

A Sense of Dichotomy in Household Space and Smartphone



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Abstract In this paper, we apply dichotomous aspects discussed in architectural theories to electronic devices and explore the relationship. In order to investigate the similarities and the differences between how people's attitudes change for the sense of individuality-communality and private-public in a household environment and in a product environment as the level of depth increases, we designed an experiment with a scenario that guides subjects to explore through a household space virtually displayed on a large display as well as a smartphone space on an actual phone. At the end of every task, we asked the subjects to complete a semantic differential survey designed using the terms used in architecture that relate to both social and spatial dichotomies. From this experiment, we can suggest that the use of analogy between the two environments is appropriate especially as the depth of navigation increases such as going into a bedroom or accessing a picture folder and that social and spatial dichotomies examined in architectural and geological research fields do exist in a smartphone environment in a way it makes sense such as front and back. Lastly, we realized that while the household environment provided static feeling overall, the smartphone environment provided dynamic feeling.

Keywords Household space · Smartphone · Dichotomy · Private · Public Individuality · Communality

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1 Introduction

In a household space, there are two dimensions: social and spatial. In the social dimension, a dichotomy of individuality and communality are present. Individual and communal space types are important factors to be considered in the field of geology and architecture design because they represent the binary opposition during the design of social spaces. In other words, should the designer make the space individual or communal is a question to be answered to proceed in the design process. This opposition divides spaces into those that are difficult to be accessed by others as an area only for me (individual spaces) and those that are easily accessed as an area for others (communal spaces). Similarly, in the spatial dimension, a dichotomy of private and public are present. The concepts of private and public spaces are similar to the individual and communal spaces but the difference is that they indicate spatial relations such as inside and outside or front and back. The sense of private and public spaces is also important factors to consider during the design process of spaces as they influence the design elements that make up the spaces. Although the boundary between the pairs are ill-defined and sometimes overlap and interact rather than being in a binary opposition [1], previous researches indicate that the dichotomy is present in our lives continuously affecting our attitudes toward household spaces and our behaviours inside. Furthermore, the social and spatial meanings of individuality-communality and private-public are observed to be different for different cultures. For instance, in far eastern cultures, private space is considered a safe and intimate space while public space is considered a dangerous and strange space [2]. When children need a time-out, parents tell their children to go outside instead of telling their children to go inside to their rooms as the parents of western cultures would do. As such, the environment that surrounds us, especially the household space in this paper, is composed of feelings of inside and outside and private and public constantly affecting our attitude toward space and social meaning of space.

In this paper, we explore the same dichotomous aspects in electronic devices and systems. During the design process of devices, metaphors from our living space are often adopted. For example, the Windows operating system uses the term, ‘window’ which is a component in our environment that represents an element that provides a view from one space to another. Another example is a home button on our smartphones where ‘home’ in our living space represents the reference point of our travel or a safe place, while ‘home’ in the smartphone device represents the reference point for navigation. While the metaphors are often used during electronic device designs, there is a lack of research attention toward how these metaphors alter in meaning when transferred to electronic devices and influence user-product interaction.

In order to investigate the similarities and the differences between how people’s attitudes change for the sense of individuality-communality and private-public in a household environment and in a product environment as the level of depth increases, we designed an experiment with a scenario that guides subjects to explore through a household space virtually displayed on a large display as well as a smartphone space on the actual phone. At the end of every task, we asked the subjects to complete a

semantic differential survey designed using the terms used in architecture that relate to both social and spatial dichotomies. From the experiment, we were able to see patterns in the sense of individuality-communality and private-public while navigating deeper into a virtual household environment, as well as the patterns in the sense of the two dichotomies while navigating deeper into a smartphone environment. By comparing and contrasting the patterns observed in two environments we were able to see a relationship between the two. By investigating the presence of the dichotomy—individuality-communality and private-public—as well as the meaning of dichotomous similarity and difference between the household environment and a smartphone environment, this paper initiates the exploration of user-product interaction in a metaphorical sense.

