Non-Finito Products: A New Design Space of User Creativity for Personal User Experience

Jin-min Seok
Department of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu, Daejeon, Republic of Korea
jinminseok@kaist.ac.kr

Jong-bum Woo
Department of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu, Daejeon, Republic of Korea
magicianwoo@kaist.ac.kr

Youn-kyung Lim
Department of Industrial Design, KAIST
291 Daehak-ro, Yuseong-gu, Daejeon, Republic of Korea
younlim@kaist.ac.kr

ABSTRACT
Conventional wisdom says that to be successful, an idea must be concrete, complete, and certain. However, what if unfinished ideas work? This CHI paper proposes a new design space we call *non-finito products* for the HCI community. This new design space is about intentionally unfinished products and how they foster new creations by end-users as they are actually used to help people solve their own problems. The central idea comes from the background of the growing complexity associated with IT advancement and from the new way of dealing with it, with the assistance of user creativity in the actual use of the products. This paper begins with the exploration of non-finito products as a new design space for the end-user's creativity in the personal user experience. We then defined and proposed non-finito products. We discussed three case studies that will help to understand the design space of non-finito products, and we framed the new design space by revealing the beneficial contexts and values. Finally, we suggested the implications of designing non-finito products. We believe that non-finito products will open a new design space in HCI, prompt a new means of replacing value-destroying complexity with value-creating version, and help to make a product better fit to user experience.

Author Keywords
Non-Finito Product; Unfinished Product; User Creativity; User Experience; Design Perspective.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
It is typically an accepted rule that an idea must be concrete, complete, and certain to be successful. Is this an absolute rule for success? What happens if an idea is incomplete and unfinished? HCI is historically rooted in dedication to the design of digital artifacts and systems that support specific tasks and workflows, especially in ways that are effective, efficient, and usable [19]. However, HCI is confronting a new design era in which design problems have become much more complex and new design movements that include uncontrollable issues as part of their designs, especially user creativity, have grown beyond the traditional purposeful design paradigms.

This is not a sudden or accidental movement. The complexity of design problems has gradually increased as the design environment in HCI has evolved: products for individuals were expanded for society; the limited spatial and temporal contexts of a product were expanded ubiquitously; the focus on usability, effectiveness, and efficiency was expanded to emotional and social values; the focuses on task, function, and performance were expanded to include user experience and relationships; and the manner of problem solving evolved from finding problems to discovering new opportunities and areas of creativity. As the complexity of design problems has increased, HCI has been helped by various collaborations, especially with users, as complex problems require more knowledge than any single person possesses. Participatory design is one of the classic examples of user involvement in the design process. Users with prototypes or probes have helped designers tangibly reflect on potential design problems during the development phase [30]. Reflective design [23] is also an example of critically exploring user experience to tackle unconscious values in people's practices with computer-enabled artifacts in the design process.

However, a new style of user involvement has recently emerged. This is involving user creativity in the real contexts of using a deployed final product. Previously, users only helped designers during the development phase, and designers completed a concrete and well-defined product. Now, the HCI community has started to recognize user creativity in instances of actual usage situations and has embraced it as a design resource. The HCI discipline not only solves the problem of complexity but also replaces value-destroying complexity with a value-creating type. Traditionally, the HCI community has tried to reduce the complexity of problems due to its negative effect on value-creation. HCI has been eager to control problems during

CHI 2014, April 26 - May 01, 2014, Toronto, ON, Canada.

http://dx.doi.org/10.1145/2556288.2557222

product development to make well-specified products even when they were helped by user participation. However, the community has started to recognize and use the complexity as one resource for value-creation [17]. Studies on everyday design [29], design for appropriation [4], and NID (non-intentional design) [2] are examples of investigating users' activities beyond the intentions of designers and the purpose of a product. Design for hackability [6] studied the customization of a product by the users who have a special level of knowledge of hacking the product. End-user development [12] allows users who are acting as non-professional programmers to create and modify systems. The study on incidental interaction [5] is also an example of research focusing on the lower level of attention, especially in the sensing and environmental context, which goes beyond the purposeful interaction. Designers are also serving as facilitators or catalysts. Products in HCI started to include rooms for user creativity in instances of real usage. For example, ambiguity [7], open interpretation [24], and randomness [11] were studied to support unanticipated use. Social computing applications, e.g., wikis and SNSs, are typical examples of open systems for involving user creativity in actual usage occasions.

