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AN INTEGRATED MODEL DEPICTING PSYCHOLOGY OF ACTIVE/NON-ACTIVE INTERNET USERS: HOW TO MOTIVATE PEOPLE TO USE INTERNET AT HOME

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Abstract. *As many convenient Internet services are entering our lives, it is essential to ensure that non-active users will not be left behind. To elucidate their disadvantages, we developed a user-model depicting psychology of non-active/active users by conducting an ethnographic study. The model points out that non-active users are stuck in a negative loop, and that external factors made it harder to escape from the loop. Design guidelines derived from the model had a significant impact on non-active users in that they dramatically changed their attitude and started to use the service actively.*
Keywords: Technology acceptance, Qualitative methods, Novices, User support

1. **Introduction.** With the rapid spread of the Internet, we have more incentive to extensively use it in everyday life. Many convenient services are available, such as reserving hotels, checking train transfer details, and getting discount coupons for many stores. However, there are still many non-active users who cannot fully enjoy the convenience of the Internet and its potentiality, although the number of the people who possess computers continues to increase [3]. As ubiquitous computing grows more popular in the home environment, it is definitely critical to ensure that non-active users will not be left behind.

Internet usage is known to be affected by the user's lifestyle, background, and environment [2,17,25]. However, the reasons why some users fail to fully exploit the Internet although they possess computers and networks remain unclear. Usage rates may also be determined by not only the interaction between human and the Internet, but also the interaction between human and human, and the surrounding physical/social environment.

Our challenge is, therefore, to activate the non-active users by identifying all the crucial factors that affect the usage. To achieve our goal, improving only the design of the service itself is not enough. All the customer touch points such as advertisements, packaging and manuals, or human support from the call-center or families while using the service should be adequately designed.

In this paper, we introduce significant design associations to all customer touch points by presenting a new integrated model that clearly explains the psychology of non-active/active users and their surrounding environment. Our field study examined households with broadband access to answer two research questions; "Why do non-active users fail to use the Internet?", "Under what circumstances do they use the Internet?". Each user has a different definition of what constitutes "sufficient" activity depending on his/her environment or life style. Thus, activeness in terms of Internet usage is, in this paper, defined as "the degree of how fully each person utilizes the Internet from the viewpoint of his/her own life style".

Our findings will provide conceptual resources for the research community at large that will help guide the design of services that will encourage Internet usage by a wide range of users. It will bring insights to the service planners/providers, call-center managers and operators, whose work covers user-related service design.

In the remainder of the paper, we first discuss related works in activating the Internet usage. We then detail the study plan, and present our new model which elucidates the differences between active/non-active Internet users. We then describe the implications of our research for the service design. One of the solutions, called "concierge support," was tested in the field as a case study.

2. **Background and Related Work.** Computers and other interactive devices that allow access to the Internet can be difficult to use [10,12,16,23,24] and extensive studies have been conducted to shed light on the reasons from many different perspectives, e.g., [4,6,11,13]. Representative example is the study by Norman [19] whose concern is about the design. Not only the design of the interface, but also other factors involving human properties and environments affect the ease of use. In this section, we overview those studies conducted in the past.

To begin with, it is well known that even experienced users do not necessarily use optimal strategies, which is called "paradox of the active user" [7,14]. They persist in using inefficient procedures in interactive tasks when demonstrably more efficient procedures exist [10,14,18,26]. The reason for this behavior has also been explored in many studies. Fua and Gray [14], for example, indicated that two major characteristics underlie the user's behavior of persisting in suboptimal methods (e.g., using spaces to center a word on a page): (1) the preferred suboptimal procedure is a well-practiced, generic procedure that is applicable either within the same task environment in different contexts or across different task environments, and (2) the preferred suboptimal procedure is composed of interactive components that bring fast, incremental feedback under the external problem states. Carroll and Rosson [7] indicated that "a production bias" which results in users focusing on the task at hand rather than on learning to use the system more efficiently, was the main reason for the paradox of the active user. Bhavnani et al. [4] describes many of the factors that may influence the paradox of the active user, such as few opportunities for acquiring effective strategies, and lack of explicit statements of the strategies in instructional material or in help systems. All of these studies imply that the assistances from others and the opportunities to learn are crucial to acquire an appropriate strategy, thus, leading to be an expert.

Although these studies focus on active users, we assume that the phenomena could also arise in the non-active users. Thus, the way to provide assistance and the opportunities to learn may play a central role in enhancing Internet usage for the non-active users as well.

The determinant of the intention to use the technology devices has been studied in the workplace. According to "Technology Acceptance Model (TAM)" developed by Venkatesh and Davis [29], an individual's behavioral intention to use a system is determined by two beliefs: "the perceived usefulness" which represents the extent to which a person believes that using the system will enhance his or her job performance and "the perceived ease of use" which is referred to as the extent to which a person believes that using the system will be relatively effortless. Learning to use interactive systems requires significant effort; thus, it is important to understand those factors that form the intention to use.

While the workplace has been the focus of attention, interest in ubiquitous computing is stimulating research into the adoption of technology in the home [5,10,15,21,28]. Computer usage in the home is different from that at work, as the goals are different [28].