2 Literature Review

Dichotomies of Home Environment. An architect, Amos Rapoport points out that “people shape and give a meaning to their own environment which endures times, is passed on to other cultures, and has permanence with regard to variations in environment, context or situation” [3]. In this sense, the relationship between home and the occupants is complex and multi-dimensional where there is a dynamic interaction between the occupant and space. In Turgut and Çahantimur (2002)’s research [4], in an attempt to further investigate the dimensions and interaction, the concepts of dialectics home are explained and constructed based on previous studies. In their approach, they divide the home into two different aspects: social and spatial. In the social aspect, the dichotomous concepts are *individuality* and *communality*; in this sense, privacy constitutes a dialectic boundary that defines whether a person is accessible to some people and inaccessible to others depending on the relationship with them. In the spatial aspect, the dichotomous concepts are *private* and *public* in the context of home and near home environment. The dichotomies in social and spatial dimensions are summarized in Table 1.

Semantic Polarization. In addition to the research work in [4], Seo (2012) explores the semantic polarization of inside and outside even further suggesting that the concepts of inside and outside are “embedded at the unconscious level affecting the social attitudes” [5]. By analysing Korean traditional house structures, Seo (2012) extends the semantic polarization of inside and outside by integrating the hidden dimension of level distinction in which inside is elevated and outside is not elevated. From this level distinction, there are changes in human behaviours as well as attitudes. For instance, elevated spaces are places where people sit and have less movement while non-elevated spaces are places where people are mobile continuously moving around; elevated spaces are places where people take shoes off and keep the place clean while non-elevated spaces are where people wear shoes and are dirty. In response to these behavioural polarizations, attitudes toward spaces change where elevated spaces are ‘sacred’ while non-elevated spaces are ‘profane’. The semantic polarization of inside and outside is illustrated in Fig. 1 taken from [5]. This research

Table 1 Dichotomies in social and spatial dimensions (Taken from [4])

Social dimension		Spatial dimension	
Individuality	Communality	Private	Public
Individual	Society	Inside	Outside
Identity	Communality	Familiar	Strange
Inaccessibility	Accessibility	Secure	Dangerous
Unavailability	Availability	Order	Chaos
Self	Other	Rest	Movement
Host	Guest	Up	Down
Invisibility	Visibility	Night	Day
Male	Female	Front	Back
		Clean	Dirty

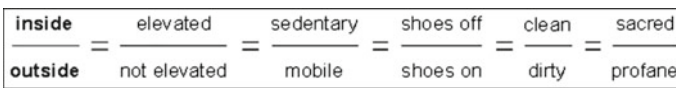


Fig. 1 Semantic polarization of inside and outside (Taken from [5])

indicates that within a household space, a dichotomy is present through structural difference influencing occupants’ behaviours and attitudes.

Sense of Dichotomy in Product Designs. In the field of product designs, only a few researches have explored the concept of public and private. One research by Richins (1994) explored the sense of possession value by examining the public and private meanings of the goods the subjects possess [6]. Richins (1994) conducted three studies where the goal of the first study was to identify the private meanings of possessions valued by consumers, the goal of the second study was to assess shared public meanings in the possessions, and the goal of the third study was to explore the differences and similarities between public and private meanings. According to the research, the public and private meanings of possessions are related and for the goods that have limited interaction with the possessor develop little private meaning leaving only the public meaning. In addition, even though the respondents were of similar backgrounds, the sense of public and private meanings toward possessions differed for individuals indicating that the emergence of public and private meanings depend highly on personal experiences and the values that people possess. Meanwhile, this research opens up the discussion for the sense of private and public in possessed goods, it is at the level of individual goods suggesting further investigation regarding the public meanings of goods. In our paper, we investigate the sense of private and public not at the level of individual goods but at the level of each task a user interacts with one product—a smartphone. In this way, how and at what point public meanings emerge can be revealed.