The current works are in the early stages as the ways of involving user creativity in the actual instance of using a product still have some limitations. The first limitation is not having an effective and usable form of knowledge for designing such products. The studies on everyday use [29], appropriation [4], and NID [2] focused on the issues designers do not have control over, which happen in the post phase of product development. Their knowledge is phenomenological and still uncontrollable in terms of use in the development phase as a design method because the form of their knowledge is beyond the designers' intentions. The second limitation is about involving the user's creativity only as a medium for the completion of a product or system. The works on open systems are representative examples of involving user creativity in the instance of actual usage of a product. However, their main purpose lies in the product itself, not the people. The position of end-users can easily become secondary as they serve as participators or helpers who provide their knowledge for open systems. The HCI community has a long history of supporting end-users and their experiences of using a product. The HCI paradigms of usefulness, usability and user experience [9] are the historical trace of the dedication on supporting end-users. However, the end-users are losing their position in the context of dealing with user creativity in HCI, and open systems hardly have the purpose to support the personal user's experience. The third limitation is considering the ordinary end-users to be the subjects of creativity. The studies on hackability [6] are dealing with the special type of users who have a special knowledge or interest in a product or technology and their ability to customize it. The works on end-user development [12] try to make end-users use programming tools, but they are locked in the concept of people as the users of software. The designing of a product with user creativity in the instances of actual usage should consider not only the special ability of a special segment of users but also the natural behavior of ordinary end-users.

Under this background, there is a need for the design of more user-centered, open, or flexible products to meet complex human needs, as a way of overcoming the limitations of the traditional HCI paradigm of designing finished, closed, concluded, and completed products based on the methods of function/feature analysis and focusing on meeting a user's good mental model. This paper sheds a new light on the current movement of increasing end-user creativity accommodation and personal experience in product updates in HCI and formally attempts to define this new space of design as a new product category, namely *non-finito products*, based on the concept of *non-finito (unfinished)*. The concept of non-finito is adapted from the non-finito technique started in the disciplines of visual art. The non-finito technique is the first and one of the most influential formal methods transcending generations and disciplines that makes people participate in a work and create their own experiences. There is a possibility of success with unfinished, unconcluded, and incomplete products. We propose this opportunity as a new design space, on the way of using the complexities in user contexts as one of design resources for value-creation. This paper begins to explore the design space of non-finito products by defining non-finito products and their characteristics. We presented three cases of non-finito products by interviewing users on their experience of using them to help illustrate and understand the space of non-finito products. We revealed beneficial contexts for non-finito products and the potential benefits of using them. Lastly, we suggested some implications of designing non-finito products based on the insights from case studies.

NON-FINITO PRODUCTS

In this section, we explored the concept of non-finito, which we adopted from the art discipline and reframed in the context of HCI discipline. We defined non-finito products and identified their characteristics.

Non-Finito

Non-finito literally means unfinished. Non-finito is an art technique used in various domains, transcending generations. As a technique, "'non-finito' refers to 'a work which the artist intended to leave unfinished, like a torso or sketch… Such a work is… recognized to be a particular form of expression in its own right, challenging and motivating its audience to [engage in] creative co-operation to fill in and find out by empathy and association [22]."

The non-finito technique was pioneered by Donatello during the Renaissance and used by Michelangelo, Leonardo, and many other artists. Previous work remained unfinished for external reasons, but by the time of Leonardo, artists left their work unfinished for internal reasons. Their

ideas were more important than the realization of the works themselves [22]. When the work was impossible to complete to meet the ideal, the artists left their works unfinished as a form of completion. Many of Michelangelo's sculptures were left unfinished and are now providing room for people's imaginations. Leonardo used "sfumato," a technique without distinctive edges and lines, in his work the *Mona Lisa* (Figure 1), which commands from viewers an attitude of engagement and open interpretation due to the vagueness of her expression [15]. The non-finito method was widespread in eighteenth-century Europe in the time of Romanticism. At that time, a sketch was accepted as a work itself without it having to be a phase of a planned masterpiece [28]. Later works by impressionists, e.g., Cezanne, are also examples of non-finito art. Currently, the non-finito method is in use in various domains related to innovation. For example, the successful crime drama *The Sopranos* (Figure 2) was famous for its unfinished ending. Also, an intersection without traffic signals in the Netherlands achieved system autonomy by means of user participation [15].

Figure 1. Sfumato in *Mona Lisa* [25]

Figure 2. The Sopranos

A non-finito work has unique characteristics that a completed work never can have. The non-finito method has the power to create something that is more than itself. The non-finito technique is not locked in its main characteristics of incompleteness. An unfinished work has the capacity of prompting and suggesting [28]. The main value of a non-finito work is its continuity and infiniteness. A non-finito work allows and stimulates the imaginations of the observers to create the unfinished piece in a perfect, unique, and personal way, as if it had been a completed work [8, 15, 21, 28]. It is associated with aesthetic pleasure. The pleasure does not result from the anticipated satisfaction of future completion but rather from the psychological pleasure the imagination derives from anticipating an indeterminate experience [8]. Non-finito works have the potential to be inspired, spontaneous, free, and universal creations [28].