Venkatesh and Brown found that social influences such as information from TV or newspapers and the barriers, such as rapid change in technology or lack of knowledge influenced the intention of users to adopt computers at home [5,28]; "adopter" and "non-adopter" indicated whether they "purchased" computers at home or not.

Even if a computer is purchased, it is known that its usage is generally restricted to just a few "favorite" applications. According to Beauvisage [3], who had collected extensive computer usage data of 661 households with 1,434 users at home over 19 months, the five most used applications by an individual represented 83% of his PC usage time on average, and the "favorite" one occupied 45% of the time. They also indicated that when there are two computer users in a household, the most active one consumes 83% of the computer usage time on average; with three individuals in the household, the main user grabs three quarters of PC usage time [3]. These results show that having a computer at home does not necessarily imply that everyone uses it equally.

Our study focuses on the reasons for these differences. Some of the determinants can be extracted from previous studies, but no integrated explanation has been given yet. For example, previous studies of technology usage in domestic environments often examined device location as an important factor characterizing its usage [6,13,15]. Usage is also influenced by how the computer is managed and shared among family members [6,11,20,21]. Frohlich and Kraut [13] suggested that the simple choice of where to locate a computer in the home has a large impact on family life, both in terms of the way individuals use the computer and also in terms of the way they share their time on it. Another study showed that the usage of technology is intertwined with domestic "routines" [8,9,15], which involve communication and collaboration between inhabitants. Crabtree et al. [8] visualized where such communication occurred by examining the "routine communication acts" in residential settings.

Although the factors indicated by previous studies give us many fruitful insights into the problem of enhancing the Internet usage, none of the studies provide an overall framework or an integrated background to understand the obstacles to everyday computer usage from the viewpoint of the situation/circumstances of the user, the history of experiences of the user and the psychology of the user.

This paper, therefore, attempts to provide the integrated framework needed to understand the major factors that influence the Internet usage; it provides a new integrated model depicting the psychology of active/non-active Internet users. Every action or behavior is based on user psychology, so a deep understanding of user psychology is essential to understand user behavior and then provide solutions. Looking at the Internet usage from the perspective of user psychology brings not only a deep understanding of the user, but important implications for designing the services to be provided. We conducted a field study to collect rich data containing information on user psychology: what they think about computers, and how their image changes, with the environment and experience.

3. **Methods.** We conducted semi-structured interviews, which lasted from 1.5 to 2.8 hours, and home tours during which pictures of the domestic setting were taken. The questions targeted the following three topics.

- What applications were they using at the moment? When and why did they start to use computers? What kind of problem had they have and how did they solve them (present/past use of computers)?
- How did they use TV, video recorder, and digital camera (home appliances)?
- What time did they wake up and go to sleep? What kind of work and hobbies did they have (life style)?

The home tours provided us with additional details about the environments of computer usage in the home. Participants consisted of 32 occupants of 17 households in Japan. We interviewed both husband (M01 $\sim$ M15) and wife (F01 $\sim$ F15) in 15 households and only the husbands in 2 households (M16, M17). They all had broadband Internet access, were in their 30's to 50's, and none worked at information technology or telecommunication companies. 4 households were recruited via mailing list of the provider service and the remaining 13 households were recruited via the web site of a survey company that holds 330 million Japanese registrants. Each family was paid to participate in the study.

4. **Data Analysis.** We adopted a method based on the Grounded Theory Approach [27] for the analysis, which allowed us to draw bottom-up conclusions. In the first step, all interviews, totaling 39 hours and 19 minutes, were transcribed yielding 764172 Japanese characters. In the second step, we conducted open coding, with aim of identifying key themes in the data without imposing pre-conceived categories. This process resulted in about 50 codes. In the third step, the initial set of the phenomena described by the open codes is compared against each other to group them into categories. This process made explicit the connections between categories and sub-categories. The next step, called selective coding, is the process of refining the categories, identifying the core category and then systematically relating it to the other categories. All the causations between the factors were examined in this process. The connections were identified when the users themselves gave their reasons, or when the factor changed when the causal factor was changed. For example, connection from factor 'A' to 'B' (A$\rightarrow$B) was identified when the user stated that "A is the reason for B", or when B changed after A was changed. Some of the causations identified in the text (e.g., [C]$\rightarrow$[A] in Figure 1) were not adopted in the model, because of the paucity of the data supporting them. Those shortened connections could be consistently explained with the other connections (e.g., [C]$\rightarrow$[D]$\rightarrow$[A]). This resulted in two psychological loops of the active/non-active users composed of 4 factors. External factors affect either positively or negatively the psychological factors. Our proposed model was finally completed by connecting two psychological loops to describe the transition between the negative and positive factors. The connections do not represent causation but instead the change in status. Thus the connections were represented as cylinders, not single lines.

Although the numbers of the transcriptions classified are shown in the figure (Figures 1 and 2) to provide context, our model is derived from a qualitative method, and so is not intended to imply statistical or quantitative significance. Note that we constructed the category by classifying the transcript rather than the users. Thus, some user's transcript was classified into both positive and negative categories (17 out of 31 participants fell into this case). This is because our interviews tackled past episodes as well as the present one.

