My Own-Style Interaction: Exploring Individuals' Preferences to Interactivity

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Abstract
There have been studies about users' preferences on different physical styles of interactive products, but the exploration of interactivity preferences and the value of customizing its expressions have not been emphasized much yet. In this paper, we conducted a three-phase user study in order to investigate individual preferences to different qualities of interactivity and its relationship with individual differences. The results showed that people have diverse preferences for several attributes of interactivity, similar to the case for appearances of products, and there are close relationships between individual differences such as human personality traits. Based on these results, we discussed their implications for designing attractive interaction.

Keywords
Aesthetics of interaction, design preference, interaction design

ACM Classification Keywords
H.5.2 User Interfaces, Interaction styles.

General Terms
Design

Introduction
In the design of products, various styles of physical attributes such as forms and colors have been popularly

studied in order to investigate how products can be more attractive to the users. However, in the design of interactive products, preferences to certain styles of interactivity that can be experienced only while using an interactive product—i.e. *interactivity preference*—and the customization of its interactivity have not been much explored yet.

In the precedent study of this research [4], a set of *interactivity attributes* which was proposed to concretely describe various shapes of the invisible quality of interactivity, namely, *Continuity, Concurrency, Movement speed, Movement range, Response speed, Expectedness and Proximity.* It was discovered that dichotomized values of all these attributes are significantly perceivable, and they give different emotional feelings—e.g. for movement speed, participants felt heavier, softer and more sympathetic feelings when they manipulated the slow movement speed prototype, while they felt lighter, harder and less sympathetic feelings in the case of the prototype for the fast movement speed. This result motivated us to explore the ways of designing more attractive and preferable interactions by using these interactivity attributes that provide diverse emotional experiences depending on their values.

In this paper, we aimed to explore how one's aesthetic preference to interactivity attributes can be determined and what is the relationship between individual difference and their interactivity preference. To investigate this, we conducted a series of user studies based on the following research questions:

1. Do people actually have preference over a certain invisible quality of interactivity as they have aesthetic preferences over certain visible qualities of a product such as forms and colors? And if there is a preference over certain interactivity qualities, what values of interactivity people prefer?
2. Is there any relationship between individual difference and interactivity preference?

The first question was to explore the nature of interactivity preference, and the second question was for exploring practical knowledge of understanding user profiles that might give design opportunities in the design of interactive products or systems.

Related Works

There have been few attempts to explore preferences to interaction with a view of aesthetic experiences, while many have discussed about effective and attractive appearance of interfaces such as GUI for websites [2]. Regarding the dynamic quality of interaction, Morris, et al. investigated user preferences to gestures for surface interface [5, 6]. However, this research only focused on the preferences to input gestures which do not cover the whole cycle of an input and an output. Our research here aims to investigate the preference to interactivity that covers this whole cycle of interaction, which is what the interactivity attributes are used to describe.

In addition, we could find insightful results from their works that motivate this research. For example, user-defined gestures were highly rated compared to designer-defined gestures in terms of easy performance and good-match with commands [5]. This enhances the value of our research that respects user-driven interaction styles.