Historically, there are four types of non-finito works: unfinished, fragmented, sketched, and ruined work [28]. The unfinished work does not have any conclusion. The fragmented work does not have some parts, like a torso (Figure 3). The sketch is accepted as a work in itself, without having to be part of a plan for a masterpiece, for its non-finito quality. The ruined work is made incomplete by the force of nature. Various methods of incompleteness produce the various types of non-finito work. However, it is important that when people meet any types of non-finito work, they individually complete the incomplete part of a work by using their imaginations and constructing their own experiences.

Figure 3. Torso as a fragmented work

Definition of Non-Finito Products

Inspired by the non-finito technique, this paper proposes a new design space, namely, *non-finito products* in HCI. We define this new design space, *non-finito products*, as

> *intentionally unfinished products, fostering new creations by end-users in their actual instances of usage for their personal user experiences*

The core strategy of designing non-finito products is intentionally unfinished. "Intentionally unfinished" here does NOT mean "logically unfinished." Non-finito products include logically finished end products that incubate in an incomplete ambiguous state. Non-finito products are NOT products that are in progress in their development. They are NOT given up, inappropriately or ineptly finished, work-in-progress, prototypes, or prototype tools during a design process. Non-finito products are NOT materials, components, or tools needed for completing other work. The product updates by designers and the iterative development process are NOT non-finito products. Non-finito products are *formally completed end products*, leaving incomplete room for continuous user creativity. Designers design *incompleteness as a core design principle* to complete a non-finito product.

The subjects using non-finito products are end-users, and their creative activities are the resource of creating a continuous experience with the product. Non-finito

products aim to support people's individual experiences. Non-finito products are intentionally unfinished products that can be completed, continued, and evolved when used by end-users. The situational aspect of non-finito products is important. The unfinished attributes of a non-finito product can be meaningful when end-users create and evoke a continuous experience.

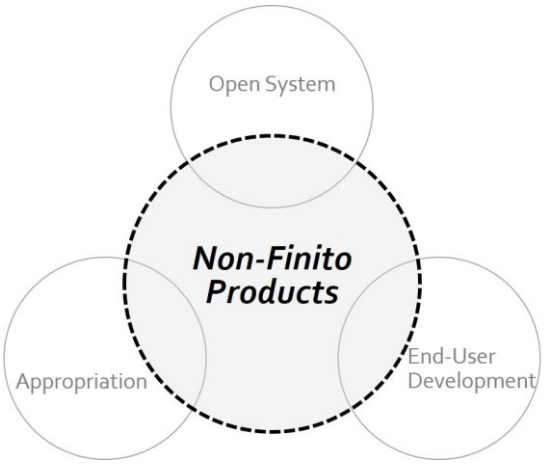

Figure 4. Design space of non-finito products

We can shape the design space of non-finito products in relation to the space of the most-influential related work (Figure 4). It is a conceptual diagram that makes the new and unseen design space of non-finito product concrete and visible. The size of each realm does not have meaning. We intentionally used a dotted line for the non-finito product space because it is the initial stage of prompting the design space of non-finito products, and we are not able to speculate the exact space of non-finito products at this moment. The design space of non-finito products will be gradually revealed through further explorations. The work on appropriation [4], open system, and end-user development [12] is the most dominant current realm that involves user creativity. The non-finito products share some common space with the related approaches, and the non-finito products shape their own design space. We will make the space of non-finito product concrete by comparing and contrasting with those three dominant related approaches in HCI, based on our definition of non-finito products.

According to the first part of the definition, non-finito products are intentionally unfinished. Non-finito products are not about passively resulting in additional usage by users beyond designers' intentions. For the example of appropriation, the 'like' feature of Facebook is made for giving positive feedback on postings and quickly sharing them. People are using the 'like' feature of Facebook in appropriated ways. People set 'one like' as 'one dollar' (1 like = 1 dollar) to collect money for social donations. Designers defined the main purpose of the 'like' feature, and users appropriated the feature in an ancillary manner. Unlike appropriation, the new creations by users in non-finito products are for actively creating the main and important usages and identities of a product. The design process of non-finito products includes being intentionally unfinished room, which can be completed by users rather than being firstly intended and then appropriated. Non-finito products are not relying on the serendipity or ad-hoc usage of a product. The unfinished quality of non-finito products shapes the critical usages of a product in specific contexts of people's own meaningful experiences.

