Chapter 10
Personal Cognitive Characteristics in Affordance Perception: Case Study in a Lobby

Y.S. Kim[1], J.Y. Jeong[2], M.K. Kim[3], S.W. Lee[4], and M. Kim[5]

Abstract User activities in performing tasks are influenced by the way the user perceives the related context and environment, and determined by the user making a judgment on their preferences. Structures in the physical environment afford user activities when they are properly perceived. This chapter addresses how user activities and perceived affordances are different and reflect personal creativity modes, which are determined by factual–intuitive perception inclination and subjective–objective decision preferences as well as the introverted–extroverted nature of the user. To enable the designing-in of various affordance features for diverse users in varying contexts, an understanding of the relationship between the personal characteristics of the user and affordance perception would be helpful. We conducted a case study in a public space used by many ordinary people. User activities and behaviors were analyzed in specific tasks given to 20 students in a building lobby they had never previously visited. The tasks were devised so that various affordance features would be relevant, while eliminating factors affecting the affordance perception (culture, intelligence, *etc.*) other than those due to the personal characteristics of the user. User activities can be classified into several

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different groups for each task based on the affordance features involved in their activities. These differences are then compared with their personal creativity modes. For users of less common activities for some tasks, relevant personal cognitive characteristics have been identified.

10.1 Introduction

User activities in performing tasks are influenced by the way the user perceives the related context and environment, and determined with their preferences in judgement. Structures in the physical environment afford user activities when they are properly perceived. In addition, user activities reflect their emotional situation. Even the way users perceive the surrounding environment will be affected by their cognitive and emotional states as well as their cultural and social backgrounds.

Affordance is a concept that is highly related to human perception, judgment, and action. Thus it is to be used in designing various artifacts such as products, architectural structures, and spaces, as well as services. Norman mentioned "unarticulated needs", which cannot easily be known with simple interviews, focus group interviews, surveys, or questionnaires [1]. In reality, these unarticulated needs can be dug out by monitoring and analyzing users' activities and contexts. Since affordance is also highly associated with the activities of users, it is necessary to substantially consider affordance and its links with human emotions and personality.

Norman mentioned that designers could communicate with end-users via the system images of products by describing the designer's conceptual model and the user's mental model [1, 2]. He regarded affordance, which was one of main system images of the products, as a tool to understand users and designers and to create a bridge between them. In addition, the affordance is highly related to features of artifacts that drive certain user activities. However, users usually perceive the affordance associated with the features in diverse ways, and they may not recognize the designer's original intents embedded in the features [3]. In other words, users could perceive affordances from features that the designers did not originally intend. Therefore, it is necessary to consider the personal or emotional characteristics of users when designing artifacts.

Recently, the relationship between users and designers has been an important issue in the field of design. To properly address this issue, it is necessary to understand the emotional characteristics of users. Emotion has a significant influence on human decisions and activities. However, human emotion is very complicated, and can be expressed very diversely according to one's experience, personal characteristics, and context. Research efforts to try to understand users have recently been very active in the field of design with studies into the context of artifacts. By taking the context into consideration, designers can gain empathy with users, avoid

the fixation on preset assumptions about the user or the product, and therefore create innovative concepts on how a product can be experienced [4].

There is also a similar research trend in the field of industry. Several methodologies to reflect users and context in the course of design have been devised and used, including usability analysis, scenario-based analysis, affordance-based design, context mapping, and so on.

At the Creative Design Institute, research into the interactions among users (consumers), designers, and products is being conducted so that various issues related to affordance are properly addressed in the design of products, spaces, and services [5, 6]. Figure 10.1 shows a diagram of the interactions among consumers, designers, and products representing the research philosophy of the Creative Design Institute. As can be seen in Figure 10.1, the cognitive and emotional aspects of consumers are very significant and should be properly addressed in the design of the products. The cognitive and emotional aspects of designers are seen as important factors for design processes and design creativity. In addition, the context – including social and cultural aspects – is very importance and its influences on consumers, designers, and products should be investigated. Consequently, if these aspects are properly managed then an enterprise can improve its competitiveness.

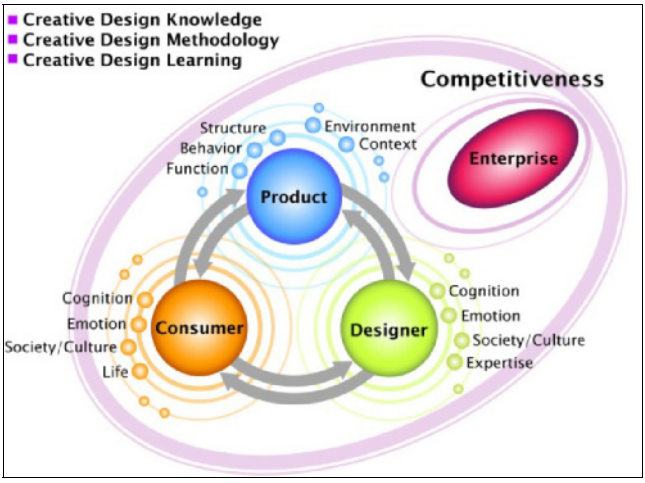


Figure 10.1 Interactions among consumers, designers, and products

This chapter addresses how user activities and perceived affordances are different and reflect personal creativity modes, which are determined by factual–intuitive perception inclination and subjective–objective decision preferences, as well as the introverted–extroverted nature of the user. We conducted a case study in a public space – a building lobby – used by many ordinary people. User activi-

ties and behaviors were analyzed in several specific tasks given to 20 students in the lobby of a building they had never previously visited. The tasks were devised so that various affordance features could be relevant, while eliminating factors affecting the affordance perception other than those due to the personal characteristics of the user. User activities can be classified into several different groups for each task based on the affordance features involved in their activities. These user activity differences are then compared with their personal creativity modes. For users of less common activities for some tasks, relevant personal cognitive characteristics have been identified.

10.2 Background

10.2.1 Affordance

Affordance was coined by perceptual psychologist James J. Gibson [7] as follows: "The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill.". It implies the interaction of the animal and the environment. Gibson's essential concept of affordance is that the relationship exists as a pair of animal and environment, and some parts of this relationship are the invariant features of the environment that permit the animal to do things. From an investigation of the affordances of everyday things such as doors, telephones, and so on, it was argued that the form of everyday things provides strong clues to their operation as a result of the mental interpretation of them, where the mental interpretation is based on people's past knowledge and experiences [8].

Instead of Gibson' affordance, Norman introduced *perceived affordance*, which is about characteristics in an object's appearance that give clues as to its proper operation. According to Norman, the Gibson's affordance is *real affordance*, which is about the physical characteristics of an object or interface that allow its operation [2]. Norman distinguished between two perspectives on products: design and emotion. He focused on two product factors – functionality and appearance (though there are a number of different constraints or considerations for designers and also users) – because these two are the most relevant for understanding the relationship between design and emotion. From the user's perspective, he focused on three kind of emotional response to products [1, 9]. Koutamanis mentioned that the affordances could be perceived by users differently from the designer's original intent [3]. As can be seen in Figure 10.2, the fence also provides the users with the affordance of sitting. This could be due to the different affordance perceptions of the users based on their different emotional characteristics.