5. **Results.** Although our proposed user model is an integrated model of non-active and active users, we first describe its separate components. We then describe our integrated model.

5.1. **Non-active users.** Figure 1 presents our model of non-active users. The negative psychological factors ([A] to [D]) are connected to each other as a loop, and the external factors ([I] to [L]) make it harder to escape from the loop. The label represented inside the "$\langle\ \rangle$" are the subcategories of the factor. Numbers in brackets next to the name of the factors indicate the number of people whose transcript was classified as exhibiting that factor. The numbers between the factors (on the arrows) are the numbers of people whose transcript was classified as exhibiting both factors (backward and forward).

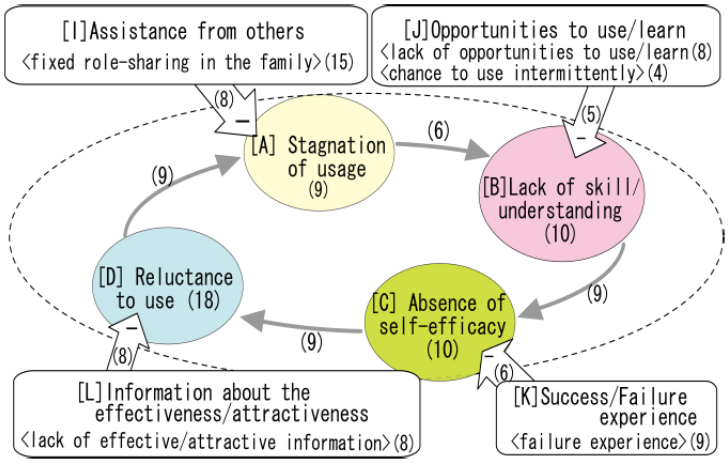

FIGURE 1. Model of non-active users

5.1.1. *[A] Stagnation of usage and [I] Assistance from others.* Factor "[A] Stagnation of usage" indicates that the non-active user restricted him/herself to a very limited range of tasks. ⟨Fixed role-sharing in the family⟩ is the subcategory of "[I] Assistance from others", which reinforce the negative effect on [A]. For the non-active users, resolving troubles or trying new operations are the job of other members of the family (⟨fixed role-sharing in the family⟩), and even when others give support, the non-active users fail to take advantage of the help. An example found in the transcript is shown below.

F01: Use it for... Oh, I can't only use for very very basic things. Shopping.. I suppose, just once or twice a week. Mmn.. Let's see... Ah, like searching gift bags with Web.. looking at sights like that.

Interviewer: Oh, you're doing net-surfing?

F01: Oh, yeah, right. Only doing net-surfing.

Interviewer: How about putting your pictures from your digital cameras into your computer?

F01: My husband does it, putting them in my computer..I mean, I make him do it.

M01: You make me do it... She just looks at the pictures shown on the display. You don't even know how to do it, do you?

F01: Hmm.. I guess it's kind of enough to have one person in a family who can take care of it.

M01: Hands-off stance!

Relying on others may not be any problem in the workplace as the user can often turn to in-house professional technical staff or expert coworkers. At home, however, experts and professionals are not readily available, as the live-in expert might be absent, and customer support lines psychological costs that can discourage people from using them [16].

5.1.2. *[B] Lack of skill/understanding and [J] Opportunities to use/learn.* Not trying to do new things by oneself leads to "[B] Lack of skill/understanding" of how to use functions, applications, and the existence of them. "[J] Opportunities to use/learn" have negative effect on the "[B] Lack of skill/understanding"; they have few and intermittent chances to use/learn computers (⟨lack of opportunities to use/learn⟩, ⟨chance to use intermittently⟩).

"[J] ⟨Lack of opportunities to use/learn⟩" is mainly because of their lifestyle; they are too busy with other works at home and have no time to spend on the computer, as is shown by the following example.

F01: I have too many things to do, I don't have time to go there (the place where the computer is settled). I do want to use it, but my husband occupies it all the time, so I can't.

Interviewer: Don't you use it when your husband is away?

F01: No, I'm not at home in the daytime, because I work outside. I don't see it and I don't go there unless I have specific need. I'm not there everyday, only once or twice a week.

From her statement, it would appear that the computer was located in a very far place. However, the computer is in the room next to the living room, just few steps from the dining table. This example implies that unless the computer is located with the user's immediate area of movement, the user may feel that it is too far away, which leads to less opportunity to use it. Computer use in the home, especially the use of the Internet, tends to be for hedonistic purposes [28] rather than work; thus, computer location and access rights, which might seem to be relatively minor factors, greatly influence the opportunities for computer use in the home.

Even if the opportunities exist, they only tend to have chances to use them intermittently ([J] ⟨chance to use intermittently⟩). It is hard to acquire sufficient understanding or structured knowledge with this usage pattern.

5.1.3. *[C] Absence of self-efficacy and [K] Success/Failure experience.* "[B] Lack of skill/ understanding" reinforces "[C] Absence of self-efficacy". Self-efficacy refers to one's perceived performance capabilities for a specific activity as defined by Bandura [1]. "[C] Absence of self-efficacy", in our definition, includes also the fear of breaking something, or a negative estimation of the costs incurred to fix the troubles encountered, as shown in the example below.