Table 2 The 1–7 scale for semantic differential

	1	2	3	4	5	6	7	
<i>Individuality</i>	O	O	O	O	O	O	O	<i>Communality</i>
Inaccessible	O	O	O	O	O	O	O	Accessible
Unavailable	O	O	O	O	O	O	O	Available
Self	O	O	O	O	O	O	O	Other
Invisible	O	O	O	O	O	O	O	Visible
<i>Private</i>	O	O	O	O	O	O	O	<i>Public</i>
Inside	O	O	O	O	O	O	O	Outside
Familiar	O	O	O	O	O	O	O	Strange
Front	O	O	O	O	O	O	O	Back
Static	O	O	O	O	O	O	O	Dynamic

3 Methodology

Construction of Semantic Differential Scale. In order to investigate the pattern for the dichotomy in the social and spatial dimensions, a semantic differential rating scale is used. Semantic differential scales are often used to measure attitude toward an object, experience, and concept. For the construction of semantic differential scale, we use the terminologies mentioned in the literature review that reflect the social and spatial dichotomies: individuality-communality and private-public. After listing the words, we filtered out the pairs that are not applicable for smartphone environment and made a set of eight pairs for the efficiency of the survey. In the social dimension, we chose inaccessible-accessible, unavailable-available, self-other, and invisible-visible semantic pairs. In the spatial dimension, we chose inside-outside, familiar-strange, front-back, and static-dynamic semantic pairs. The semantic differential scale used in the survey is illustrated in Table 2 where the linear scale from 1 to 7 is used to differentiate the paired terms. The survey sheet shown in Table 2 was presented to the subjects after each task that they were asked to complete.

Scenario Design. In order to keep the subjects within the context of a household space during the survey stage of smartphone space, we designed a scenario to keep the subjects within the same context. The ultimate goal for the subjects is to go into your friend’s house where you have never entered before (See Fig. 2) and find your friend’s smartphone to find a passport photo your friend saved in his phone (See Fig. 3). The scenario asks the sense of individuality-communality and private-public at appropriate points to investigate how the senses shift from one space to another in a household environment and a smartphone environment.

In detail, the first part of the scenario asks the subjects to first virtually explore a house by going through the six tasks shown in Table 3. These six tasks guide the subjects to explore deeper into the house from a space with the highest connectivity (a living room) toward the space with the lowest connectivity (a computer room). After the completion of each task, the subjects are to mark their feeling while accomplishing the task on a 1–7 semantic differential scale. The second part of the scenario asks

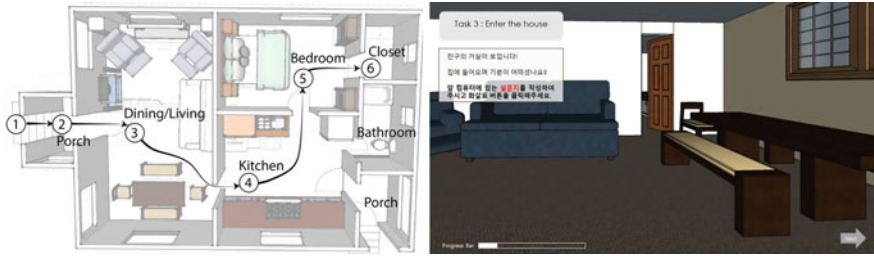


Fig. 2 Scenario design for household environment. Left: the household environment the subjects explored through. Right: one of the scenes from the scenario

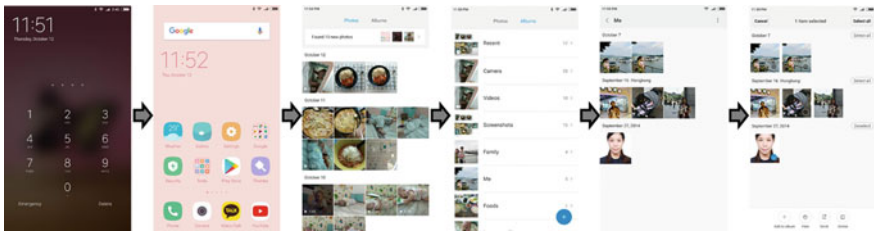


Fig. 3 Screenshots of the scenario design for smartphone environment

Table 3 Corresponding tasks in two environments

Tasks	Household environment	Smartphone environment
1	Approach the front door	Turn the phone on
2	Open the door using the passcode	Enter code to unlock
3	Enter the house (a living room)	Flip through the pages
4	Enter another space (a kitchen)	Find a gallery button for pictures
5	Enter a room (a bedroom)	Find a folder
6	Enter another room (a computer room)	Find a passport photo