Affordances are more than an addition to functional reasoning in building design [3]. And affordances for a conference room in space were proposed [5]. However, affordance has been recognized as a cognitive concept in the field of architectural design, and thus there has been very little research into developing

a systematic methodology for designing architectural space to reflect the concept of affordance.

In the field of engineering design, there have been considerable research efforts into developing a design theory and methodology to reflect the concept of affordance. Maier and Fadel proposed Affordance-Based Design (ABD) to overcome the weaknesses of Function-Based Design, thus taking the synergy between affordance and function-based approaches to create better design [10, 11]. They also introduced Affordance-Structure-Matrix (ASM) for evaluating and grading the affordances embedded in each component of a product. This matrix can illustrate correlations of affordances and also of components [12].

Figure 10.2 The sitting affordances of a bench and fence [3]

Galvao and Sato proposed the Function–Task Interaction (FTI) Method. This method includes a general product development process and also an affordance method, especially the FTI matrix [14, 15]. In the FTI method, product functions and user tasks were derived from function decomposition and task analysis, and linked to each other in the FTI matrix.

The notion of affordance features in its explicit sense has recently been introduced. Murakami tried a formulation of affordance features for product design by experimenting with some simple shapes [16]. Structural elements tightly related to activities under specific contexts and tasks are identified as affordance features in our own team in two different design domains, in hand-held devices and in interior and space design [5, 6]. Affordance features are used in this research as a way to identify user and activity characteristics.

10.2.2 Personal Creativity Modes

Douglass J. Wilde of Stanford University developed the Personal Creativity Modes Test (PCMT), referred to as Wilde's test, based on the cognitive theory of Jung. Wilde's test has drawn considerable attention since it can be used for pro-

moting the performance of the creative design activities of individuals or teams [17]. Personal creativity modes represent the different creativity modes of individuals, which are intrinsically related to their personal cognitive preferences [18]. At Stanford, Wilde's test has been used in composing design teams so that the personal creativity modes are distributed as evenly as possible throughout the team. As a way to verify the utility of this team composition method, they used the design team performances in a typical design competition as reflected in the quantity and quality of the awards received by Stanford design teams [17]. At the Creative Design Institute, research work is being conducted into various underlying elements of design creativity, including personal creativity modes, with the aim of developing training programs that reflect an individual learner's characteristics in order to enhance their design creativity [19]. Recently, the relationships between personal creativity modes and perceived creativity, and design team interaction have been studied [20].

According to Jung's cognitive theory, there are four aspects of personal cognitive preferences, including perceiving/judging preferences, factual/conceptual perception, thinking/feeling judgment, and introverted/extroverted cognitive motivation. These four aspects can be deployed into eight different modes of creativity [17], as shown in Tables 10.1 and 10.2, and Figure 10.3. The characteristics of each personal creativity mode have also been described in a more recent work [21].

Table 10.1 The eight personal creativity modes [18]

	Perception		Judgment	
	Factual (sensing)	Conceptual (intuitive)	Objective (thinking)	Subjective (feeling)
Introverted	Knowledge-based	Transforming	Analyzing	Evaluating
Extroverted	Experiential	Synthesizing	Organizing	Teamwork

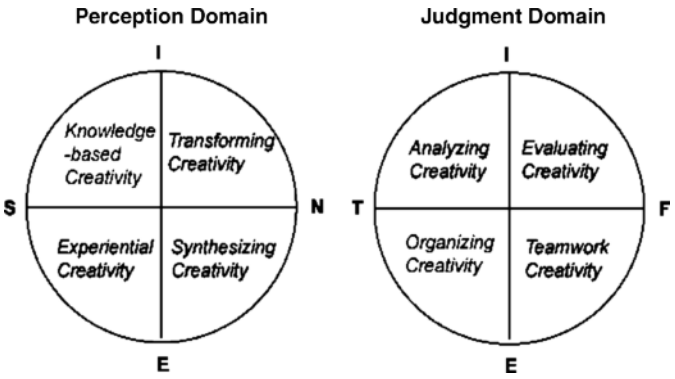


Figure 10.3 The eight personal creative modes

The personal creativity modes of each individual may have significant influence on their activities when they are asked to carry out certain tasks. In a space with a large number of unspecified floating individuals, users show a variety of activities under given tasks. When they are conducting the given tasks, they perceive many affordances and show diverse activities according to their personal characteristics. In other words, users perceive the same affordances in many different ways according to their personal characteristics and carry out various activities to accomplish the given tasks. Therefore, this chapter discusses the relationships between individual personal characteristics and the affordances that they perceive in the space throughout the case study. This research helps in the design of interior space to effectively provide the necessary affordances to its users based on their emotional and personal characteristics.

Table 10.2 Explanations for the eight personal creativity modes [21]

	Perception		Judgement
Synthesizing creativity 	Rearranging various elements into new configurations Seeing external patterns, trends, and relationships Exploring profitable new things and methods	Organizing creativity 	Organizing and managing people and projects to achieve goals Managing resources efficiently and enforcing specifications Setting deadlines, defining procedures, and breaking bottlenecks
Transforming creativity 	Transforming external objects as imaginary things	Analyzing creativity 	Internal reflective reasoning on relations among data and theories Clarifying ideas through analyzing by internal reasoning Comparing results with goals and standards
Experiential creativity 	Discovering new ideas and phenomena by direct experience Providing prompt, practical responses to crises and emergencies Building and testing models and prototypes	Teamwork creativity 	Building environment to support human values Detecting and fixing team interpersonal problems Harmonizing team, client, and consumer
Knowledge-based creativity 	Finding elements of solution in catalogs, handbooks, or class notes Getting or having existing facts and know-how Detecting and correcting mistakes	Evaluating creativity 	Using personal values to distinguish between good and bad Governed by a person's own values – aesthetic, ethical, moral, and spiritual Evaluating human factors and people's needs

10.3 Case Study – Experiments

The case study was conducted in order to investigate the relationships between personal and emotional characteristics and users' perception of affordance. A lobby space was selected for the case study, which had a large number of unspecified floating individuals and required a variety of affordances to perform many user tasks. The personal creativity modes of participating students were identified and their activities under the given tasks were monitored. Then the activities of participating students were analyzed, and their relationships with the personal creativity modes were studied by considering the associated affordances.

10.3.1 Participants and User Tasks

Twenty engineering students from Sungkyunkwan University participated in the case study. It is assumed that these students share similar cultural and societal backgrounds for the given simple tasks. Each student conducted the PCMT and their personal creativity modes were identified.

The lobby space of a commercial building, namely the P-building, which had a large number of unspecified floating individuals, were selected for the case study. We divided this research space into three sub-spaces overall according to their locations, and this was further divided into 11 zones. The floor plan of the research space and associated sub-spaces and zones is given in Figure 10.4. As can be seen in Figure 10.4, Space A was further divided into six zones and Space B consisted of three zones. Finally, Space C was composed of two zones. The details on the spaces and zones are summarized in Table 10.3.