F04: Oh, I don't like it (the computer). I'm not good at it. (snip) It's the same (for other devices). When something goes wrong, I say Oh, No!!..It's over! (snip) It's kind of my character to break things. (snip) I don't know why, but I always break something, and then, can't fix it. But, computers are too expensive to break. It's far more expensive than other things.

As the transcript shows, "[K] ⟨failure experience⟩" is another reason for the "[C] Absence of self-efficacy".

5.1.4. *[D] Reluctance to use and [L] Information about the effectiveness/attractiveness.* "[C] Absence of self-efficacy" then reduces the user's interest in computers, which is described as "[D] Reluctance to use". When the non-active users have a strong negative feeling that they cannot use computers by themselves ([C]), they tend to state that they are not interested in using them ([D]) as the following description shows.

Interviewer: Do you wish to improve your computer skill?

F04: Ahh.. I'm afraid not. It might be better if I had, but I don't, at all. Yes. I don't have any motivations like, "I wanna do more", or "I'm gonna do something". Well, it's just a collection of information for me.

"[L] ⟨Lack of effective/attractive information⟩" is another factor underlying "[D] Reluctance to use" computers. The above interviewee F04, for example, didn't have any friends who were active in computers, and thus, couldn't get attractive information from them, which strengthened computer alienation.

"[D] Reluctance to use" again negatively impacts the "[A] Stagnation in usage". When the user enters this negative loop, it is hard to escape, because of these chained factors.

5.2. **Active users.** Figure 2 shows the psychological model of the active user. Factors [E], [F], [G] and [H] represent the positive loop of the active user; they are the inverse of

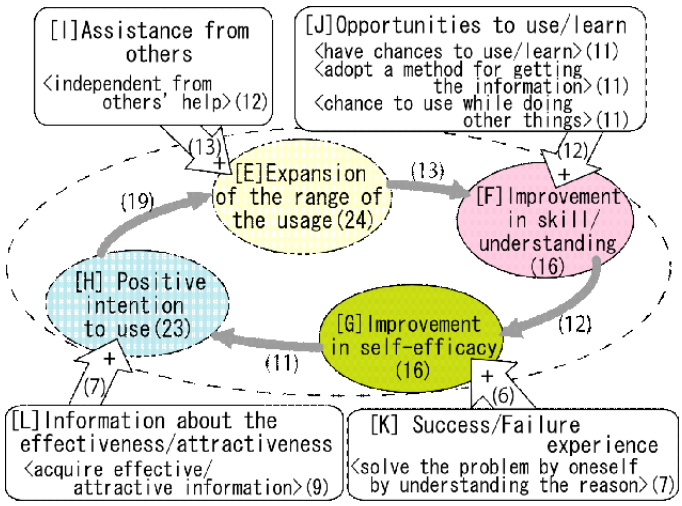

FIGURE 2. Model of active users

the negative factors mentioned above. External factors ([I] to [L]) are the same factors as shown in Figure 1 although the sub-categories differ, but here they reinforce the positive psychological factors.

5.2.1. *[E] Expansion of the range of usage and [I] Assistance from others.* The active users had a broad scope ([E]) which was to try to tackle the problems by themselves when faced with something new. Trial-and-error allowed users to expand the range of usage.

M05: When I wish to use something or some new functions, I try to find out how to do it by myself without any hesitation. Unless doing it, my skill does not expand. And then, few years later, the person who had more question have more skill, in any case, such as TVs or the computers.

Further, active users did not excessively rely on others, but rather the "[I] Assistance from others" tended to broaden their range of usage patterns. In detail, active users scarcely relied on others ([I] ⟨independent from others' help⟩). In this way, active users expand their usage by taking advantage of "[I] Assistance from others" resulting in a positive reinforcement.

5.2.2. *[F] Improvement in skill/understanding and [J] Opportunities to use/learn.* Through many trial-and-error experiences with new services or functions ([E]), they acquired new knowledge and improved skill ([F]). Not only did they have many more opportunities to use/learn computers ([J] ⟨have chances to use/learn⟩) but they also tended to adopt learning approaches that suited them ([J] ⟨adopt a method for getting the information⟩) as is shown below.

M05: (The way to get information about how to use new systems are) Mainly from newspapers, you know. In newspapers, they say like "it's gonna be like this", and so we can get those information. (snip) First, I notice those information from them (newspaper), and then, search for further information on the Web. I always follow that sequence.

Active users knew how to make use of the information around them, which led to improving their skill/understanding ([J]). Another factor that comprises " [J]", is the ⟨chance to use while doing other things⟩. The episodes included in the sub-category are "starting to use computers on the way to the bath-room" (F08), or operating computers while listening to the television (M05, F09).

5.2.3. *[G] Improvement in self-efficacy and [K] Success/Failure experience.* Consequently, they gradually improved their self-efficacy ([G]). "[K] ⟨Solve the problem by oneself by understanding the reason" also improves self-efficacy ([G]). The transcript below represents an example of the user who gained self-efficacy after a successful experience.