The second part of the definition tells that non-finito products are used by end-users. Non-finito products might easily be confused with end-user development. The work of end-user development, e.g., Microsoft Excel, is focused on programming and software development. However, non-finito products focus on the natural behaviors of end-users[1] in their everyday lives as the resource of new creations and product evolution, rather than being interested in the end-users' software development knowledge level. Non-finito products naturally evoke the continuous experience and make users solve their problems when using a product.

The last part of its definition states that non-finito products are for the personal user experience. The difference between non-finito product and an open system, such as Wikipedia, can be confusing. Wikipedia is an online encyclopedia that can be edited by anyone. Wikipedia leaves the content empty, and a user who knows about the content can edit the encyclopedia. The difference between an open system and non-finito product is the main objective of involving user creativity. The objective of a non-finito product is to solve individual personal problems that the users deal with. Completing a non-finito product is also a valuable personal user experience because people construct their own meanings during the problem-solving process and as a result, they are able to have a better product experience. However, open systems like Wikipedia require user creativity in order to complete the system for other users. Unlike open systems, non-finito products aim to satisfy the user's own personal experience.

Proposing non-finito products in HCI is not about merely replicating the non-finito technique or the experience of non-finito artwork. Rather, it opens a new area and dimension of user imagination and creation that people can actively and appropriately participate in and dramatize their everyday activities in the HCI realm. In the discipline of art, people take a passive role even though they have the chance to participate in making art. People have their limitations as their reflective receivers. In the case of non-finito artwork, people are allowed to participate in the completion of the works of art. However, this mostly ends in a short period of time in people's mind or in the art performance and exhibition contexts in, and does not extend to being a part

[1] Although we are rather hesitant to use the term "end-user" here, we intentionally used it to compare the users of non-finito products with the users of other end-user related open systems and tools.

of users' daily lives. Non-finito products with the strengths of HCI, i.e., the ability of interacting and dealing with technologies that open up a vast amount of flexibility in alteration, would change people's role into being active creators, and their creations could have a substantial effect on their own lives.

Characteristics of Non-Finito Products

The followings are the characteristics of non-finito products that we infer from their definition and design space. More detailed illustration of the characteristics will be discussed in the later section of case study.

1. Purposelessness

Non-finito products are purposeless. The usage of non-finito products is not pre-defined. Users will discover the uses when they actually use the product. The uncertainty, unpredictability, and indeterminateness of the usages of a product are the related characteristics of non-finito products. The level of purposelessness can be different in various non-finito products.

2. Clear Functionality

Non-finito products should be clear on their functionality though their purpose is incomplete. The incompleteness of non-finito products does not mean that non-finito products have an arbitrary or confusing functionality. Non-finito products should function well, and how a product works should be effectively communicated to users.

3. Continuous Experience

The main value of non-finito products is unrelated to incompleteness itself, but is in the *continuity* in use and *infiniteness* of the product experience. Users can try to complete unfinished products by themselves in their use context. A non-finito product is a way of trumping what it is by what is not there. Non-finito products can be completed and defined during the process of continuous experience, which will be driven by end-users.

4. Non-radical Customization

Non-finito products do not require radical customization. The main point of using non-finito products is end-users. Non-finito products evolve the way in which the end-users can create continuous experience through their natural behaviors. Ordinary people create experiences that fit into their contexts through the ordinary ways of using a product. Everyone is a specialist on his or her situation. Non-finito products do not require special knowledge of a product itself or its customization.

CASES OF NON-FINITO PRODUCTS

In HCI, there are examples that have recently emerged that will help illustrate the design space of non-finito products. We collected case examples of non-finito products that satisfy the four characteristics of non-finito products. Three representative examples, namely, the poke feature of Facebook, the status message of KakaoTalk, and Twine, are studied through the interviews of users on their user experience. The following case studies will help understand and show various aspects of the design space of non-finito products.

Case 1. The Poke Feature of Facebook

The SNS feature, *poke* (Figure 5), has been one of Facebook's popular features. The poke feature intended to imitate the poke gesture, and many Facebook users use this feature to attract attention or say "hello" to their friends. Why was the poke feature successful? What made it different from other features? One clue is from Mark Zuckerberg's mention of the poke feature: "We thought it would be fun to make a feature that has no specific purpose. […] So mess around with it, because you're not getting an explanation from us [10]." To users, the poke feature is an ambiguous feature that they don't exactly know how to use. It is because the poke feature intentionally has no specific purpose, which allows it to be used in many different ways.

Figure 5. Poke feature of Facebook

The characteristics of the poke feature imply an insightful space as the non-finito product from the perspective of the designers and design activity. The poke feature is *intentionally incomplete in its purpose* though it has a *clear functionality*, i.e., selecting people to poke and then poking. The poke feature provides *a vacant room* that can be used for people's own usage in real situations as one of the feature's core characteristics. The incomplete room of the poke feature makes people *engage* with it, which *triggers* users to creatively participate in *the completion of the experience* of the poke feature by deciding the reasons for and context in which to use it. The intentionally unfinished poke feature, which is *not predefined in its purpose* to use, completes, evolves, and is *continuous* in the moment of real usage through users' natural behavior, i.e., poking, *without any radical customization*.

