the person are distant from each other; we are not linked. The process is just "I share, he shares," and nothing happens between us. At first, I thought "add this product button and link the case and my new case," but I couldn't do that. I was disappointed with the lack of such a feature."

When she found a person who had experienced the same thing, she expected the system to link them. This psychological distance was also mentioned by other participants. Most of the participants asked for support in such a way that they would be able to find people who had the same or similar uses as those of their cases. Therefore, we can say that the psychological bond formed through sharing cases is an emotional value of the cases shared on Wikiuse.

7. Discussion

7.1. Process of co-constructing the practice of appropriation

Appropriating artifacts are sustainable actions as everyday practices. In order to reinforce the practice of appropriation, this study suggests the sociotechnical platform, Wikiuse, where people can co-construct appropriation and its meaning. The process of social appropriation through Wikiuse involves (1) adopting the cases of appropriation shared in the platform, (2) domesticating the case by using one's own creativity by adapting the real context, and (3) sharing the developed cases of appropriation on the platform (Figure 9).

Among the three processes, the second, domestication of appropriation, is an existing practice not created by Wikiuse. This domestication occurs locally regardless of the cases of Wikiuse. It involves the actions involved in appropriating the artifacts themselves and often adds previous experiences of appropriation for the better. Without this second process, the sociotechnical platform, Wikiuse, created the new process of adopting other people's appropriation and sharing one's own appropriation.
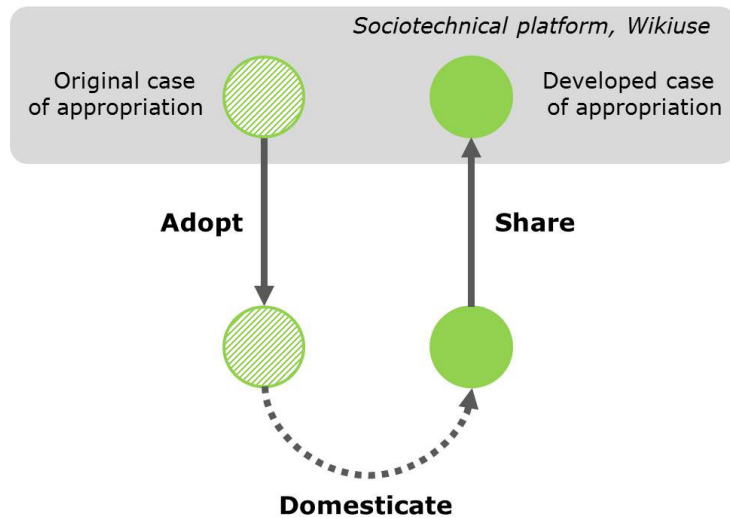

Figure 9. Process of co-constructing appropriation through the sociotechnical platform, Wikiuse

(1) Adopting other people's cases of appropriation

Wikiuse enables people to adopt other people's ways of appropriating artifacts. Adoption means applying the original case of appropriation without any domestication into the viewer's life. This study reveals that people are willing to apply other people's ways of appropriation better than their own ways. Here, the criteria used to judge is if the appropriation is better is functional and sustainable usefulness and creativity. Functional usefulness solves the viewers' unsolved problem or replaces the unsatisfactory solution. Sustainable usefulness supports people's methods of creating sustainable use of their possessions in that it makes people discover an unknown use and value of the possessed artifacts. In addition, people also prefer to adopt a creative use of artifacts while respecting this creativity.

Adopting other people's ways of appropriating artifacts does not

always remain a passive action. Different contexts and different individuals involved in the action lead people to domesticate appropriation, which is the beginning of co-creating appropriation.

(2) Sharing one's own cases on the platform

After domestication, some forms of appropriation can be brought back and shared on Wikiuse if they create value so much as they are worthy of sharing. Here, Wikiuse helps people acknowledge the value of their appropriation by viewing other people's cases, motivating them to share whatever is meaningful. In addition, Wikiuse reduces the effort to describe the case of appropriation by providing a simple framework that includes the item, its purpose, and its picture. Satisfaction from helping others and emotional bonds to people who had similar experiences were also motivating factors for participating in the social practice of appropriation. These contributions of Wikiuse indicate its potential as an ecological platform that encourages vigorous participation and, consequently, active co-construction of social appropriation.

7.2. Further social actions of participating in appropriation

The current version of Wikiuse limited the social aspect of people's actions of appropriation. Other than simply receiving responses from other people, the sociotechnical platform of sharing cases of appropriation can support various social actions in the cases.