F07: I've always asked my husband to make greeting cards every year. But once, he was busy for work, and he didn't do it for a while. (snip) He told me like "Well, do it yourself". And so I somehow I did.. well, the sequence was written in the manual, but I thought that I couldn't do it, but, when I tried, I managed to do it against my expectations. So, from that time, I do it myself every year.

As the description shows, understanding the reason for the trouble is as important after the problem is solved, as it is before the problem is solved.

5.2.4. *[H] Positive intention to use computers and [L] Information about effectiveness/attractiveness.* Any improvement in self-efficacy ([G]) strengthened their intention to use computers ([H]). "[L] ⟨acquire effective/attractive information⟩" also enhanced their intention to use computers. The transcript below is from a user who gained a more positive intention to use computers after going to a computer lesson.

F05: Well, I became interested in the more effective usage, some function.. I wanna master functions.

Interviewer: The functions you use at your work?

F05: Oh, yes. That's right.

Interviewer: Does it mean you want to use it more effectively?

F05: Yeah, not only that I wanna use it effectively, but actually, I'm also feeling that I want to study a bit more. (snip) I'd like to increase my abilities.

She noticed the usefulness of learning new things (spreadsheet, in this case) after going to a computer lesson.

In this way, active users gain skill and motivation while traversing the positive loop.

5.3. **Integrated model.** We now explain the integrated model, see Figure 3. The model was constructed by connecting the loop of the non-active user (Figure 1) to that of the active user (Figure 2) with the cylinders. Non-active users and active users are not discrete entities; thus, the degree of activity is represented by the vertical axis of the cylinder. Each external factor consists of subcategories that have either positive or negative effects as described in Figure 1 and Figure 2.

In some cases, there are distinct differences in their lifestyle or the environment depending on their activity level, and thus, the external factors themselves differ. However, even if they were presented with the similar situation, the impact of the external factors differs depending on the activity level because their perception and utilization of the external factors differ; the lower the level is, the more the negative effect is reinforced while the positive effect is weakened.

In the case of "[K] Success/Failure experience", for example, even though they faced a problem that they could not solve by themselves, active users tend to state that the problem was "successfully" solved by asking others (e.g., call-center). Non-active users, on the other hand, tend to perceive that they "failed" to solve the problem because they had to ask others, which created the strong impression that they could not do it by themselves ("[C] Absence of self-efficacy").

The situation is the same for the other external factors, where the non-active users did not pay attention to them even if they could receive them; non-active users tend to pass on such chances. In this way, the external factors negatively impacted the non-active users, but positively impacted the active users. Therefore, providing assistance ([I]), opportunities ([J]), experience ([K]), and information ([L]) to non-active/active users in

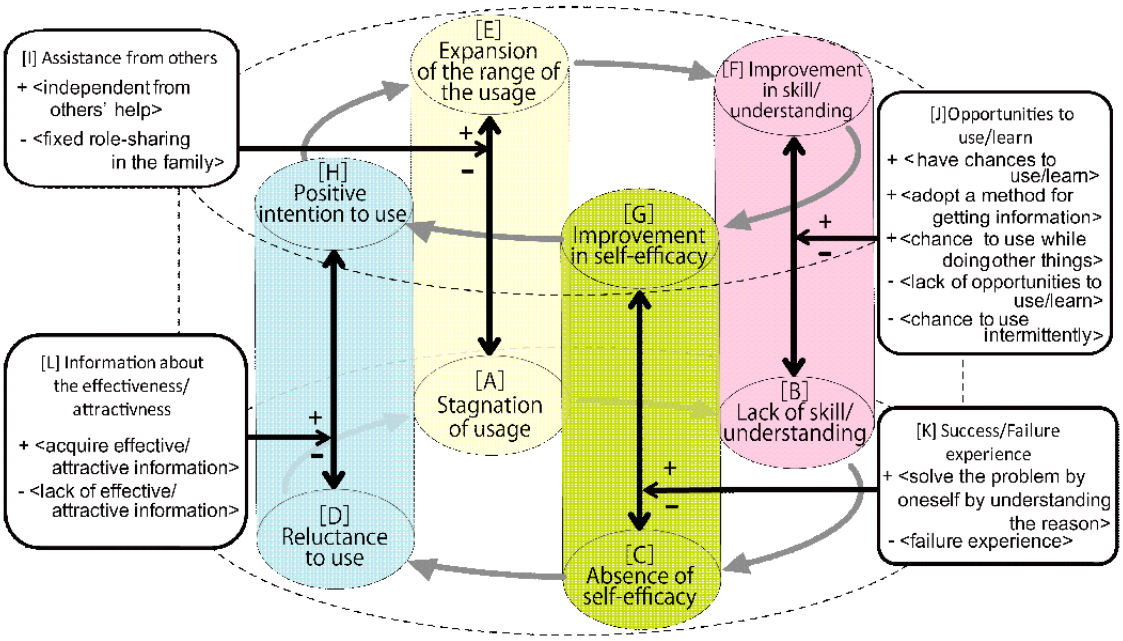

FIGURE 3. The integrated model based on psychology of active/non-active computer users

a similar manner can worsen the situation for the non-active users. Therefore, the crucial factor to activate computer usage is to carefully design the external factors so as to better suit the activity level.