To explore the experience of the poke feature as non-finito product, we interviewed 25 Facebook users. We asked questions on their usage of the poke feature to understand the contexts of using the poke feature and capture its good or bad experiences. The questions were: When or in what situation do you use it? With whom do you use it? Do you have any good or bad memories of it? Multiple answers are allowed in order for users to capture the poke feature's rich experience. The following is the examples of the experience of poke feature as a non-finito product.

People decided the purpose of using the poke feature by themselves. Therefore, people used Facebook's poke feature in various situations and for various reasons, and made the poke feature fit into their own usage context. People used the poke feature to say "hello" to their friends. It is used as another special type of message or status update feature, i.e., the silent message or the shortest status update of sending the message "I'm alive," when people want to communicate a simple greetings and at the same time have no special content to deliver. People also used the poke feature for other purposes. People used the poke feature in the context of teasing friends or cheering them up. People also used the poke feature to get attention from others or express their affection to someone. However, 4 users did not use the poke feature because they did not find any appropriate contexts to use, or not fully understood what it is.

In SNSs (social network services), people encounter dynamic situations while interacting with other people. SNSs are complex in their nature. Designers are not able to provide specific solutions for every dynamic situation that user might face as design problems get more complex. In the complex environment of SNSs, the poke feature is an intentionally unfinished product, i.e., a non-finito product that did *not have any pre-defined conclusions* and let people complete their incomplete conclusions with their own needs and meanings. The sources for completing the poke feature were the dynamics of individual characteristics, the types of people communicating with, and their situations. Diverse needs and desires in communication as well as various individual preferences on self-expression were *engaged* during the incomplete finalization of the poke feature. The poke feature was *personally continued and re-created* in its conclusion. Different people created different ways of using the feature. Different situations create different results. The *multiple usages and meanings* was supported by the unfinished qualities of the poke feature, and people are able to strengthen their *personal experience* by themselves with the poke feature.

Case 2. The Status Message of KakaoTalk

KakaoTalk is one of the most popular mobile social applications in Korea. It is a mobile app that allows users to send and receive messages, including texts, photos, and videos. These messages can be sent to one or multiple users. KakaoTalk's status message feature is one of the components the app's user profile. With the status message feature, people present themselves in 60 characters. When people see their friend list or click on a friend's profile, people can view his or her photo and status message.

The KakaoTalk's status message is a good example of a non-finito product in the digital world. Basically, it is a small writing place, just like a paper in the physical world. Designers provided a place to write with a simple and clear functionality (Figure 6). Most of people can easily understand and use it without radical customization. They just write some characters. At the same time, the types of *content and context of using it are not predefined* by the designers. The users decide the purpose and content to fit within their own context of using the feature (Figure 7). It is easy to confuse open systems and non-finito products when the non-finito products are incomplete in their content. However, we need to make the distinction between the open systems for a system itself, e.g., wikis and social bus systems, and the non-finito product for users themselves. The different goals and perspectives will result in our actions of designing a product.