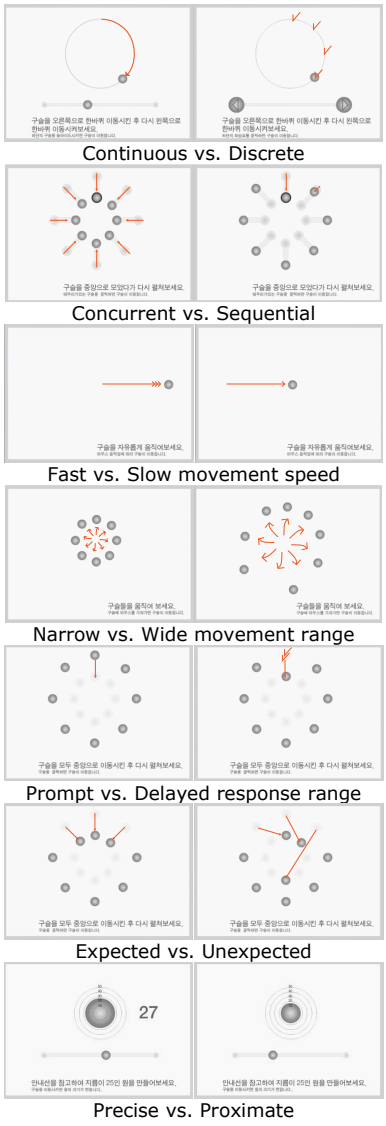

Figure 1. Seven Flash prototypes for the study 1

User studies

Study 1

Before exploring people's interactivity preferences, we first had to figure out *whether the interactivity attributes can be the subject of preference* as we stated in the first research question. To investigate this, we devised an online questionnaire with Flash prototypes representing a value of interactivity attributes. For each interactivity attribute, we had a pair of prototypes, representing its two dichotomized values (Figure 1). Each participant manipulated all the seven pairs of interactivity attributes in a random order. For each pair, we asked two questions: 1) Check whether you have specifically preferred one between two prototypes or not, 2) write the reason for choosing/not choosing the preferred one, if you have any. The questions were designed to get both quantitative and qualitative answers from participants.

STUDY 1 RESULTS

85 people (51 male) who are in their late 10s or 20s were participated in the study (M=20.65, SD=2.35). The result showed that over 87% of participants had a specific preference to one of the dichotomized values in all interactivity attributes except Response speed (Figure 2). Also, they expressed their preferences to the specific value given through the Flash prototypes: "I have a preferred one: the wider one, because I like its dynamic interaction."

Although the portion of people who don't have specific preference was larger in Response speed compared to other interactivity attributes, still over 63% of people expressed his/her own preference to it. From the answers of the open-ended question, it was discovered that the larger portion of people who don't have preference was because of small value difference between two opposite values of response speed we designed for the prototypes: prompt response and delayed response. All the participants who answered the open-ended question wrote that they couldn't convince whether they have preference or not because it was hard to distinguish one from another. If the value difference become large enough to clearly perceive its difference, then the ratio of having preference over having no preference can be similar with other interactivity attributes.

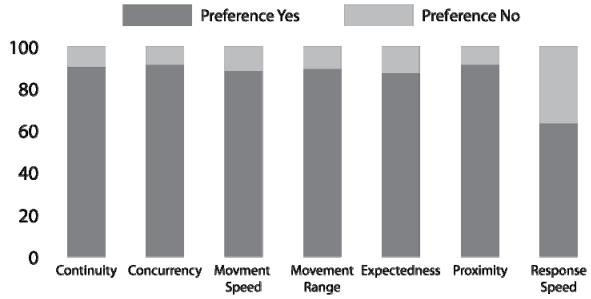

Figure 2. Portion of having preference vs. having no preference for each of seven interactivity attributes.

Study 2

In the study 2, we aimed to investigate *what values of interactivity people prefer*. Although it was discovered that all the interactivity attributes could be the subjects of preference from the study 1, we selected only five interactivity attributes which have continuous values, because they are more proper to be investigated in detail throughout the whole range of their values. The selected 5 attributes are *Movement speed*, *Movement range*, *Concurrency*, *Continuity* and *Response speed*.

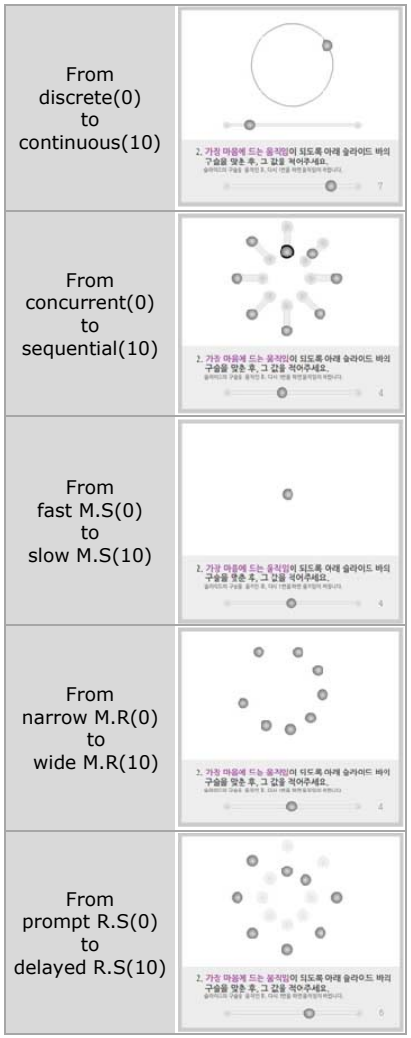

Figure 3. Five Flash prototypes for the study 2

The study 2 was also conducted through an online questionnaire with Flash prototypes. In this case, five prototypes were devised for each five interactivity attributes selected from the study 1 (Figure 3). Each prototype has a slider that enables participants to experience and adjust eleven-level values (from 0 to 10) of each interactivity attribute. The range of each interactivity attribute was defined in a way that provides full experience of its maximum and minimum values.