6. **Design Implications.** We found that non-active users failed to actively use Internet because of the negative loop and the 4 external factors. The active users, on the other hand, are in the positive loop and the external factors further strengthen the loop. The external factors have different effects depending on the activity level, and significant insights can be derived from the conclusion that how to design each external factor is the key to allowing the non-active user to escape from the negative loop. That is, the design should move the psychological factors from the bottom of the cylinder to the top. Further, it is essential to take into consideration the chained psychological factors (negative loop) when designing the external factors. Our resulting guidelines are described below.

6.1. **Moving from "[A] Stagnation in usage" to "[E] Expansion in range of usage".** To escape from the stagnation of usage ([A]), assistance ([I]) must be carefully structured to expand the scope of usage. More precisely, people who have chances to assist non-active users such as operators in the call-centers and family members should enhance the use of the functions/applications that the non-active user has not used before. When they are asked by a non-active user to solve some trouble with the Internet, it is more effective to not only fix the problem but also give additional advice about how to avoid the problem. "[A] stagnation in usage" is also heavily impacted by "[D] reluctance to use", so non-active users tend not to ask for help by themselves. Thus, it is very important that the assistance ([I]) take "[D]" into consideration; the people assisting them should not just wait for the non-active users to ask for help but should be forward in giving advice.

Normal technical call-centers, for example, only answer calls about technical problems, but by considering the guideline, calling the user is one solution.

6.2. **Moving from "[B] Lack of skill/understanding" to "[F] Improvement in skill/understanding".** To escape from the "[B] Lack of skill/understanding", the design of the "[J] Opportunities to use/learn" is the key. The opportunities may be PC classes, manuals, or any other user touch points that should give generic information to improve skill and understanding. Considering the users' lifestyle, they have limited time to learn new skills, the location of the devices and the manuals should carefully be designed to provide easy access by the users. However, providing "[J] Opportunities to use/learn" as much as possible is not enough, because a user who is stuck in "[A] Stagnation in usage" will not give any attention to those opportunities and will make no use of them. Thus, it is crucial to ease the user's burden by providing the opportunities that could be recognized as relevant to their interests. If we provide information that suits the user's interest, preferences, or lifestyle and that does not diverge greatly from the user's present scope of usage, it would be well received by the non-active users. Reading manuals is a great opportunity for improving skill/understanding; however, most non-active users tend not to read them. Thus, the designer of the manual should take special care on the front page; putting simple pictures that show the target users and the things that can be done with the manual may encourage the users who have poor usage rates.

6.3. **Moving from "[C] Absence of self-efficacy" to "[G] Improvement in self-efficacy".** Improvement in self-efficacy", successful experience ([K]) plays a key role and when designing the experience, it is essential to consider that non-active users lack knowledge/skill ([B]). One simple solution is providing a series of easy-to-accomplish tasks that match the user's skill to reinforce self-efficacy. For example, when teaching how to copy and paste on the computer in PC lessons, selecting "edit" menu from the menu-bar may be easier than using shortcuts for the people who lack skill. For the user-support section, it may be better to provide real-time support to avoid failures as it is easier to avoid failure with assistance than by trying by oneself. Further, it is important that the designers of user-interfaces or manuals conduct repeated user-tests in ensure failure avoidance as much as possible. Another solution is to carefully design instructions so that they do not discourage users even if they fail (e.g., warning messages should not explicitly use the term "error"). Showing the required knowledge and skill in advance may make them better at accepting the failure, and prevent them from losing even more confidence afterwards.

6.4. **Moving from "[D] Reluctance to use" to "[H] Positive intention to use".** To escape from "[D] Reluctance to use computers", an appropriate way of providing information on effectiveness/attractiveness is the key. We note that the solution is to break the negative pressure of "[C] Absence of self-efficacy". The information should emphasize that anyone can use the attractive new service because it is so simple. The non-active user will perceive that her/his capabilities may actually be sufficient to use the service, which weakens [C]. More precisely, when designing the advertisements and user-interfaces, the designer should use only user-friendly words and illustrations, and should eliminate all technical terms. Designing non-threatening packages may also encourage the non-active users to open the box. Users who have low self-efficacy tend to give up seeking the service/functions that attract them because there are too many services/functions that look difficult to use. Therefore, not only providing attractive services with simple looking interfaces, but also recommending such services/functions is important to escape from the negative loop. Recommendation can be done by family members, call-center support, or any other users' touch points.

7. **Case Study.** We show an example of a design solution derived from our model, for the purpose of validating the effectiveness of our model. The "concierge support" was carefully designed considering the 4 key factors in our model, and tested in the field study described below.

7.1. **Concierge support derived from the model.**

7.1.1. *"Usage Suggestion Support" to provide "[L] Information on effectiveness/attractiveness".* We designed "Usage Suggestion Support", a paper-leaflet that showed a use-case (over 15 possible usages) that matched the user's needs, by providing "[L] information on effectiveness/attractiveness". Each use-case was drawn as a picture of old woman/man using the service to satisfy their interest, showing that even old people can easily use the service; this should break the negative loop by eliminating "[C] Lack of self-efficacy". The interested shown was selected to match the users' interest as elucidated from the interviews.