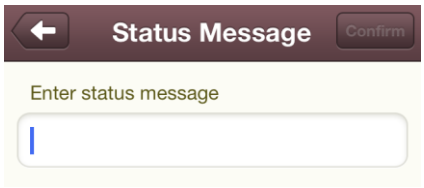

Figure 6. Edit page of status message

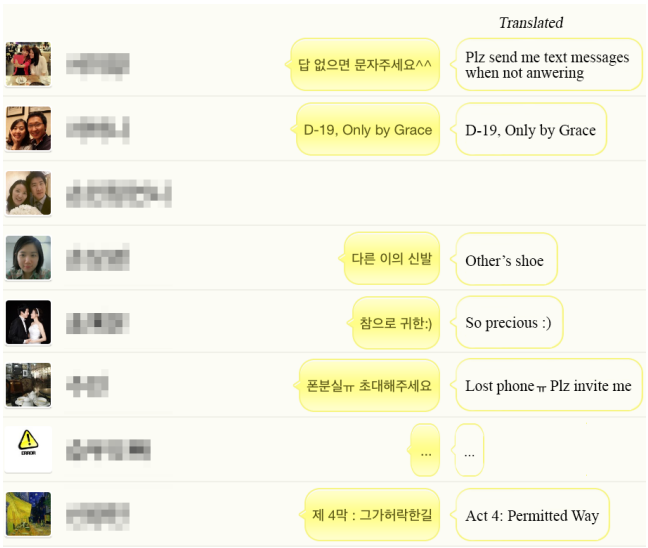

Figure 7. Status messages of KakaoTalk

To understand the experience of KakaoTalk's status message of as a non-finito product, we observed the status messages of 200 users. As a result, we captured three main patterns, i.e., the *message for myself*, the *message to other people*, and *no message*, and the dynamics around the patterns. In case of the *message for myself*, people presented their nicknames, e.g., "sweetie" or "superman." People presented their affiliation or place, e.g., "idKaist," "3rd semester," or "London." People also presented their mental status, e.g., "happy," and activity status, e.g., "in the workshop." People sent self-encouraging messages, e.g., "it's alright." People also presented a quotation that they liked, e.g., "John 3:18." People counted down to important days, e.g., "D-20" or "2 years." People presented their plans in their status message, like "healthy body in 2013." People also presented the change in seasons, e.g., "autumn is coming." People presented messages that other people could not interpret, e.g., "@@@." In the case of the *status*

message to other people, people presented their KakaoTalk IDs or other services like Twitter, e.g., "@[their Twitter ID]." People took note of events, e.g., "being mom." People also noted their special schedules like traveling or working abroad, e.g., "09.02-12.01 Beijing." People said hello to friends, e.g., "I'm fine, and you?" People also presented their status of receiving messages, e.g., "please make a phone call" or "not using for a while." People asked to join in communication, e.g., "please invite me to chat."

By exploring the experience of the status message in KakaoTalk, we can observe dynamic ways of using a feature and the *incomplete room for contents* enable the *multiple and personalized usages*. Behind the various usages, there were various motivations for different individuals. The situated contexts were different from user to user. The situation became more complex because of its momentary characteristics and the frequent interaction with others. The non-finito quality of the status message enabled to deal with those complex issues and to create *continuous experience* that fits to users' own contexts. Twitter is an example of unfinished products in HCI. The social media site was not concretely designed for the specific activities or goals. It frames indeterminate experiences. According to Williams, Twitter is framed around the question, "What are you doing?" (Now, "What's happening?") People use it in all kinds of different ways. It is like a blank canvas. It is a small canvas, but it allows people to think of new, creative uses [16].

Case 3. Twine

Twine is a wireless sensor block that can create rules to send a message and twits in certain sensor values [27] (Figure 8). Twine consists of the Twine block, sensors and the web App. The Twine block has internal sensors such as temperature, vibration and orientation sensors. Also, Twine can be connected with additional sensors such as magnetic switches, external temperature sensors, and moisture sensors. Through the sensors, the Twine block can check environmental information. The web App provides a form to create rules to trigger sending messages, or twits, at specific sensor values. It also provides presets of available conditions and actions so that users do not need to have any expert programing knowledge (Figure 9).

We choose Twine as a non-finito product because it clearly shows the four characteristics of a non-finito product. First, there is *no clear purpose* of the product. The purpose can change, depending on the needs of the user. Second, Twine does *not need radical customization*. Users can use it as the provided form. It provides a packaged product form and the web app platform so that users do not need to make many changes. Third, the *function* of Twine *clearly explains* through the web App, and it does not require expert knowledge in programing skills. Lastly, there is *room for active user participation*. Users have to install the Twine block and create rules through the web App to use it in their daily lives.

Figure 8. Twine blocks with extra moisture sensor to check water heater break

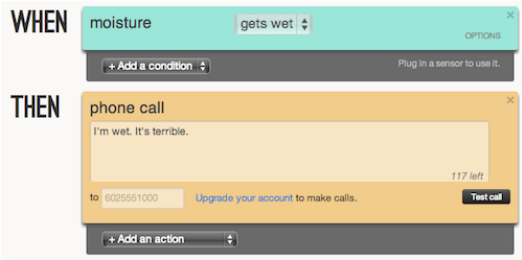

Figure 9. Twine web app

Twine is a newly launched product. Therefore, it is hard to collect user reviews, where we can investigate actual use cases. Luckily, we found one experienced user who bought and used Twine for about a month (21, Female). We interviewed her about her experience with Twine; we asked her about the process and the use of ideas created from Twine. The interview mainly included the prepared questions, but some related additional questions were asked.

From the interview, we found two values of non-finito products, namely, *user creativity* and *user customization*. First, the incomplete room of Twine gives the interviewee a chance to find the right context to use. This chance can trigger user creativity and the ability to solve the problem in a unique way. In her case, the door was the right context in which she could check three kinds of environmental information: door knocking, door opening and temperature. She was the expert of her environment so that she could easily find the purpose and appropriate installation spot of using Twine. After installation, she continuously came up with additional ideas.