the subjects to explore a phone they have never used before to find a passport photo by following the six tasks also shown in Table 3. Similar to the experiment setting for navigating through the household space, these six tasks guide the subjects to navigate deeper into the smartphone in correspondence to each of the tasks given in the household environment. A total of twelve tasks are summarized below.

Survey Setting. To keep the scale of spaces different as we are comparing the household space and the smartphone space, we use a large display environment for the first part of the scenario where the user has to explore through a household space. Meanwhile, for the second part of the scenario, we use an actual smartphone to guide the subjects through the tasks (See Fig. 4). We recruited ten subjects for this preliminary research each with two sets of six tasks in the order of household space to smartphone space. For the surveys and follow-up interview, the subjects spent 15–20 min.



Fig. 4 Experiment Setting. Left: large display for navigating the household environment. Right: actual smartphone placed under the display for subjects to find and navigate

4 Results and Discussion

From the survey results, we were able to interpret two aspects from the household environment and the smartphone environment: the fluctuation between the dichotic set of words as the tasks were carried out and the points of lowest and the highest values that represent a relatively strong sense of a particular word either on the individuality/private end or the communality/public. In addition, we were able to infer similarities and differences between the two environments.

Patterns in Household Environment. In the household environment, there were three notable fluctuations as the tasks were carried out. First, as indicated in cyan in Fig. 5, ‘self-other’ dichotomy stayed consistent throughout the tasks within a range of 4.6–4.9. This indicates that the survey subjects felt more ‘other’ than ‘self’ in a household environment. A possible reason for this is because the house that the subjects virtually navigated through was someone else’s. Second, ‘inside-outside’ dichotomy decreased in the average value as the tasks were carried out (indicated by a grey line in Fig. 5). In other words, the subjects felt more ‘inside’ as they approached the bedroom. However, it was interesting that the subjects felt relatively more ‘outside’ (1.50) when going into another space from a bedroom. Third, ‘front-back’ dichotomy fluctuation (indicated by a solid red) observed from our experiment reflected the sense of “backyard” used in our daily lives because the subjects felt more ‘back’ as they navigated deeper into the house.

Furthermore, the lowest value was observed in the inside-outside dichotomy during the task of entering a bedroom with a value of 1.40 indicating that the subjects felt a strong sense of inside when entering a bedroom. The highest value was observed also in the inside-outside dichotomy during the task of approaching a house with a value of 5.40 meaning that the subjects felt a strong sense of outside. We can come down to a conclusion that the sense of inside and outside has a large effect on people’s minds when dealing with a household environment where people physically enter and exit.