7.1.2. *"Taking Order Support" to provide "[I] Assistance from others".* Non-active users including those "[D] reluctance to use" the service cannot effectively use the "[I] Assistance from others"; they will not often call support-centers even when they have a problem. We therefore designed "Taking Order Support", which the call-center operator uses when calling the users to ask whether they have any problem. By asking and giving advices to users, the assistance is expected to eliminate the negative factor of "[D] reluctance to use" and expand the use ([E]) of the service.

7.1.3. *"Skill Improvement Support" to provide "[J] Opportunities to use/learn".* The back sides of the paper-leaflets were designed to realize improving the users' knowledge/skill ([F]) by providing the "[J] Opportunities to use/learn", which we call "Skill Improvement Support". So that the opportunities will not be neglected by the users who had limited scope of usage ([A]), the information given to the user must be recognized as relevant to their daily life. We therefore provided detail procedural information of the use-case on the front side of the paper-leaflets. The point here is that the opportunity for improving their skill/knowledge is designed to suit the user's interest.

7.1.4. *"Successful Experience Support" to provide "[K] Successful experience".* Non-active users often experience a failure because they tend to "[B] Lack skill/understanding". We therefore designed "Successful Experience Support" in that the operator asked users to operate the remote controller and assist them to experience new functions, which is intended to "[G] Improve self-efficacy". It should be easier to avoid the [K] ⟨Failure Experience⟩ with the assistance of the call than by trying by oneself.

7.2. **Method.** 7-week field study was conducted to validate the effectiveness of our purposed support. We selected different devices and participants from the first study detailed in the previous chapter, for the purpose of verifying the flexibility of our model. An Internet system, "Net-Kun", was provided to the participants, and we observed how the support impacted their usage. Net-Kun can be used as a communication tool and a personal tool. As a communication tool, the image of the computer screen at the remote location can be sent to the TV screen through the Internet and can be printed out. Mothers or fathers, for example, can show their children's pictures or web-sites to their grand-parents who are living apart. As a personal tool, the users can enjoy Internet (web-browsing) on the TV screen through the use of a remote controller.

We recruited users with the lowest level of computer literacy. Via a web-monitoring site, women whose ages ranged from 30-40 and who lived with more than one child under 13 were asked to recruit their parents to participate in the trial. Participants (F16 $\sim$

F25) were selected on the condition that they had no prior experience with computers and lived apart from their children-family. Their age ranged from 57 to 75. The reason why we recruited the participants via their children was to find the participants who were computer illiterate. The reason why we asked the women who had children was because "Net-Kun" is a service that can be used as a communication tool between the parents and their grand children. During the trial, participants were free to use Net-Kun. The concierge support (concierge-call and the support leaflet) was provided 3 times. To elucidate the effect of the timing of support provision, we provided support at different times.

They were asked to keep a diary every day, and to record when they used Net-Kun. We visited the participants' house before and after the trial and conducted semi-structured interviews. In the first visit, participants were asked to enter "attitude score" on a 7 point scale for 26 questions. These questions were developed on the 4 key factors of our model and were intended to confirm that the participants were non-active users. Phone interviews were also held after 4 weeks passed. All the interviews and the voices during the concierge-call were recorded and transcribed.

7.3. **Result.** Concierge support was provided through leaflets and call-center support following the 4 external factors of our model. The impact of each was analyzed.

7.3.1. *Initial attitude and the number of usages.* Participants used the services 11.4 times on average ranging from 4 to 49. All initial attitude scores were lower than "3", which means that they were all negative about using the service at first. The numbers of service usages, especially the personal usage of Net-Kun, varied widely. There was no significant relationship between the initial attitude scores and the number of service usages. This implies that experience gained during the trial impacted the number of the usages, not the initial attitude.

7.3.2. *Reactions to the support leaflets.* Reactions to the support leaflets were positive when the timing of sending was suitable and the contents touched on the user's interest. Few users did not utilize the leaflet, and the common reason was that the timing of sending was not suitable (F16, 21, 24). For example, F21 mentioned that the leaflet was useless because she had already experienced what was written in the leaflet. Another reason was that the content did not touch on their interest in the first place (F23, 25). For example, F25 who received a leaflet with a recipe stated that it was useless, because she does not look at the cook books she already has.

The users who reacted positively to the leaflets (F17-19, 22, 24) seemed to find the service attractive which means that the factor "[L] Information about the effectiveness/attractiveness" yielded a positive effect. The following transcription shows that the user broke the negative chain at the negative factor, "[C] Lack of self efficacy", because of the picture shown in the leaflets.

F18: I felt relieved with it (the leaflet), of course, when I see this beautiful picture. (snip) It's because that there was a picture of grand-pa and grand-ma. I thought that "Oh! Even an old-aged person can do it". (snip) I saw the picture and thought 'Ahh.., pictures like this would appear'. Oh yes, it was easy to understand.

Net-kun, the Internet service, has too many usages for novices, so prior to receiving the leaflet many participants had a hard time finding contents that attracted them and perceived the service to be useless and ineffective. The leaflet, therefore, played the role of informing them of the existence of interesting services. The participants who perceived the leaflet positively also showed improvements in their skill ([F]) after looking at the back side of the leaflet to discover Skill Improvement Support. An example is shown below.