Each participant manipulated all the five prototypes in a random order and asked two questions: 1) Find the most preferred value for each prototype, and 2) write the reasons for the preference to the value you selected, if you have any. This was to investigate *whether people have diverse preferences to interactivity rather than have consensual value that most people prefer*.

STUDY 2 RESULTS

78 people (50 male) who are in their late 10s, 20s or early 30s were participated (M=20.85, SD=2.79). It was discovered that three interactivity attributes, *Movement speed, Movement range and Concurrency, provoke diverse preferences from individuals*. The graphs in Figure 4 visualize eleven-level values of each interactivity attributes on the X axis and percentage of the people who selected a certain value as the most preferred one on the Y axis. As it shows, the ranges of individual preferences for each interactivity attribute are widely distributed from the value 0 to 10. Specifically, we got several peaks on the graphs for Movement speed, Movement range and Concurrency, which means that there is no consensual value that most people prefer.

On the other hand, *participants tend to have a consensually preferred value to Continuity and Response speed.* About 70% of participants preferred *the most continuous interactivity and the most prompt response speed*. We found out that the reason is that they have been accustomed to experience continuous interactivity and prompt response speed when interacting with digital devices, especially, the advanced ones. Therefore they tended to perceive and feel them positively, whereas they had negative feelings when they experienced discrete and delayed interaction: "I feel softer and more natural as the circle continuously moves, so it is obvious that I prefer the most continuous value.", "Prompt response is, of course, the most desirable one, because delayed response causes negative feelings for people who should wait for the feedback.", "It seems there might have some errors when the Flash doesn't react promptly."

We discovered that the eleven-level values we designed for each interactivity attribute can be reorganized based on the qualitative data we gathered from the study 2, because participants whose preferred values belong in a certain range of values had similar reasons for their preferences. In order to have clearer descriptions of the original eleven-level values, they were merged into several segments and relabeled by the main characteristics of each segment that induced participants' preferences. Each of three interactivity attributes had three-level segments as shown in Table 1: S1, S2, and S3 for movement speed; R1, R2 and R3 for movement range; C1, C2 and C3 for concurrency. The popularity for each interactivity attribute wasn't concentrated on a specific segment, as it was for the original values.

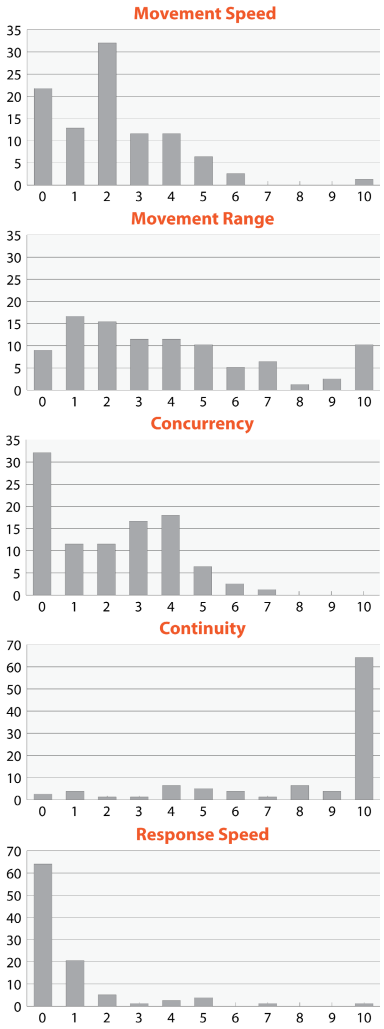

Figure 4. Percentage of people in each preferred value of interactivity attributes