The observation method was used to objectively monitor the participants' activities with video recording and by taking photos. The tests were conducted individually, and each test took 20–30 min with the whole test lasting 4 days. The detailed user tasks assigned to each participant, the associated sub-spaces, and the participants are summarized in Table 10.4. As shown in the table, in Space A, each participant was asked to wait and, at the same time, eat a snack (a cup of beverage and some boiled eggs), and read the magazine. Afterwards, participants moved into Space B's lobby, and were asked to sketch the impressive scene on the paper given. Finally, they were asked to go downstairs, and to lace their shoes and shake some sand out.

In this case study, the four tasks given in Table 10.4 were considered. However, all 20 students did not participate in all four tasks. In the cases of tasks T-1 and T-2, a total of 15 students participated, and these participants are given in Table 10.4. Similarly, 15 students participated in the task T-3 in space B, and these participants were not same as those for T-1 and T-2, as can be seen in Table 10.4.

Finally, in the case of T-4, five participants carried out the task in space A and nine ones in space C, and as a result a total of 14 students performed task T-4.

Five participants carried out the task in space A and nine ones did in space C, and as a result a total of 14 students performed task T-4.

Note that these tasks are simple enough so that the participants' emotional aspects beyond those related to their individual perception of the building lobby structures could be regarded as eliminated. Also note that these tasks are all individually performed so that no direct social interaction issues occur other than their indirect interaction with other unknown people in the lobby. In this way, the personal cognitive characteristics of each user as well as their affordance perception could play significant roles in their activities in performing the tasks.

Table 10.3 Spaces and zones of the lobby space of the P-building in the case study

Space A (on the second basement)	• SA-ZA: Artificial pond zone • SA-ZB: Revolving door zone • SA-ZC: Red stool zone A • SA-ZD: Red stool zone B • SA-ZE: LCD TV zone • SA-ZF: Bench zone
Space B (on the second floor)	• SB-ZA: Escalator sign bar zone • SB-ZB: Lobby zone • SB-ZC: Stair hall zone
Space C (on the first floor)	• SC-ZA: Stair zone • SC-ZB: Bollard zone (outside)

Table 10.4 Tasks and spaces for each student

Task No.	Task	Space	Participants	Sum
T-1	Waiting	Space A	P-01, P-03, P-05, P-07, P-09, P-11, P-12, P-13, P-14, P-15, P-16, P-17, P-18, P-19, P-20	15
T-2	Eating a snack and reading the magazine			
T-3	Sketching on paper	Space B	P-02, P-04, P-06, P-08, P-10, P-11, P-12, P-13, P-14, P-15, P-16, P-17, P-18, P-19, P-20	15
T-4	Lacing shoes and shaking sand	Space A	P-01, P-03, P-05, P-07, P-09	14
		Space C	P-11, P-12, P-14, P-15, P-16, P-17, P-18, P-19, P-20	

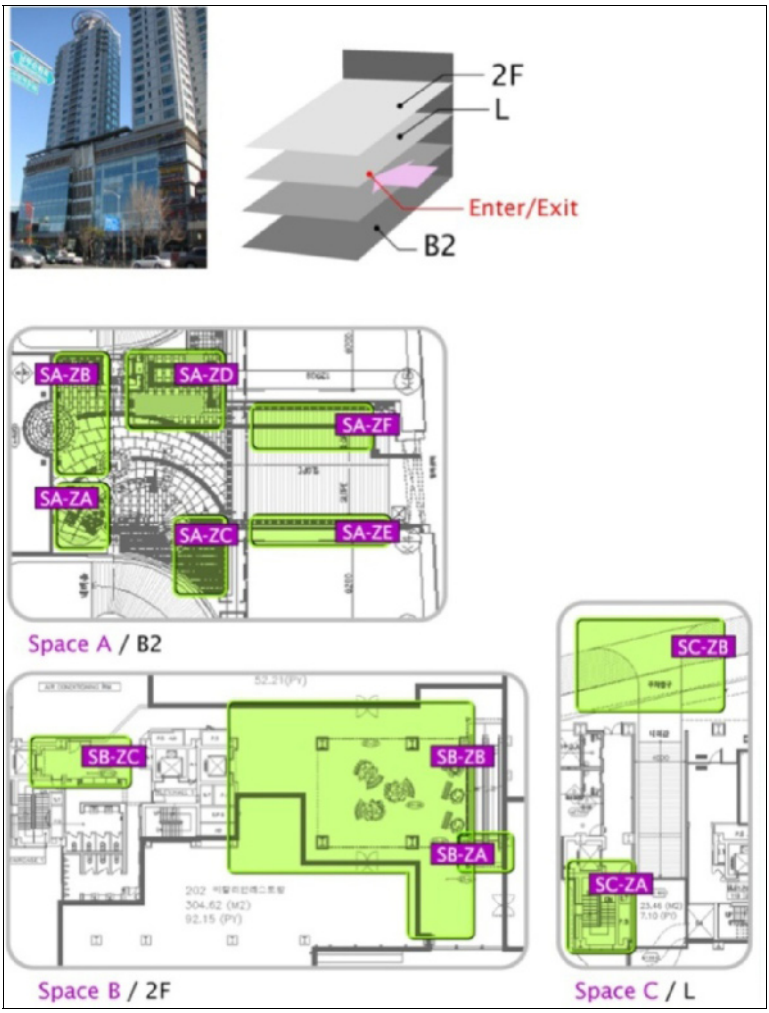


Figure 10.4 Floor plan of the research space for the case study

10.3.2 Activities and Related Affordances

We extracted the task-oriented affordances by observing the participants' activities under given tasks. From the results of the four tasks in the experiment, a total of 35 activities of all 20 participants were observed and listed in a sequential manner, and these are shown in Table 10.5. As can be seen in the table, one or more affordances were mapped to each participant's activity, and a total of 17 affordances were extracted from the activities of the participants.

Table 10.5 Activities and related affordances

Task No.	Activity No.	Activities of Studentes	Related Affordance			
			Physical Feature		Human Feature	
T-1	A-01	Looking for sitting place.	Look	Walk		
	A-02	Sitting.	Sit			
	A-03	Walking.	Walk			
	A-04	Stepping up and down.	Step			
	A-05	Leaning.	Lean			
	A-06	Placing the bag on somewhere.	Place			
	A-07	Supporting the bag on somewhere.	Support			
	A-08	Hanging the bag.			Hang	
	A-09	Looking something.	Look	Information Access		
	A-10	Touching something.	Touch			
T-2	A-11	Placing a cup of beverage and eggs.	Place			
	A-12	Holding a cup of baverage.			Hold	
	A-13	Drinking a baverage.	Drink			
	A-14	Tapping eggs.	Tap			
	A-15	Eating eggs.	Eat			
	A-16	Placing the magazine.	Place		Place	
	A-17	Supporting the magazine.			Support	
	A-18	Hold the magazine.			Hold	
	A-19	Reading the magazine.	Read			
T-3	A-20	Looking for place to draw painting.	Look	Walk		
	A-21	Touching tree.	Touch			
	A-22	Looking at framed picture.	Look			
	A-23	Looking at the warning message.	Information Access			
	A-24	Placing bags and belongings.	Place			
	A-25	Holding and Biting a cup.			Hold	
	A-26	Sitting and Leaning to draw painting.	Sit	Lean		
	A-27	Supporting paper.	Support		Hold	
	A-28	Biting a pen cap with teeth.			Hold	Support
	A-29	Drawing.	Draw			
T-4	A-30	Looking for place to lacing.	Look	Walk		
	A-31	Placing bags and belongings.	Place		Place	
	A-32	Placing foot.	Place			
	A-33	Holding shoe.			Hold	
	A-34	Lacing shoe.	Lace			
	A-35	Tapping shoe.	Tap		Tap	

There are two affordance drivers in the research space. One is a physical feature of the building itself, and the other is the human body or belongings. For instance, as noted in Table 10.5, the activity A-16 is mapped to two different place-abilities, represented by white shading and gray shading respectively. The "place-ability" denoted by the white shading is attributed to the physical feature of the space, and that denoted by the gray shading is due to the human body or a belonging such as a laptop or palmtop computer. The 35 activities given in Table 10.5 cannot be regarded as generic since they were monitored by observing the participants' activities in the particular research space. The relationships between the extracted affordances and activities can be rewritten as shown below. The activities with an apostrophe represent the one associated with the human body or belongings.

