

# **Design Guidelines for User-Friendly Washing Machines for Young Single People Based on the Goal-Directed Design Process**

**Nameui Lee**

Department of Product Design  
Hongik University  
Chungcheongnam-do, Korea

**Sung Yeon Kim**

Department of Product Design  
Hongik University  
Chungcheongnam-do, Korea

**Frank Biocca**

S.I. Newhouse School of Public Communication  
Syracuse University, New York, USA

Copyright © 2014 Nameui Lee et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## **Abstract**

With recent increases in single-person households, single households with 20–30 year old members have been identified as prominent consumers. While small-sized domestic appliances have been released to meet their requirements, they ordinarily only provide usability provision on a smaller scale. Further, one of these consumers' major anxieties—laundry or cleaning tasks—has been excluded from these changes. This study attempts to identify the needs of users and to improve laundry experiences by designing user-friendly washing machines differentiated from existing small-sized domestic appliances. The goal of this study is to present design guidelines for single household washing machines, based on a goal-directed design process.

**Keywords:** Small-sized Appliances, Washing Machine, User-friendly, Single-person Household, Goal Directed Design Process

## 1 Introduction

The number of single households is increasing worldwide. There were an estimated 202.6million in 2006, and general lifestyle surveys report that the proportion of single-person households has doubled, especially single households aged 25–44, which increased five-fold from 1973 to 2011 [1], [2]. In Japan, for example, the number of one-person households in reached 16.1 million in 2011, which accounts for 31.5% of all Japanese households. The trend of single households is highly correlated to cultural and living standards [3]. Further, one out of four South Korean households is a single household, and the annual spending of single households nationally reached almost 5 trillion dollars in 2011, and has been continuously increasing since then. Single household members represent the largest portion of the population, those aged 20–30, also spend the most out of all single households and are receiving attention as a new influential consumer group [4].

Based on these trends, products targeted specifically to young single household members are on the rise. Young single-person households tend to present a huge market for household goods such as electric rice cookers, refrigerators, washing machines, vacuums, etc. [5], [6]. Although many single household domestic appliances are being introduced to the market, many single household members in their 20-30s consider doing house chores, such as cleaning and doing laundry, as one of the most burdensome daily life problems [7]. The everyday problems of laundry or cleaning faced by these households continue to persist in spite of these diverse small domestic appliances. It is because domestic appliances for single households simply focus on storage efficiency and usability through miniaturization, rather than on in-depth understanding of users. This research investigates the use of single household appliances, especially washing machines, to understand user experiences based on the user's psychological conditions, the washing machine usage conditions etc.

In fact, users sometimes showed low adoption rates, although domestic appliances with improved functions have been produced that have considered user experience. For instance, Ki-Hyuck Park, who is the director of pxd UX Lab, found in a survey that washing machine users expressed the desire to indicate, on the machine's display, the amount of detergent they intended to use in the washing cycle. With this idea in mind, the following laundry process was designed: 1) sort clothing by type, 2) put in laundry, 3) push operating buttons, 4) indicate the detergent amount, and 5) put in laundry detergent. This was designed to replace the existing laundry process: 1) sort clothing by type, 2) put in laundry, 3) put in laundry detergent, and 4) push operating buttons.

However, this project failed because users rarely employed the function in reality, although they had stated they wanted that function the most. Researchers found that users generally left after pushing the operation buttons without waiting

to indicate the detergent amount. Users were accustomed to leaving after pushing the machine's operation buttons, and so did not change their habits despite the small amount of time required to indicate the detergent amount [8]. Several researchers and philosophers have discussed machine learning : when performing a new task, users use knowledge drawn from previous experiences or previously learned tasks. While these are unsettled issues[9], this study's finding shows behaviors correlated with users' familiarity with washing machine use as well as existing washing machine operation platforms. In other words, washing machines present a passive platform in which users receive information provided to them from the platform, rather than having to take initiative. An active platform might force users to engage with the platform, such as playing a game, while a passive platform allows users to simply receive information, such as watching TV [10]. Washing machine as a passive platform can be assumed to be a factor, considering as one of the most burdensome daily life problems. These investigations are carried out in order to extract factors that may transform a mundane chore, like doing laundry, into a more meaningful experience.

The purpose of this paper is to improve the overall user experience, focused on user-centered design through an in-depth understanding of users through surveys, investigations, in-depth interviews, and personas. This study is based on Cooper's "goal-directed design" methodology as a user-centered method, by conducting user research and using persona [11].

## **2 Psychological Characteristics of Single Household Members, Age 20-30s**

### **2.1 Life Condition of Single Household Members, Age 20-30s**

**General Characteristics.** According to the survey conducted by the Korea Institute for Health and Social Affairs in 2012, 67.4% of single household populations in their 20-30s lived alone because of work or school, and 22.1% of them lived alone to have a freewheeling lifestyle. The satisfaction level for a solitary life was higher when the person voluntarily chose to live alone for a free lifestyle. It was also higher when the person had many people who he or she could depend on even when living alone.