(1) Sharing the case of failure

With Wikiuse, people share only worthwhile cases of appropriation. However, in the local process of appropriation, many actions of appropriating end in failure without producing any valuable result. Failure is also worthy of sharing with others who could possibly make the same mistakes. The cases of failure excite the basic passion of people for appropriation to overcome failure and consequently stimulate the practice of appropriation.

(2) Pointing out problems

Furthermore, some cases appear successful or creative at first glance but

experience some problems over time. Dynamic context and locality cause certain problems that the protagonist of the case was unable to find. The problems occurring in domestication can lead to a better case of appropriation and sharing. However, without this eventual sharing, people can still contribute to the platform. People who adopt the method used in the case and who also discover problems with it can contribute to the platform by pointing out these problems. This action leads people to respond more proactively to other people's appropriations and, consequently, to participate in them.

(3) Supplementing cases with one's own cases

Participants in the field study of Wikiuse mentioned that the existing cases on the platform caused them to recall their own experiences related to the case. This means that people can add their own know-how and experience when they view the case without the process of adoption, domestication, and sharing. This amounts to helping the protagonist of the case as well as other viewers who may experience the problem in the future.

7.3. Practical sustainability

Previous studies for sustainability in HCI discovered the limits of negotiating people's practices (Shove 2003; Pierce et al 2010; Strengers 2011). Numerous green designs have attempted to alert people to environmental issues and to promote people's sustainable actions. However, these efforts were discovered as limited in saving energy and minimizing waste. The critical factor of this limitation is that people do not want to change their existing practices. Therefore, instead of promoting rational choice for environmental problems and intervening in people's practices intellectually, this study made no effort to determine sustainability when designing the platform. Rather, this study attempted to construct a method to reinforce the sustainable practice and the actions of appropriating artifacts by having people voluntary share their cases of appropriation. Even though the platform does not focus on the purpose of sustainability, it shows potential for consolidating people's everyday practices of appropriation by adopting other people's ways and sharing their own. Therefore, this

study suggests a new direction of HCI and interaction design toward sustainability. Instead of negotiating existing practices with sustainable purpose, it is relevant to respect people's practices and understand the practice per se without overstrained interpretation.

7.4. Future design of Wikiuse

The present version of Wikiuse reveals that sharing cases of appropriation itself promotes people to view, adopt, and share cases of appropriation. However, promoting continuous participation from more people requires designing social facilities to give incentives for participation. Many social platforms promote various forms of participation through social facilities such as the "like" button of Facebook. In the case of Wikiuse, the social facility for promoting participation needs to accord to the process of co-constructing appropriation discovered in this study. For example, the case adopted by others can provide incentive. Additionally, Wikiuse needs to minimize the effort to find appropriate cases by constructing its database by meaning. The present version of Wikiuse uses alphabetical categories, which makes it more difficult to find the intended case.

8. Conclusions

This study investigated appropriation in terms of everyday practice and revealed that appropriation is sustainable action to reuse and reinvent new uses for possessions. In order to support its sustainability, we proposed a sociotechnical platform, Wikiuse, where people share their own experience of appropriating artifacts and view other people's cases of appropriation. From a field study, we found that Wikiuse helps people acknowledge their experiences of appropriation and share them with others. Additionally, sharing cases of appropriation leads people to adopt other people's ways of appropriation, domesticate them to their own appropriation, and share the domesticated, which creates the cycle

of social appropriation. From the design of Wikiuse, we concluded that the practice of appropriation can be reinforced and its meaning can be co-constructed through online sharing. Finally, this paper suggests that the new direction for sustainable HCI should be to consolidate people's existing sustainable practices.

The contribution of this work includes (1) reframing actions of appropriating everyday artifacts as sustainable practices; (2) respecting people's existing practices rather than interpreting and defining the individuals of the practice; (3) proposing a sociotechnical platform design that reinforces the practice of appropriation by sharing cases of appropriation; (4) showing the value and potential of the platform as a platform of social appropriation; and (5) proposing a new direction for sustainable design without intellectual efforts to achieve sustainability.

Wikiuse, as a sociotechnical platform, took the first step for social appropriation in which the existing practice of appropriating is reinforced through people's collaboration. Even though it has the potential to support more social actions through the cases of appropriation, it is still limited in its ability to motivate people to share their cases. People's voluntary participation and contribution to the platform would be a critical point for the success of social appropriation. Therefore, additional research needs to be conducted to prove the effectiveness of Wikiuse in promoting participation in the platform.