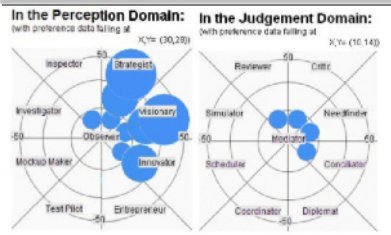
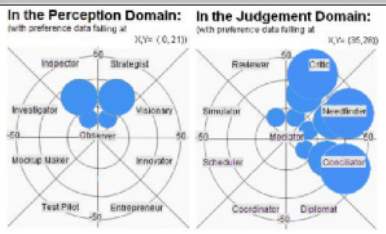
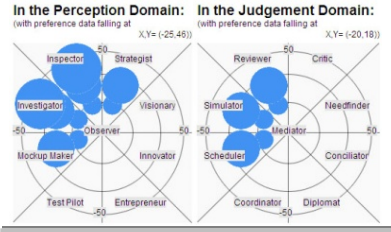
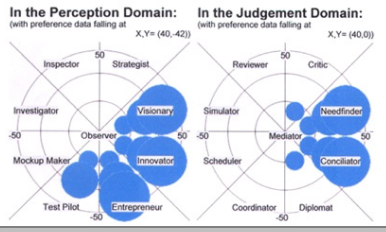
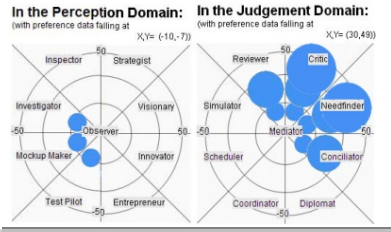
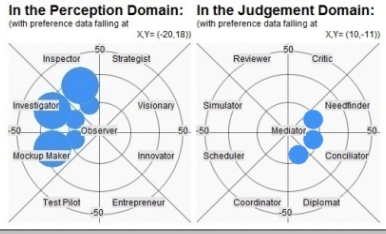
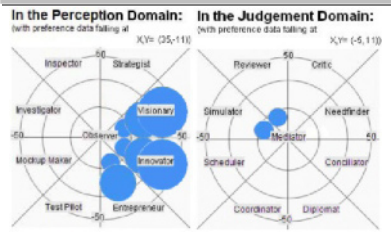
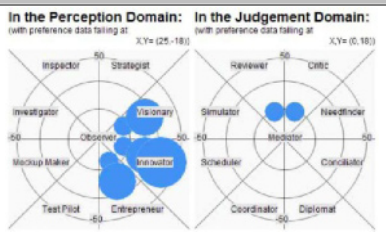
- Walk-ability: A-01, A-03, A-20, A-30
- Step-ability: A-04
- Sit-ability: A-02, A-26
- Lean-ability: A-05, A-26
- Place-ability: A-06, A-11, A-16, A-16', A-24, A-31, A-31', A-32
- Support-ability: A-07, A-17', A-27, A-27'
- Look-ability: A-01, A-09, A-20, A-22, A-30
- Information Access-ability: A-09, A-24
- Tap-ability: A-14, A-35, A-35'
- Touch-ability: A-10, A-21
- Hold-ability: A-12', A-18', A-25', A-27', A-28', A-33'
- Eat-ability: A-15
- Drink-ability: A-13
- Read-ability: A-19
- Draw-ability: A-29
- Lace-ability: A-34
- Hang-ability: A-08'

10.3.3 Personal Creativity Modes

The personal creativity modes of all 20 participants are summarized in Table 10.6. Diverse personal creativity modes were observed according to the participants' personal cognitive characteristics. For each student, the perception mode and the judgment mode are shown in separate diagrams. The stronger their preferences are, the bigger the bubbles that are shown, while their numeric values on intuitive/sensing inclination, feeling/thinking orientation, and intro/extroverted motivation determine the cognitive characteristics.

For example, in Table 10.6 student P-04 has very strong preference in extroverted intuition in perception mode as well as very strong feeling orientation in judgment. That is, he has strong synthesizing creativity as well as a mixture of both evaluating and teamwork creativities. On the other hand, student P-10 in Table 10.6 is very weak in both perception and judgment preferences.

Table 10.6 Personal creativity modes of participants

P-01	P-02
	
P-03	P-04
	
P-05	P-06
	
P-07	P-08
	
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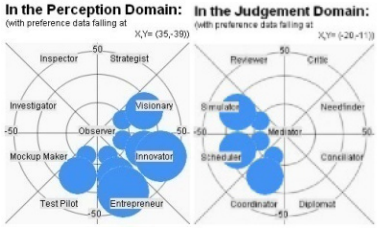
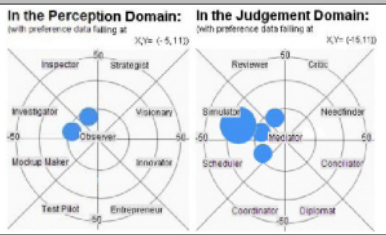
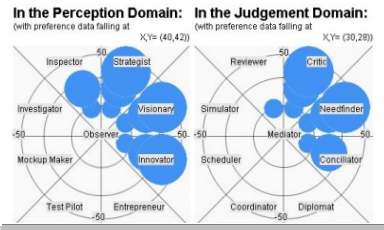
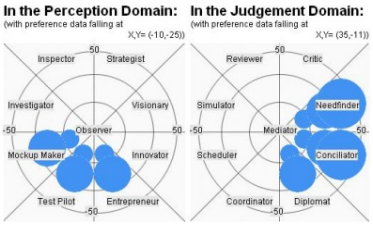
	