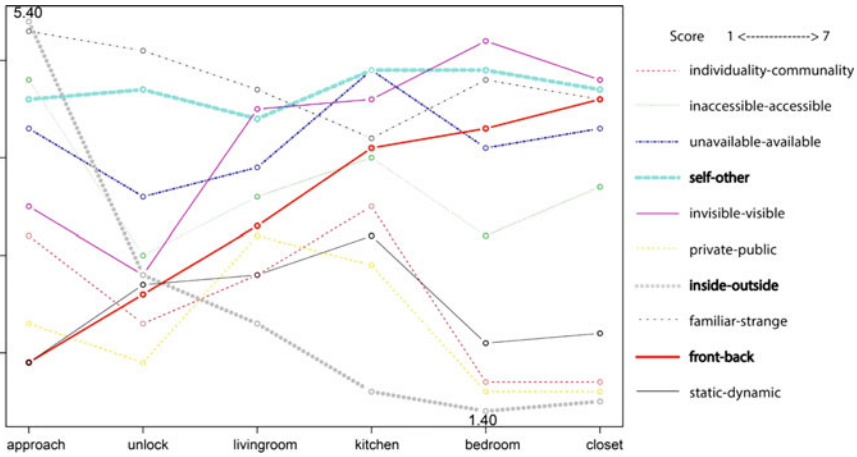


Fig. 5 Dichotic fluctuations in the household environment

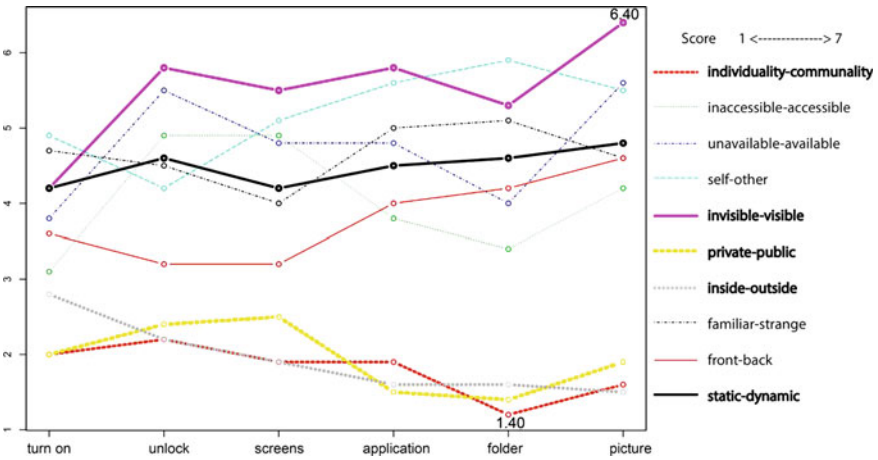


Fig. 6 Dichotic fluctuations in the smartphone environment

Patterns in Smartphone Environment. In the smartphone environment, there were two notable fluctuations as the tasks were carried out. First, as indicated in magenta in Fig. 6, ‘invisible-visible’ dichotomy showed a large fluctuation throughout the tasks generally changing from invisible to visible. A possible reason for this may be due to the increase in the amount of information displayed in the phone which leads the subjects to feel more visible than invisible. Second, as indicated in black solid line, ‘static-dynamic’ dichotomy stayed relatively consistent throughout staying in the dynamic end of the scale.

The lowest value during navigating smartphone was observed in the individuality-communality dichotomy during the task of opening a folder in a camera application

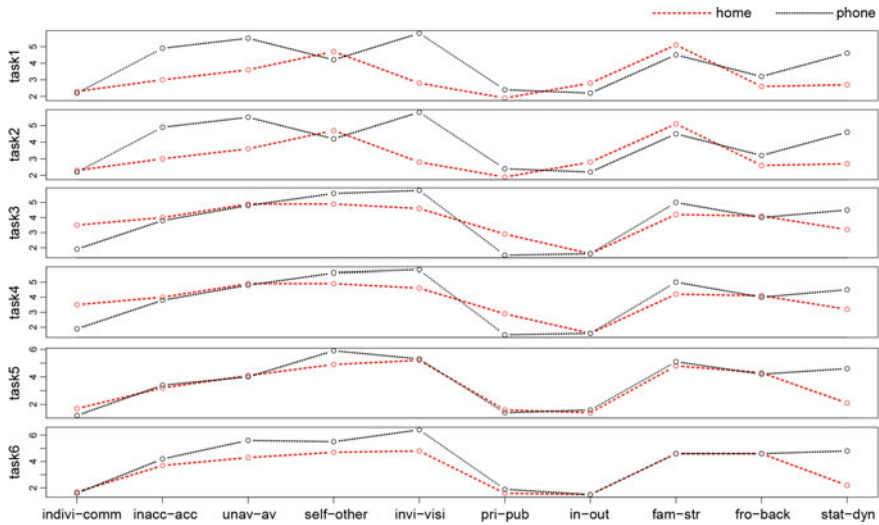


Fig. 7 Dichotic differences for each task

with a value of 1.40 indicating that the subjects felt a strong sense of individuality when opening a folder in a camera application. The highest value was observed in the invisible-visible dichotomy during the task of finding a picture with a value of 6.40 meaning that the subjects felt a strong sense of visibility when finally finding the picture in the scenario.