References

1   Greenbaum, J., & Kyng, M. (1991). Introduction: situated design. In J. Greenbaum and M. Kyng (Eds.), *Design at Work: Cooperative Design of Computer Systems* (pp.1–24). New Jersey: Lawrence Erlbaum Associates.

2   Heidegger, M. (1962). *Being and time*. Wiley–Blackwell.

3   Henderson, A., & Kyng, M. (1991). There's no place like home: Continuing Design in Use. In J. Greenbaum and M. Kyng (Eds.), *Design at Work: Cooperative Design of Computer Systems* (pp.219–240). New Jersey: Lawrence Erlbaum Associates.

4   Ihde, D. (1990). *Technology and the lifeworld: From garden to earth*. Bloomington: Indiana University Press.

5   Instructables. (2012). Retrieved November 6, 2012, from http://www.intructables.com.

6   Jelsma, J. (2006). Designing "moralized" products: Theory and Practice. In P.–P. Verbeek, & A. Slob (Eds.). *User Behavior and Technology Development: Shaping Sustainable Relations Between Consumers and Technologies* (pp.221–231). Netherlands: Springer.

7   Kim, H., & Lee, W. (2012). *Framing creative uses for describing cases of appropriation.* Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work (pp.135–138). Seattle, WA, USA.

8   Latour, B. (1992). Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts. In W. E. Bijker, & J. Law (Eds.), *Shaping Technology/Building Society: Studies in Sociotechnical Change* (pp. 225–258). Cambridge: MIT Press.

9   Pierce, J., Fan, C., Lomas, D., Marcu, G., & Paulos, E. (2010). *Some consideration on the (in)effectiveness of residential energy feedback systems.* Proceedings of the 8th ACM Conference on Designing Interactive Systems (pp.244–247). Aarhus, Denmark.

10 Pierce, J., & Paulos, E. (2011). *Second–hand interactions: Investigating Reacquisition and Dispossession Practices around Domestic Objects.* Proceedings of the 2011 annual conference on Human factors in computing systems (pp. 2385–2394). Vancouver, BC, Canada.

11 Reckwitz, A. (2002). Toward a Theory of Social Practices: A Development in Culturalist Theorizing. *European Journal of Social Theory, 5*(2), 243–263.

12 Salovaara, A., Höök, K., Cheverst, K., Twidale, M., Chalmers, M, & Sas, C. (2011). A*ppropriation and creative use. Proceedings of the 2011 annual conference extended abstracts on Human factors in computing systems* (pp.37–40). Vancouver, BC, Canada.

13 Shove, E. (2003). *Comfort, Cleanliness + Convenience*. Oxford: Berg.

14 Strengers, Y. (2011). Negotiating everyday life: The role of energy and water consumption feedback. *Journal of Consumer Culture, 11*(3), 319–338.

15 Suchman, LA. (1994). Working relations of technology production and use. Computer Supported Cooperative Work 2 (1–2), 21–39.

16 Schatzki, T.R. (1996). *Social Practices—A Wittgensteinian Approach to Human Activity and the Social . Dialogue.* Cambridge: Cambridge University Press.

17 Torrey, C., Mcdonald, D., Schilit, B., & Bly, S. (2007). *How—To pages: Informal systems of expertise sharing.* Proceedings of the 10th European Conference on Computer—Supported Cooperative Work (pp.391–410). Limerick, Ireland.

18 Verbeek, P.—P. (2006). Acting artifacts. In P.—P. Verbeek AND A. Slob (Eds.). *User Behavior and Technology Development: Shaping Sustainable Relations Between Consumers and Technologies* (pp.53–60). Netherlands: Springer.

19 Wakkary, R., & Maestri, L. (2007). *The resourcefulness of everyday design.* Proceedings of the 6th ACM SIGCHI conference on Creativity & cognition (pp.163–172), Washington, DC, USA.

20 Wakkary, R., & Maestri, L. (2008). Aspects of Everyday Design: Resourcefulness, Adaptation, and Emergence. *International Journal of Human—Computer Interaction, 24*(5), 478–491.

21 Wakkary, R., & Tanenbaum, K. (2009). *A sustainable identity: The Creativity of an Everyday Designer.* Proceedings of the 27th international conference on Human factors in computing systems (pp.365–374), Boston, MA, USA.