63.8% of single household members responded that they had difficulty living alone. 35.7% said dealing with daily routines like house chores, etc. is challenging. 21.9% said they experienced psychological instability and loneliness; and 20.6% said they found living alone difficult because they did not have anyone to take care of them when they are sick [12].

**Emotional Issues.**In 2012, the Korea Institute for Health and Social Affairs conducted in-depth interviews on single household members in their 30s ( $n=12$ ; female=5, male=7). The participants mentioned emotional issues, such as loneliness, as a challenge of living alone. They considered being able to live a free life as the benefit of having a single household, but not feeling like they had anyone to depend on was challenging. Three of these participants were struggling

with insomnia, depression, and sociophobia; some of them were taking medicine or had visited professional counselors [12].

## 2.2 Psychological Characteristics of Single Households, Age 20-30s and the Design Trend

The most challenging issue of single household members in their 20-30s was related to practical issues, such as finances. Yet the underlying problem was their solitariness. Their daily life problems caused loneliness and sometimes such emotion intensified their daily life issues. Therefore, such internal issues should be taken into account when designing single household appliances in order to find out what this unique group of consumers values and appreciates.

## 3 User Analysis

### 3.1 Research Plan and Progress

To obtain effective results, it is important to integrate multiple methods, especially when seeking an in-depth understanding of users' needs and expectations. The study used surveys, investigations, and in-depth interviews as the basis for personas. First, a survey about general use of washing machines was conducted on 50 single household participants (female= 26, male = 24, mean age = 26.2 years,  $SD = 3.88$ ) in their 20-30s. Second, the goals of 4 users (female=2, male=2, mean age= 24.75 years,  $SD= 1.71$ ) were investigated based on their washing machine use. Third, in-depth interviews were conducted on the 4 users to extract their personal goals.

### 3.2 Research Results and Analysis

**Survey Results.** Regarding the frequency of washing machine use, 62% of users said they do laundry 1-2 times a week. This was because they did not have enough laundry loads or time to do laundry. Further, 24% of the users responded that they keep their laundry in the machine itself. 35% were male while 19% were female. They kept laundry in the machine because it was convenient, or they did not have a laundry basket, etc. Lastly, 44% of the users responded that they had difficulty knowing when the laundry cycle was completed.

**User Investigation Results.** Three user types are extracted through Card Sorting based on the investigation of washing machine use, as listed in Table 1.

**Table 1.** Three user types of user goals for washing machine use

User Type (Goal)	Level	Usage of Washing Machine
The user who would like to keep all clothes fresh and new.	Expert	Too many steps for doing laundry, too complicated, take too long.
The user who would like to keep all clothes clean.	Inter-mediate	Some additional steps on top of the basics, but mainly uses consistent steps.
The user who would not want to waste too much time and effort on doing laundry	Novice	Rarely uses functions other than the basics, prefers simple steps.

Additionally, a Washing machine is usually installed in a secluded and dark area, and users had difficulty using the machine due to such confined space. It was difficult to leave room for a laundry basket in a small studio; laundry detergent containers also got in the way, as shown in Figure 1.

**Result of In-Depth Interviews.** One-on-one interviews were adopted to gather feedback on individual experiences. All interviewees who participated in the investigation of washing machine use responded that using the Washing machine was convenient because the machine did everything that they needed when they pressed the button. However, they stated that the process of taking the laundry out and air-drying laundry was very inconvenient. This meant that when the machine stopped running, users have to manually take care of the rest of the steps, as listed in Table 2.



Fig. 1. Washing machine usage environment

Table 2. Laundry process

Washing process	Preparation →	Washing → Rinsing → Spin-drying	Complete →	Dry
Agent	Person	Washing machine		Person
Act	Putting in laundry, detergent, and operating buttons		Taking out laundry	Taking laundry to drying rack and hanging it
Category	Washing machine operation		Beginning of new labor	

Some respondents also stated that they could not hear the alerts and simply forgot that they were in the middle of doing laundry. This was because while the machine was running, users naturally prioritized other tasks (reading, playing games, studying, etc.), and could not hear the machine alerts or simply postponed taking the laundry out of the machine.

In terms of the psychological context, most interviewees were exhausted by the excessive amount of work or study, and they felt lonely that they have to deal with all the house chores by themselves. Most of them sought solace in music or books, and when this was interrupted, they felt extra stressed or lonely.

**Result Analysis.** The result showed that ‘the users who do not want to spend much time and effort on doing laundry’ and ‘the users who want to do laundry very well’ were considered to be the most represented users of washing machines. In this study, doing laundry was not just about using the machine but the entire laundry process, including the steps from preparation to drying. The study specifically focused on the problems that occurred during the steps after the machine stopped running. Although each user’s goal for experience was different, “finding comfort in a solitary life” was set as the key phrase. A detailed persona was created based on the users’ goals and experiences of using washing machines.

## 4 Persona

### 4.1 Creating Persona

The first place persona of Min-ho Song (Table 3), and the second place persona of Min-young Kim (Table 4) were selected based on the investigation. The details are shown below.