Table 10.6 Continued

P-11	P-12
	
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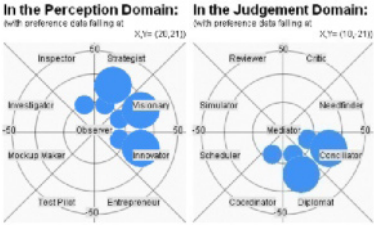
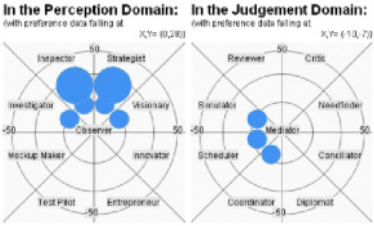
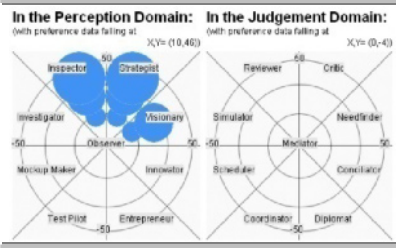
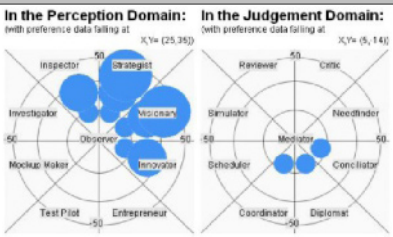
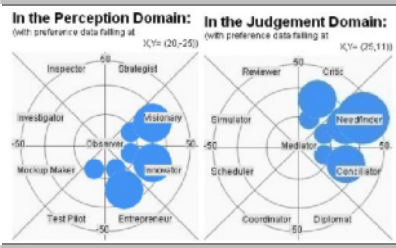
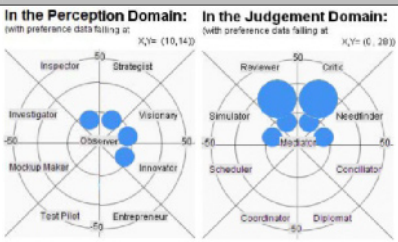
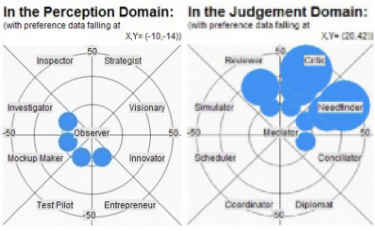
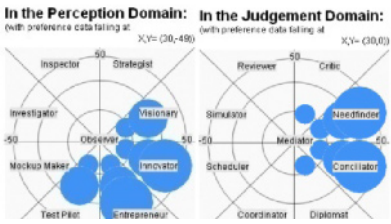
	
P-15	P-16
	
P-17	P-18
	
P-19	P-20
	

10.4 Case Study – Analysis on Personal Creativity Modes and Actives

The participants' activities from four user tasks such as waiting, eating and reading, sketching, and lacing shoes and shaking sand were observed and their relationship with the personal creativity modes were analyzed. The observation method was applied to capture the personal and emotional characteristics of each participant from their various activities under the given tasks.

10.4.1 Task: Waiting (T-1)

The task of waiting, denoted by T-1, was assigned to participants in space A. The detailed composition of space A is shown in Figure 10.5. As can be seen in Figure 10.5, there were six zones in space A, namely, SA-ZA, SA-ZB, SA-ZC, SA-ZD, SA-ZE, and SA-ZF.

Figure 10.5 Detailed composition of space A

Basically, the six zones of space A were open zones. However, only SA-ZA, SA-ZB, SA-ZE, and SA-ZF were completely open. We could feel that SA-ZC and SA-ZD were somewhat separated due to the stairs between them. In particular, a more private atmosphere could be found at SA-ZC since it included a hidden area due to the winding stairs.

Scenes of the minor activities associated with the task of waiting (T-1) are shown in Figure 10.6. As can seen in Figure 10.6, P-05 and P-11 showed the activities of appreciating Gogh's painting and looking at the banner and LCD TVs introducing the floor guide and commercial space of the building. Their activities might be attributed to their curiosity, and were related to the affordances of look-ability, walk-ability, and information access-ability. P-11 and P-12 fooled around in space A looking at the displayed cards on the Christmas stall, and these activities were related to the affordances of look-ability, walk-ability, and step-ability. In particular, P-11 showed the activities of seeing the artificial pond, and touching the uneven materials on which water was flowing and the doll symbolizing the bookstore located in space A. These activities were associated with the affordances of look-ability and touch-ability.

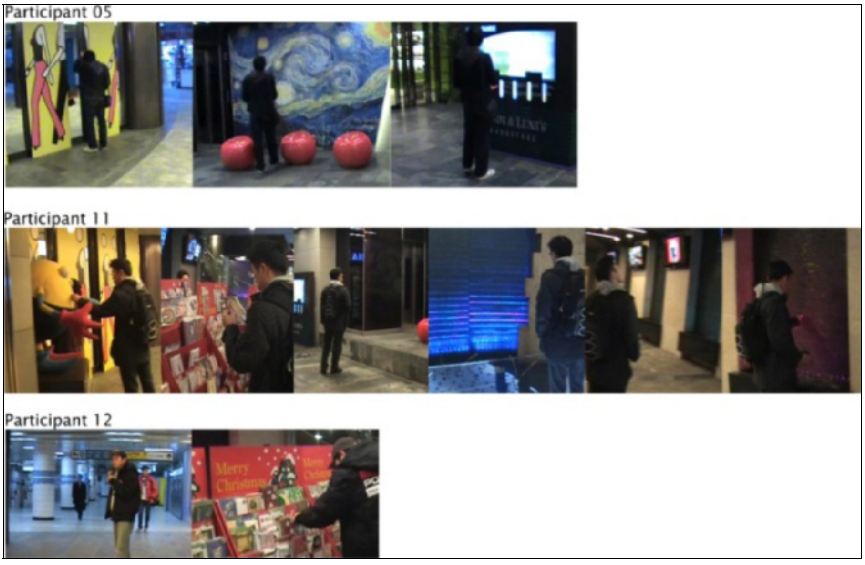


Figure 10.6 Activities associated with the task of waiting (T-1)

The personal creativity modes of P-05, P-11, and P-12 are given in Figure 10.7. As can be seen in Figure 10.7, their personal creativity modes are very similar in the judgment domain and they are feeling oriented. This means that they judged based on their emotion and had a lot of interactions with the features related to look-ability and information access-ability for their pleasure during the task of waiting. In addition, P-11 showed much more touching activities than P-05 and P-12. This means that P-11 perceived more stimuli from the features than others due to a much stronger inclination in the perception domain.