"*When I bought the Twine, I was really excited about improving my environment. It feels like I attached a mouth to my space. First, I want to check the door opening. So I should think about how to detect door opened… There were digital door lock devices on the door, so I put the Twine block on the digital door lock. After attaching it, I realized that Twine can also detect the knocking from internal vibration sensors. So I created three rules from one installation—temperature checking, door opening, and knocking."(translated)*

Second, the contexts that the user dealt with are different from each other. Figure 8 is a different example from a blog

source [26]. This user uses Twine to check a water heater break. Each non-finito product is designed to solve a unique problem. Therefore, the non-finito design has *user-customized and personal values*. A ubiquitous sensor network like Twine creates many possibilities. However, it is not easy to design the right application. One suggested solution for this is to offer a useful tool and allow people to choose when and where to use it [18]. People, who live in their situations, fully understand their contexts, and they can discover real problems, limitations, and solutions; they live with Twine and solve unique problems with self-created *continuous experiences*. The characteristics of a non-finito design allow users to decide when and where to use the product.

However, a non-finito product needs a clear function performance. From the interview, we found that usability issues on installation and functionality mattered in the exploration of ideas.

"The purpose of Twine and the place to attach the Twine block is highly related. When an attachment is impossible, I cannot try my ideas with Twine." (translated)

As the interviewee mentioned, the place to attach the Twine is highly related to the purpose of using Twine. In the case of Twine, the physical environment is incomplete, which makes it purposeless as non-finito products. Dynamic and complex physical contexts engaged with creative exploration for personal problems. Different context, decided by users themselves identified different experience of Twine.

PRINCIPLES OF NON-FINITO PRODUCTS

In this section, we reveal the beneficial contexts and potential values as the principles for non-finito products. This is based on the literature reviews on the role of the concept of non-finito and the comprehensive insights from the case studies.

Contexts for Non-Finito Products

Where do non-finito products fit? Basically, a non-finito product is not the opposite of a concrete, closed and completed product. Non-finito products exist in a complementary relationship with them. In general, non-finito products deal with complex design problems. Several beneficial contexts for non-finito products, where the design domains include high levels of complexity in the HCI realm, can include the following:

1. Social Computing Applications

Social computing applications are domains in which a product has a high level of complexity. User participation, user creativity, social creativity, collaboration, evolutional nature, and flexibility are the characteristics of social computing applications. There are many people involved in social computing applications, and there is variety of contexts, needs, and motivations, as much as the amount of participants. The cases of the poke feature of Facebook and the status message of KakaoTalk show how various people create their personal experience to meet the dynamic needs in social computing applications with non-finito products.

2. Products and Systems for Ubiquitous Computing

Ubiquitous computing is a domain in which complexity of the uncontrollable dynamics of the context of a product exists. Discovery-driven prototyping [13] is an example in addressing this issue. It is a unique prototyping technique that inspired us to develop this concept of non-finito products. The authors described the prototypes as "discovery-driven". This means the prototypes allow end-users to actively discover new usage space with intentionally ambiguously designed prototypes in ubiquitous computing contexts. Rogers also stated the importance of designing technologies for proactive people in the era of ubiquitous computing [20]. Smart home [3] can be a well-matched domain in the ubiquitous environment in which various types of activities and situations should be supported. The case of Twine shows how the incompleteness evoked autonomous interactions between end-user and the physical environments and to make personalized smart home.

3. Products for Emotional, Playful, and Explorative Experience

This context is related to complex experiences, such as experiences beyond usefulness, efficiency, or effectiveness. The experience beyond performing a task requires the consideration of dynamic situations and related contexts of individuals. Such products should be designed without losing the richness of the experience. The cases of the poke feature of Facebook and the status message of KakaoTalk show how incomplete rooms were associated with the emotional and playful user contexts and used in non-task oriented ways.

4. Personally Meaningful Products on a Universal Platform

This context encompasses the complexity of building strong relationships with a user, as well as achieving universal resonance and satisfaction among people. The globalization increased the amount of people who are using the same product. A product should support the complexity for different people and their dynamic contexts of using the product. Making a product that fits the use of every individual's context and constructing individualized meanings are complex problems. Appropriation is an example of building an identity of a product by user creativity in the real-use contexts [1].

Potential Benefits of Non-Finito Products

How can non-finito products maintain power in the revealed contexts? Having non-finito products as a design space may enable us to:

1. Increase Spontaneous Participation

The incompleteness engages with seduction, attention, and curiosity. According to the information-gap theory [14], when we are aware of gaps in our knowledge, we feel deprived, a feeling we label as curiosity. A lack of certainty and predictability increases engagement and awareness; it

can also create a desire to explore [15]. For example, in the case of the poke feature of Facebook, users stopped for a while and questioned about its purpose, and most of the users answered the question in their own ways to use.