Comparing the Patterns. Unlike the patterns observed in the household environment, there is another interesting pattern in the smartphone environment: the three dichotomies in Fig. 6—‘private-public’ (yellow), ‘individuality-communality’ (dotted red), and ‘inside-outside’ (grey)—stayed at the low end of the scale throughout the tasks. This indicates that a smartphone environment is different from a household environment in that overall when navigating within a smartphone environment, people feel and stay feeling ‘private’, ‘individualistic’, and ‘inside’ compared to when navigating in a household where people feel greater fluctuation on average between the individualistic/private end and the communality/public end.

While the average range of fluctuation is observed to be greater in a household environment, when observing the differences between the dichotomies felt in a household environment and the smartphone environment, there are a couple of tasks that show similar sense. As shown in Fig. 7, task 5 shows little difference especially. The task 5 is composed of entering a bedroom in a household environment and clicking a pictures folder in a gallery application. For most of the dichotomies, the values were similar except for the ‘static-dynamic’ dichotomy which might indicate that there is another factor causing the subjects to feel more dynamic in the smartphone environment.

5 Conclusion

In this research, we observed patterns in the sense of social and spatial dichotomy in a household environment and a smartphone environment by first constructing a semantic differential scale through literature reviews, second designing a scenario with six tasks in both household environment and a smartphone environment, and third surveying ten subjects. From our experiments, we found out that the sense of inside-outside is strongly visible in a household environment compared to other dichotomies. The strongest sense of individuality/private was observed when entering a bedroom (inside), and the strongest sense of communality/public was observed when approaching the house (outside). Another interesting result to point out is that in a smartphone environment, the fluctuation between invisible-visible was large meaning that the concept difference between the two is clear. Moreover, we observed that the act of navigating through a smartphone gives a feeling of more dynamic than static. The strongest sense of individuality/private was observed during the task of accessing a folder (individuality), and the strongest sense of communality/public was observed during the task of finding a photo (visible). From the experiment, we noticed that in a smartphone environment, people felt more private, individual, and inside in comparison to a household environment. Finally, from the results, the pairing of two environments with highest analogy relevance is the entering of a bedroom and accessing a folder in the photos.

From these findings we found that the use of analogy between the two environments is appropriate especially as the depth of navigation increases such as going into a bedroom or accessing a picture folder. Also, the social and spatial aspects dichotomies examined in architectural and geological research fields do exist in a smartphone environment in a way it makes sense such as front and back. For example, while the level of 'back' increased throughout the tasks in a household environment, a similar trend was observed throughout the task in a smartphone environment. Lastly, we realized that while the household environment provided static feeling overall, the smartphone environment provided dynamic feeling.

During our experiment, we had several limitations in the experiment setting. One was that the subjects were guided through the household environment virtually on a screen rather than moving in the actual space. If the subjects were guided through an actual space, there may have been a different result. Another limitation was that the subjects were led through a household environment first, then a smartphone environment which does not take order effect into consideration. Lastly, as a preliminary research to explore how the results will appear, we only surveyed ten subjects which is a very minimal number not enough for us to analyse the data in detail using statistical measures. Nevertheless, we were led to interesting questions from our experiment. For instance, what makes people feel dynamic during the usage of smartphones and what makes people feel static while occupying a space? In addition, we were led to think whether if we can design the smartphone user interface or experience to be more static using the elements observed in a household environment. If so, is a static user experience in smartphone environment necessarily better than a dynamic user

experience? For our future work, we plan to investigate the dichotomies of static and dynamic further.

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