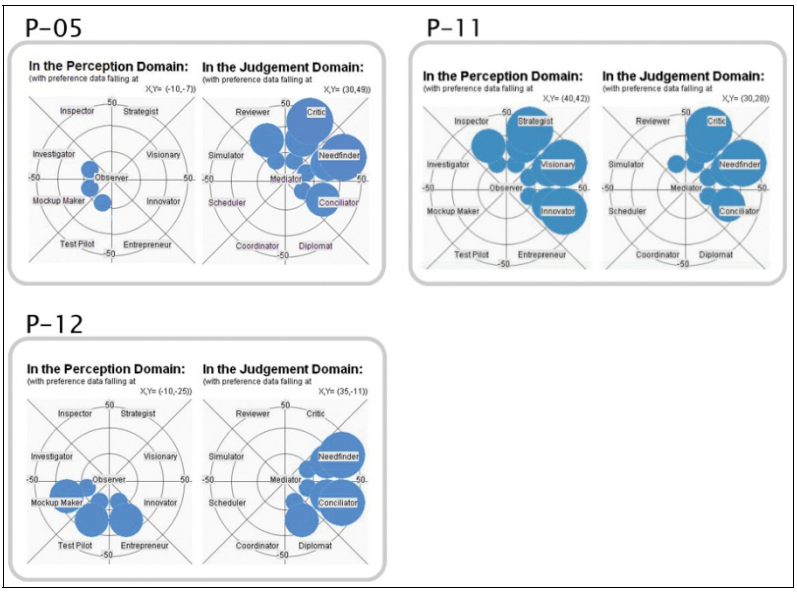


Figure 10.7 Personal creativity modes of P-05, P-11, and P-12

10.4.2 Task: Eating a Snack and Reading the Magazine (T-2)

The tasks of eating a snack and reading the magazine (T-2) were not asked to carry out in the same zone, but most of participants carried out those tasks in the same zone. A total of 15 participants carried out T-2, and ten of those, P-05, P-07, P-09, P-11, P-12, P-13, P-14, P-17, P-19, and P-20, performed T-2 at the bench in zone SA-ZF. This bench can allow several people to sit at the same time. The associated affordances were sit-ability, eat-ability, drink-ability, read-ability, place-ability, support-ability, tap-ability, and hold-ability. The scenes of the various activities of T-2 performed by participants are shown in Figure 10.8. As can be seen in Figure 10.8, most of participants performed T-2 while they were sitting. However, P-20 carried out T-2 while leaning on the feature that afforded lean-ability. This feature also afforded drink-ability and read-ability so that P-20 could eat their snack and read the magazine.

Unlike the above ten participants, P-03 and P-15 performed T-2 at the stone stools located in SA-ZD and SA-ZA respectively. These two zones had a more private atmosphere than SA-ZF. The affordances associated with the stone stool were sit-ability, eat-ability, drink-ability, read-ability, place-ability, support-ability, tap-ability, and hold-ability. The scenes of P-03 and P-15 while they were carrying out T-2 are shown in Figure 10.9. In the case of P-15, he continued to read the magazine while walking after he had performed the reading task in SA-ZA. His activities were related to the affordances of walk-ability, read-ability, and drink-ability.

Figure 10.8 Activities associated with the task of eating a snack and reading the magazine (T-2) – part 1

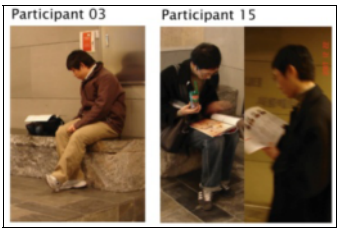


Figure 10.9 Activities associated with the task of eating a snack and reading the magazine (T-2) – part 2

The remaining three participants of the 15, P-01, P-16, and P-18, performed T-2 in the zone SA-ZC, which had the most private atmosphere. There were red stools in SA-ZC which were located at a from distance each other and only allowed one participant at a time to sit. As a result, each participant could have their own private space. These three participants were only ones to put their belongings on the floor. In particular, P-01 also placed his belongings on the feature that protruded from the wall. His activity was associated with the affordance of place-ability. The scenes of P-01, P-16, and P-18 performing T-2 are shown in Figure 10.10.

The personal creativity modes of five participants, P-01, P-03, P-15, P-16, and P-18, who showed minor activities of T-2 are shown in Figures 10.11 and 10.12. As can be seen in Figures 10.11 and 10.12, four of the participants, except P-18, showed a stronger inclination in the perception domain than the judgment domain and possessed a more introverted inclination. In addition, P-01, P-15, and P-16 were more intuitive in the perception domain.

Figure 10.10 Activities associated with the task of eating a snack and reading the magazine (T-2) – part 3

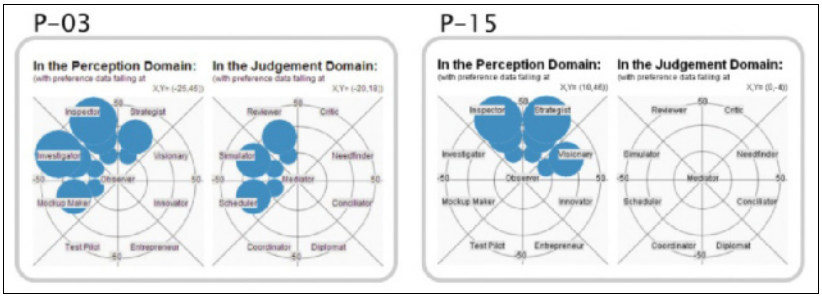


Figure 10.11 Personal creativity modes of P-03 and P-15

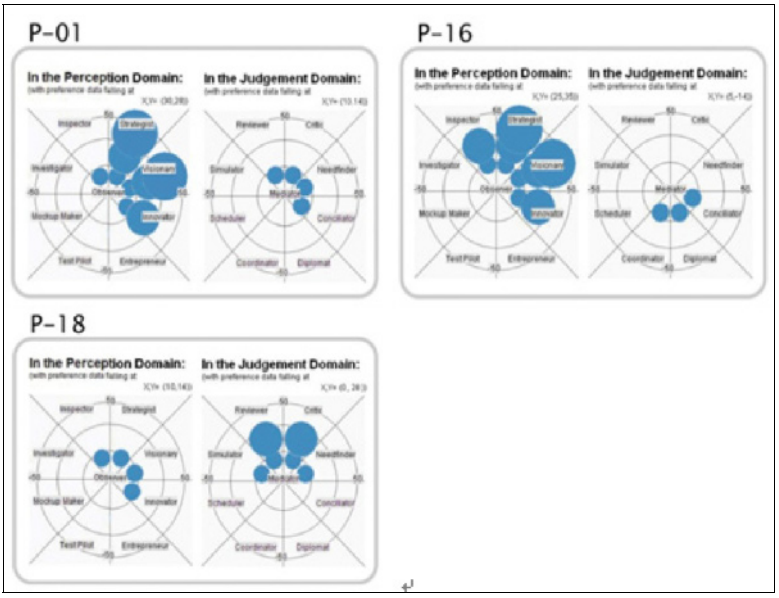


Figure 10.12 Personal creativity modes of P-01, P-16, and P-18

Of the above five participants, P-01 and P-16, who performed T-2 at zone SA-ZC, which was the most private, showed strong transforming creativity modes in the perception domain. This observation could be related to their introverted attitudes and insight with an intuitive sensing capability. In particular, P-01, who recognized the protruding wall and used it as the necessary affordance feature, representatively showed the characteristics of the transforming creativity mode. In the case of P-18, who selected zone SA-ZC for task T-2 but spent too much time on finding the zone to actually perform T-2, showed a stronger inclination in the judgment domain than the perception domain, but the degree of inclination strength in both domains was weaker than in the cases of P-01 and P-16. As a result, he seemed to spend more time to find the features providing the necessary affordances. In addition, his introverted inclination led him to find a quiet place with fewer people where he could sit. Note that none of the other 12 students shared similar personal creativity modes with P-01 and P-16.

It could be noted that P-01, P-15, P-16, and P-18 used their intuition to select spaces to perform their task of eating a snack and reading the magazine rather than judgment based on the fact. The introvertedness of P-01, P-03, P-15, P-16, and P-18 could also have led them to find a more private zone to carry out the task.

10.4.3 Task: Sketching on Paper (T-3)

The task carried out in space B was to sketch the impressive scenes of the lobby space on the sheet of paper provided. This task aimed to discover which features in the space were used to afford the drawing activity on the flexible paper. The detailed view of space B is shown in Figure 10.13.