	Original value	Description of value characteristics	New label	Popular-ity (%)
M.S	0 - 1	Very quick M.S	S1	34.62
	2 – 4	Quick enough & soft M.S	S2	55.13
	5 – 10	Slow & very soft M.S	S3	10.26
M.R	0 – 2	Narrow & stable M.R	R1	41.03
	3 – 6	Wider & a bit dynamic M.R	R2	38.46
	7 - 10	Wide-opened M.R	R3	20.51
C.C	0	Perfect concurrent	C1	32.05
	1 -2	Imperfect concurrent	C2	23.08
	3 – 10	Perfect sequential	C3	44.87

Table 1. Relabeled interactivity attributes values

When we select one segment from each of three interactivity attributes, 27 combinations can be possible such as S1+R1+C1, which can represent one's taste for an *interaction style*. Although our user studies were conducted with a small number of the participants that cannot cover the wide range of people characteristics, we discovered that at least one person belonged to one of 20 combinations among 27 possible ones. This implies people have unique and various patterns of preferences to even for the invisible quality of interaction. Recent digital devices are getting more homogeneous in physical forms, and the room for customization is more on the software and the interactive parts of the product. If we enable users to customize interactivity as they prefer, they would experience unique pleasures throughout the whole use of interactive products or systems.

Study 3

In order to investigate *how individual differences are related to one's preferences to interactivity*—i.e. the second research question—, we conducted a survey for the participants of the study 2. We asked several questions about individual characteristics. Individual differences can be defined by the several factors, but we start from exploring fundamental factors that have been discovered as influential factors for defining individual difference: genetics, experiences and personality [1].

For the genetics, we asked only gender and age since that are what the marketers of products can consider and control. For the experience factor, we asked one's previous experiences focusing on personal digital devices which are common and meaningful for interaction design. Years of experiences and average usage hours in a day were asked for each of three representative personal devices: mobile phone, computer/laptop and MP3 player. Also, numbers of personal digital devices that one frequently uses, experiences of the function for customizing interaction were asked. To measure participants' personality, we selected 20 adjectives for human traits from IPIP(International Personality Item Pool)[3] based on the Big Five Factors of human personality: *Extroversion (E), Openness (O), Agreeableness (A), Neuroticism (N)* and *Conscientiousness (C)*. Participants were asked to evaluate themselves based on the adjectives shown in Table 2 with Likert Scale. To elicit score for each of the five human personality factors, the values for the two opposite meaning adjectives in each factor (underlined in the Table 2) were recalculated and summed with values for the other two adjectives.

STUDY 3 RESULTS

Regarding the individual difference and interactivity preference, we found out that *only personality are related to the interactivity preference*, while gender,

Factor	Sub-characteristics
E	Talkative, Extroverted, Shy, Quiet
O	Creative, Imaginative, Unintellectual, Uncreative
A	Sympathetic, Warm, Cold, Unsympathetic
N	Relaxed, Unenvious, Mood, Jealous
C	Organized, Efficient, Sloppy, Disorganized

Table 2. 20 sub-characteristics for 5 personality factors

age and previous experiences of using digital devices had no significant relationship with one's preference to certain value of interactivity attributes. The result of correlation analysis for scores of the five personality factors and preferred value of each interactivity attribute discovered significant correlations between: 1) higher openness and preference for faster movement speed ($r=-0.280$, $p<0.01$), 2) higher agreeableness and preference for wider movement range ($r=0.198$, $p<0.05$), 3) higher neuroticism and preference for continuous interactivity ($r=0.188$, $p<0.05$).

These relationships are quite an interesting result that is beyond their literal meanings, because the relationship with interactivity preference was only discovered from several personality traits, *the innate personal characteristics*, instead of general demographic information or prior experiences which doesn't have close relation with one's unique characteristics. This emphasizes the importance of further research on interactivity preferences, so that researchers and practitioners could utilize this knowledge in designing interactive products and services in a way that supports individuals' tastes to even invisible aspect of interaction.

Conclusion and Future Works

In this paper, we found that people have diverse preferences to interactivity and the interactivity preferences are related to personal innate characteristics. The key implication of these results is that designers can strategically apply interactivity attributes and its relationship with characteristics of targeting users so that designed interactive artifacts can provide preferable and pleasurable experiences to them. Each individual user will experience differently even with the same product. We will further research on these effects to develop more concrete and practical guidelines for customizable interactivity design.

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