F19: I saw this, this.. 'Search the TV program' (on the leaflet), and recognized that if I push this, this will come up. I understood this through this paper.

The front and back side of the leaflet, the Usage Suggestion Support and Skill Improvement Support, had a synergistic effect; their motivation of using improved ([H]) looking at the front side which led to expanding the scope of the usage ([E]), and the back side provided knowledge of how they could actually do it ([K]).

7.3.3. *Reactions to concierge-support-calls.* Reactions to the support-call were mostly positive (F16-20, 22, 24) except for the cases where the users were not available (F23, 25) or the initial activeness was extremely low (F21). Even though the participants could call by themselves (the number of the call-center had been given to the participants), most participants asked the operator questions about troubles when the external call was conducted. An example of the first utterance of the participant during a support-call is shown below.

F17: Oh, it's great to have a call. I've already sent my diary. I can't understand the content (of the service)... I'm low-tech person. (snip) When I tried to do it myself, I couldn't do it at all.

Many participants stated that the call led to an expansion in the use of the service ([E]), which is the goal of Taking Order Support. For example, F22 stated that she did not know how to delete letters written inside the search-window, but after hearing how to do it from the operator, she started to search many words and expand her usage. She stated as follows.

F22: I appreciated it (the call), you know. I don't take time to call myself, so if you give me a call, then, I can ask about the troubles I'm facing.

During the call, Successful Experience Support played the role of improving users' self-efficacy. One participant, for example, noted that until she experienced the outside support, she did not feel that she had improved her skill; even when she solved the trouble by herself, she failed to recognize that she had acquired general knowledge.

In this way, the concierge support calls proved to be positive in "[E] Expansion of the range of usage" and "[G] Improvement in the self-efficacy". The support calls also enabled us to understand what service would realize their desire (this information was reflected in the subsequent leaflet).

8. **Discussions.** Our main finding is that the positive/negative factors are connected to each other as loops, which highlighted the fact that a holistic approach is needed. Although some of the previous studies have found similar factors that can be positioned in our model, none of them have presented them within a comprehensive framework.

Previous studies which conducted home visit interviews have focused on a particular aspect of computer usage and thus their results are limited to that point. For example, the study that focused on "how the technology is shared within the families" [24], found the prevalence of shared technology in domestic environments. In our study, the corresponding factor of "[I] Assistance from others" provides further design implications that point out the importance of taking "[D] Reluctance to use" into consideration. Previous studies that focused on the location of the technology devices [6,13,15] pointed out the importance of designing adequate spaces, while in our model, the factor can be placed under "[J] Opportunities to use/learn" which yields similar design implications. Further, our study identified that the opportunities should be designed so that they recognized as relevant to the user's present scope of usage.

Our study is aligned with MATH and TAM [28,29]; the causation factors of "perceived ease of use" and "perceived usefulness" strengthen the "Intention to Use". In our

model, those are included in the circular loop ([C]→[D], [G]→[H]) and the external factors ([L]→[D], [H]). Our model explains why the loop is hard to escape from because the "effect" becomes, in turn, the "cause".

Our model is based on a broad range of data collection covering not only Internet usage, but also about personal interests, hobbies, and lifestyle. This was done by not having defined any preconceived hypothesis. Other studies that did not define any hypothesis in advance tended to conduct quantitative data collection such as Beauvisage [3]. Compared with those studies, our qualitative data collection, not limited to the visible behavior information, enabled us to understand the users' inner experience and the external factors that affect them.

The model is schematic and we make no claim that connections not expressed in our model do not exist. Our intention is not to identify the "complete mechanisms" of the complicated human psychology, but to understand them in a practical manner that will lead to greater assistance to non-active users. The implication derived from our model was proved to be effective in the case study; the leaflet and the concierge support call had the effect of strengthening their intention to use, expanding their usage, and improving their skills/knowledge and self-efficacy.

Note that the two support modes (the leaflet and the call) interacted synergistically. The expansion of the usage with the support-call led to improved skills, and the leaflet further enhanced the improvements in their skill and led to improvements in the self-efficacy and so on.

All of the external factors affect the psychological loop, and thus are crucial. One of the participants, for example, dramatically changed her attitude during the trial; her motivation decreased because of a repeated failure experience and wrote in the diary that she do not want to use the service in the first half of the trial, but after receiving the leaflet and the support-call the day after, she started to use the service every day and told us that she decided to purchase a computer after the trial. As shown in this example, although non-active users may say initially they are not interested in the Internet, we have shown that providing appropriate support can break the negative loop and make them change their attitude in a positive manner.

9. **Conclusions.** We have developed an integrated model of computer usage and showed its effectiveness. Our model, which is based on empirical data, covers the key factors and leads to a deep understanding of Internet users' psychology and their surrounding physical/social environment. To activate non-active users, solutions based on the external factors that help overcome the negative loop are effective. Our model allows practical design solutions to be developed in an all-encompassing manner, rather than an ad-hoc manner. This has elucidated significant design implications that can be applied to all customer touch points such as advertisements, packaging and manuals, and human support from the call-center.

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