As can be seen in Figure 10.13, there were three zones in space B, namely, SB-ZA, SB-ZB, and SB-ZC. In particular, there were three sets of artificial trees with heights of about 3 m. These trees each had a cylindrical base with a height of

Figure 10.13 Detailed composition of space B

0.5 m and a diameter of 1.3 m, which could afford the sitting of people. Thus, a message warning "Do not sit" was attached to the tree.

Of the 15 participants who carried out task T-3, five participants, P-08, P-12, P-13, P-14, and P-17, did not sit on the cylindrical base of the artificial trees after looking at the warning message, but used the flat surface of the cylindrical base as the affordance feature to sketch the scene. They placed their belongings and paper on the top surface of the cylindrical base, sat down on their heels, and sketched the scenes on the paper. The associated affordances were draw-ability, support-ability, place-ability, and information access-ability. The activities of the above five participants are shown in Figure 10.14.

Four participants, P-06, P-18, P-19, and P-20, used column and wall features to carry out task T-3. They perceived the affordance of support-ability of column or wall features to hold the paper with their hands in order to sketch the scene. Figure 10.15 shows their activities. The affordances they perceived were draw-ability, support-ability, and hang-ability.

The participants P-04, P-11, and P-15 ignored the warning message and sat on the cylindrical base of the artificial tree while sketching the scene. The scenes of their activities are shown in Figure 10.16. In this case the affordances they perceived were sit-ability, draw-ability, place-ability, support-ability, and information access-ability.

Finally, P-02, P-10, and P-16 used their palms to support the paper and sketch the scene while they were performing task T-3. In particular, P-16 leaned on the column while sketching the scene with the paper supported by his palm. The activities of those three participants are shown in Figure 10.17. The affordances they

Figure 10.14 Activities associated with the task of sketching on paper (T-3) – part 1

Figure 10.15 Activities associated with the task of sketching on paper (T-3) – part 2

Figure 10.16 Activities associated with the task of sketching on paper (T-3) – part 3

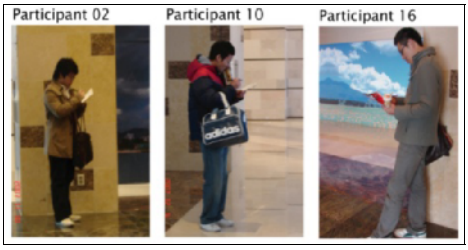


Figure 10.17 Activities associated with the task of sketching on paper (T-3) – part 4

perceived were draw-ability, lean-ability, support-ability, hold-ability, and hang-ability. These three participants did not find any features to place belongings and support the paper, and used their own human body features to perform task T-3.

After analyzing the diverse activities of the participants who carried out task T-3 and their personal creativity modes, those who sat on the cylindrical base in spite of the warning message (P-04, P-11, and P-15) showed very strong cognitive inclinations with the coordinate values larger than 40. Their personal creativity modes are given in Figure 10.18. It is believed that they intuitively responded to the cylindrical base to afford the sit-ability before recognizing the warning message due to their strong inclination in the perception domain.

The personal creativity modes of those who used their palms to support the paper and sketch the scene in task T-3 are given in Figure 10.19. As can be seen in Figure 10.19, P-02 and P-10 showed a stronger inclination in the judgment domain than the perception domain, and were introvert in both domains. They rather passively performed task T-3 without actively searching for the affordance features in the space. They used their own body features to hold bags or a beverage cup and to sketch the scene while performing task T-3. In other words, it seemed that they may not have perceived their surrounding environment and hence made their own judgment in order to perform the task T-3.

On the other hand, P-16's activity in carrying out task T-3 was somewhat different. Although he showed a similar posture when drawing the scene on the paper to the cases of P-02 and P-10, he leaned on the column feature while sketching. P-16's personal creativity mode showed a much stronger inclination in the perception domain than the judgment domain. This characteristic might have led him to find the column feature to lean on while sketching the scene on the paper supported by his

palm. Therefore, his different personal creativity mode may have led him to show a different activity from those of P-02 and P-10. It may be the case that the leaning affordance was stronger for his perception preference than any other affordances. Then, P-02 and P-10 may be the only two who did not perceive any affordance features other than their body features, reflecting their very low perception preferences.

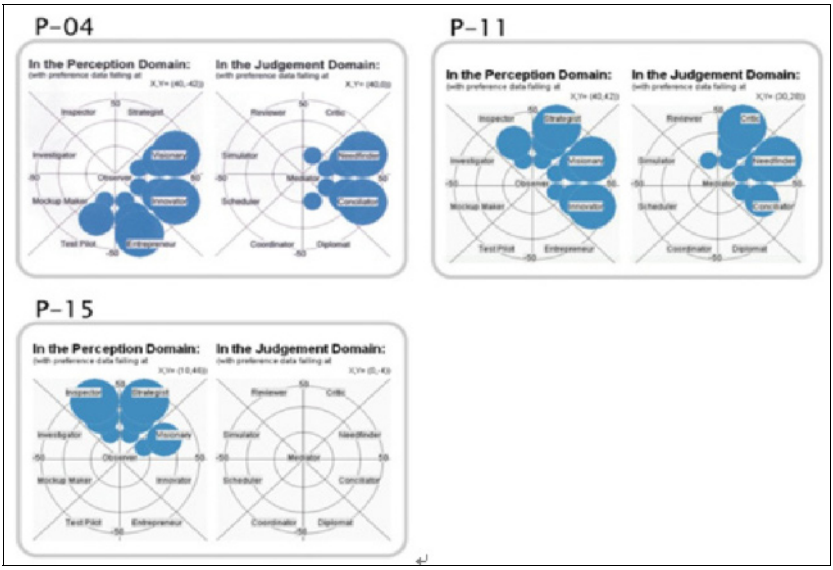


Figure 10.18 Personal creativity modes of P-04, P-11, and P-15

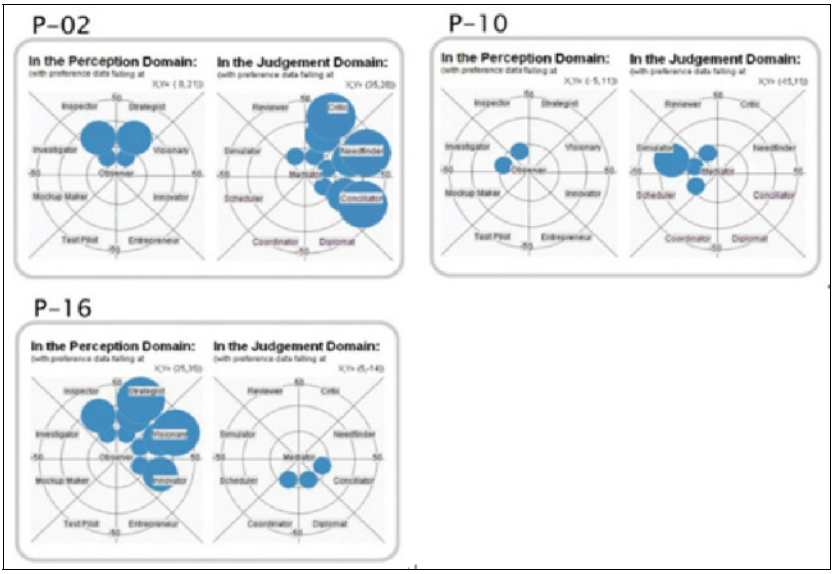


Figure 10.19 Personal creativity modes of P-02, P-10, and P-16

10.4.4 Task: Lacing Shoes and Shaking Sand (T-4)

Two experiments were conducted for the task of lacing shoes and shaking sand (T-4). In the first experiment, the participants carried out task T-4 in space A. In the second experiment, task T-4 was performed in space C. The detailed view of space C is given in Figure 10.20. As can be seen in the figure, there are two zones in space C, namely, SC-ZA and SC-ZB. In particular, zone SC-ZB was the exterior one.