**Table 3.** Summary of Min-ho Song's (first place persona) personal information

	Name	Min-ho Song
	Age	30
		“o·ti·um cum dig·ni·ta·te” (living free from worldly cares)
Occupation	Third year Office Worker of the Marketing Team in SGroup	
What does doing laundry mean to Min-ho?	Doing laundry is tiresome thing that I have to do to live.	
Min-ho's hobby	I listen to music, read, watch movies to escape from the real life problems and concerns.	
How often do you use the Washing machine?	1-2 times per week	
Min-ho's goal for experience	I would like to do whatever I want when I am home by myself.	
Min-ho's goal for use	I would like to minimize the time and effort while using the Washing machine.	

**Table 4.** Summary of Min-young Kim's (second place persona) personal information

	Name	Min-young Kim
	Age	26
		“Become a woman that others respect and envy”
Occupation	Second Year Editorial Designer of NPublishing Company	
What does doing laundry mean to Min-young?	Courtesy for my clothes that maintain my dignity	
Min-young's hobby	Interested in things that increases one's existence and value such as cooking and shopping.	
How often do you use the Washing machine?	2-3 times per week	
Min-young's goal for experience	Would not like to have laundry or other house chores interfere with her free time.	
Min-young's goal for use	Would like to make laundry simple and easy.	

## 5 Design Guideline

On the basis of the results, we have established guidelines to resolve potential and existing problems with regard to user needs. The guidelines identified four main categories that needed improvement, as described below.

**Emotional Factor.** Comfort users by converting a dark and dull laundry

area into a sentimental area. Further, even after the machine stops running it should be able to help the user finish the rest of the steps.

**Structural Factor.** 1) Support limited spaces available for the machine, lighter laundry loads. 2) Reduce the chances of bending one's back by making the machine taller. 3) When keeping the laundry in the machine, laundry can smell bad due to lack of ventilation. It is helpful to design a machine that can function as a laundry basket as well. 4) After the machine stops running, users often drop clothing on the floor while taking them out of the machine, and it is inconvenient to move everything from the machine to the drying rack. The machine should have a container that can be detached so the users can take out the clothing all at once using the detachable container.

**UI Factor.** Users only use certain buttons and methods. There are too many buttons or functions that are unnecessary. Come up with an intuitive and simple UI, and add HOT KEY functions for ease-of-use. Further, the anticipated ending time is not clear since the machine only displays the remaining time. It is helpful to display both the remaining time and ending time.

**Other Factors.** By providing a different feedback from the existing ones, it becomes reliable and intuitive, especially when the alert for the completion is neglected or cannot be heard at times.

## **6 Conclusions and Further Research**

This research is significant in that it enhances the users' general laundry experiences through the human laundry machine design, which is distinguishable from existing small domestic appliances. The necessary items could be extracted from the goal-directed design methodologies. For the future subject of study, the arrangement, flow, and function should be researched based on the residence situations for a more interactive Washing machine design.

## **References**

- [1] An Overview of 40 Years of Data (General Lifestyle Survey Overview - A Report on the 2011 General Lifestyle Survey), Chapter 3. Increase in the Proportion of People Living Alone, Office for National Statistics, [http://www.ons.gov.uk/ons/dcp171776\\_302655.pdf](http://www.ons.gov.uk/ons/dcp171776_302655.pdf)
- [2] A. Hodgson, One Person Households: Opportunities for Consumer Goods Companies. Euromonitor International from National Statistics (2007).
- [3] Single-Person Households on the Rise in Japan. Euromonitor International from National Statistics, <http://blog.euromonitor.com/2012/03/single-person-households-on-the-rise-in-japan.html> (2012).

- [4] S.-H.Ahn, Top 4 Consumer Trends of the Emerging Single Households SERI BusinessNote, No.159, 1.Samsung Economics Research Institute (2012).
- [5] Small Things Are In: Reasonable Revolt of Miniature Home Appliance Stocks. Money Today. (in Korean)  
<http://m.mt.co.kr/new/view.html?no=2013072411112329994>
- [6] Special Report: The Family Structure of the Future. Euromonitor International from National Statistics, <http://blog.euromonitor.com/2013/07/special-report-the-family-structure-of-the-future.html>
- [7] What is the Toughest Thing About Living in a Single Household? (in Korean) Edaily, <http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=102&oid=018&aid=0002745186>
- [8] K.-H Park, Behavioral Economics & UX: Inducing User Behavior Change (in Korean).In:HCI Korea 2013 (2013).
- [9] A.A.Toptsis, Reflective thinking, machine learning, and user authentication via artificial K-lines.International Journal of Advanced Science and Technology 5 (2009), 51–73
- [10] J.Kim, *Introduction to Human-Computer Interaction; Principle and Methods*, AnGeurapikseu, Korea, 2012.
- [11] A.Cooper, *The Inmates Are Running the Asylum: Why High-Tech Products Drive Us Crazy and How to Restore the Sanity*, Sams, Indianapolis, 1999.
- [12] G-H.Jung, S-H.Nam, E-J.Jung, J-H.Lee, Y-K.Lee, J-S.Kim, et al., Policy Implications of Changes in Family Structure: Focused on the Increase of Single Person Households in Korea (in Korean).Research Paper, Korea Institute for Health and Social Affairs (2012).

**Received: August 6, 2014**