2. Engage with Creative Power, i.e., Imagination, Inspiration, Exploration and Ideas

The non-finito method was, or is, a specialized form of imaginative expansion [21]. The unfinished quality is appreciated for its ability to engage the creative powers of the beholder's imagination [8]. Uncertainty and ambiguity can create intriguing feelings, which makes us slow down, think [15] and explore. For example, the case of Twine shows how the incompleteness provoked the user to think right contexts of use.

3. Activate Emotions and Playfulness

People can become distinctively emotional when they encounter an unfinished work [28]. The non-finito method increases the pleasure of spectators by challenging them mentally [21]. The concreteness and specification of a product can reduce the playfulness in using it.

4. Have the Freedom of Multiple Usages and Meanings

Users can have freedom when using a non-finito product, in terms of an indeterminate experience [8]. Multiple usages and meanings are welcomed with non-finito products. All the examples in case study were intentionally incomplete in their purpose and allowed multiple usages.

5. Increase Naturalness, Sustainability and Autonomy

The restriction of an uncontrollable system in limited and enclosed artificial ways decreases the natural and ideal status of a product. The non-finito quality can help a product appear more as a product itself. Voluntary participation, self-exploration and creation can increase the sustainability and autonomy of a product.

6. Let a Product Evolve Fit to User Experience

The non-finito quality may better enable new creations fit the context of using a product. The continuous and infinite experience, created by users, defines and makes an undefined non-finito product evolve in a timely manner. All the examples in the case study were timely identified and evolved by different people or different situations of using them.

7. Increase Affection for a Product

The unfinished quality provides the rooms for people to participate and construct experience and meanings. This mechanism of non-finito products may help to make a strong relationship between people and a product by increasing affection.

Design Implications for Non-Finito Products

For non-finito products, making an incomplete part of the complete product is the core design strategy. From the literature review on the types of non-finito works (i.e., *unfinished, fragmented, sketched*, and *ruined)* and the insights on the ways of achieving the incompleteness of non-finito products from case studies, we could find some implications on designing non-finito products. The following implications will help to manage the incompleteness of non-finito products feasible.

1. Unconcluded: Incomplete in Conclusion

'Unconcluded' is the way to have no specific conclusion in the product. This means that users cannot recognize what the product is made for and the purposes of using the product. The product works well but there are no indications of the use or consequential meaning of the product. The poke feature of Facebook is an example: "I can poke, so what?"

2. Fragmented: Incomplete in Contents

'Fragmented' is characterized by a missing part in the product. Removing the contents of a product is one method of making a fragmented non-finito product. The status message of KakaoTalk is an example, since there is an empty space to fill various status contents.

3. Sketched: Incomplete in Contexts

'Sketched' is the way of offering a product that is not in fully-assembled form. When a product is given in not fully-assembled form, it evokes new creations based on the combinational relationship within the product, e.g., Lego Mindstorm, a programmable brick, or with the external environment, e.g., Twine provided with several sensors with the block. Users are engaged to assemble the parts to use a product. The physical properties take a critical role for finding the appropriate places to be combined. Various combinations can be made depending on users' purposes or contexts.

There are some considerations for the implications. First, the incompleteness of non-finito products should deal with the purposelessness of a product, which is one of the main characteristics of non-finito products. This is because the incomplete part is for determining the uses of a product by users. This should not be related to functionality or usability. Second, the suggested implications are in their early stages. There should be more studies about discovering the strategies of designing non-finito products.

CONCLUSION

This paper proposes the new design space of non-finito products—unfinished products for fostering user creativity in real instances for personal user experience—as a means of dealing with the complexity of design problems in HCI. To develop the design space of non-finito products, further studies should explore the space by finding and creating more non-finito product cases. The three cases that we introduced in the paper show various aspects, techniques and potentials of the non-finito products. This potential should be supported and strengthened with further works. To build the new design space of non-finito products as a method, there are a number of questions that can be answered in further studies; the questions are as follows. What are the design guidelines of the non-finito products? What are the design activities, related to the development of non-finito products? What is the right level of

incompleteness? How can a clear function performance and purposelessness be offered at the same time? What is the role of the designer in making non-finito products?

We are confronting a new era in which non-finito products can be successful. It is not easy for designers to surrender their rights of the control of a product willingly. A world in which not doing can be more powerful than doing is a different world than the world to which we are accustomed [15]. However, the difficulties related to our perception and attitudes should not be excuses for disregarding the value of non-finito products. The HCI community should remember that there is a major difference between a completed work and a finite one: completed works are not necessary finite.

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