Scenes of the diverse activities of the participants when carrying out task T-4 are shown in Figures 10.21–10.23. As can be seen in Figure 10.21, six out of a total of 14 participants, P-11, P-12, P-16, P-17, P-19, and P-20, performed task T-4 while they were sitting on their heels on the floor. The affordances they perceived were lace-ability and tap-ability.

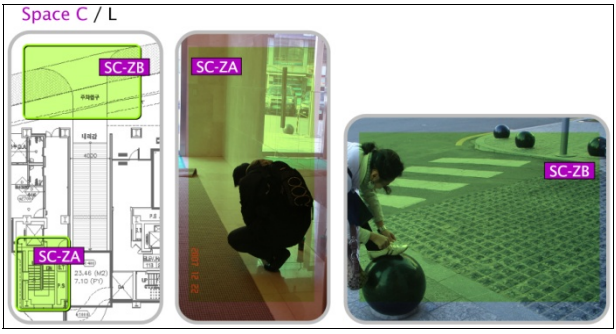


Figure 10.20 Detailed composition of space C

Figure 10.21 Activities associated with the task of lacing shoes and shaking sand (T-4) – part 1

In addition, five participants were seen lacing shoes and shaking sand while they were sitting on a stool, bench, or bollard. The scenes of their activities are given in Figure 10.22. As can be seen in Figure 10.22, P-01, P-03, P-05, and P-18 laced shoes by leaning forward with their backs bent while they were sitting. On the other hand, P-09 laced his shoes while sitting on the bench by raising one leg and putting it across the other leg without overbending his back. The affordances they perceived were lace-ability, tap-ability, and place-ability.

Finally, P-07, P-14, and P-15 raised their legs and put them on a bench or bollard in order to lace their shoes with their backs bent, overbending their backs. The scenes of their activities are shown in Figure 10.23. As can be seen in Figure 10.23, P-07 used the bench to put her leg on and lace her shoes in zone SA-ZF of space A, and P-14 and P-15 put their legs on the bollards and laced their shoes in zone SC-ZB of space C. The affordances perceived by those three participants were lace-ability, tap-ability, and support-ability.

When investigating the relationship between personal creativity modes and activities of the participants carrying out task T-4, P-14 and P-15, who put their legs on the bollard to lace their shoes, showed similar personal characteristics. The personal creativity modes of P-14 and P-15 are given in Figure 10.24. As can be seen in Figure 10.24, they had a stronger cognitive inclination in the perception domain than the judgment domain. They also showed introvertedness. When they conducted the task of lacing their shoes, it is believed that they perceived the bollard as the affordance feature to support their activities by using both their intuitive sensing and concrete and factual information.

Figure 10.22 Activities associated with the task of lacing shoes and shaking sand (T-4) – part 2

Figure 10.23 Activities associated with the task of lacing shoes and shaking sand (T-4) – part 3

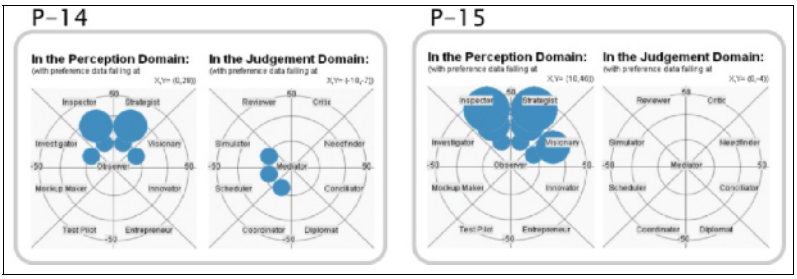


Figure 10.24 Personal creativity modes of P-14 and P-15

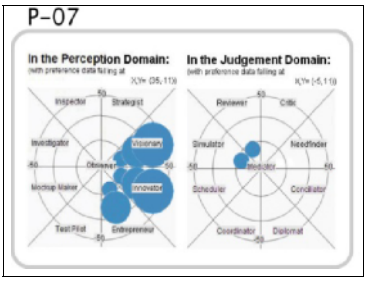


Figure 10.25 Personal creativity mode of P-07

On the other hand, P-07 showed similar activities to P-14 and P-15 when carrying out task T-4. This may be due to her stronger cognitive inclination in the perception domain than the judgment domain, which is similar to the cases of P-14 and P-15. The personal creativity mode of P-07 is shown in Figure 10.25. However, as can be seen in Figure 10.25, she had more extrovertedness in her personal characteristics. This characteristic may have led her to find a more publicly open zone such as SA-ZF while searching for the affordance feature to support her activity, which is different from the cases of P-14 and P-15 who used zone SC-ZB to carry out their task.

10.4.5 Discussions

As discussed in the previous sections, humans perceive diverse features in different ways based on their personal cognitive and emotional characteristics. In other words, humans do not think and act equally although they look at the same features. In addition, humans perceive different affordances based on their personal characteristics, resulting in different activities to carry out the same tasks in the same environment.

In this research, a total of 17 affordances were used as extracted by observing the participants' actual activities. It is observed that those affordances could or

could not be perceived according to the participants' personal cognitive characteristics. It was also found that the user of the lobby space could perceive affordances that the designers may not have originally considered. In particular, when participants perceived different affordances, their activities and behaviors varied. If some participants behaved similarly, but in less common manners compared with the majority of the participants, they had similar personal creativity modes. For instance, participants with transforming or synthesizing creativity modes could intuitively perceive affordances that the designers had not originally intended.

Therefore, it may be necessary for designers to consider various users' activities in the course of the design of the lobby space. For example, when designers are to provide the affordance of sit-ability for the lobby space, they may have to provide various features to afford the sit-ability, whilst considering diverse users and contexts. In addition, they also need to expect the users to perceive unintended affordances.

10.5 Conclusions

In this research, the analysis on the user activities and perceived affordances reflecting personal cognitive characteristics was conducted through the case study in a public space – the building lobby. The user activities and behaviors were monitored and analyzed under several tasks. We developed the tasks so that various affordance features could be relevant while eliminating other factors affecting the affordance perception of users. The users' activities were classified and then compared with their personal creativity modes. It was observed that the personal cognitive characteristics could be related to the different and diverse perceptions of affordances. While this study presents a qualitative explanation that personal cognitive characteristics may affect affordance perception, a more systematic user study is desired in order to justify the initial findings, possibly with quantitative support. Similar user studies could also be conducted to understand the relationships between affordance perception and other user characteristics such as physical, cultural, and social aspects. Many such studies when properly compiled and classified would support designers in their affordance-based design processes.

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