Incongruent Aesthetic Preferences in Design Collaboration: An Enabler or Barrier for Novelty and Appropriateness?

Seung Wan Hong¹, Sae-young Lee² and Jae Seung Lee*³

¹Assistant Professor, Department of Architecture, Inha University, Republic of Korea
²Associate Professor, Department of Architecture, Chung-Ang University, Republic of Korea
³Assistant Professor, Department of Urban Design and Planning, Hongik University, Republic of Korea

Abstract
This paper examines ways in which the congruent and incongruent aesthetic preferences of collaborators influence the production of novel and appropriate design outputs. Authors compared the novelty and appropriateness scores in urban furniture design outputs, produced from teamed-up, twenty-six designers who shared congruent aesthetic preference with their partners, and those who did not. Nine expert-judges assessed the novelty and appropriateness of the collaborative results, following the Consensual Assessment Technique (CAT). Two-way ANOVA indicates that the novelty scores between the two groups are not statistically different, but the appropriateness scores of the congruent aesthetic preference group are higher, than those of the incongruent aesthetic group. Based on in-depth interviews and theories of mental model and conflict, authors interpret that the results indicate that while congruent aesthetic preference facilitates the participants to build up a shared team mental model without affective and process conflicts, the incongruent aesthetic preference causes conflicts and misinterpretation, and thus hampers task performances, in the search for creative outputs. As another value of this paper, this study's theoretical frames and research methods have not been treated hitherto in previous creativity studies, thus the frames and methods may help and inspire the relevant future studies.

Keywords: aesthetic preference; novelty; appropriateness; design collaboration; mental model

1. Introduction
In design practice and industry, collaboration is a common approach among artists, architects, and designers in varying disciplines, in order to produce more creative design products. In the discipline of psychology, creativity is defined as the combination of two psychometrics: novelty (e.g. feeling of newness, unexpectedness) and appropriateness (e.g. useful, valuable) (Amabile, 1996; Kaufman and Sternberg 2000; Runco and Jaeger, 2012). The definition is also shared implicitly in the field of architecture (Styhre and Gluch, 2009).

However, all participants in design collaboration have their own worldviews, gained by discipline-specific knowledge and education. Therefore, it is almost inevitable that conflicts arise, when participants begin to share these worldviews, and merge them to develop an integrated solution (Jehn, 1997). Since conflict management is relevant to the production of better quality of design outputs, investigating the nature of conflict in design collaboration is regarded as an important research issue (Badke-Schaub et al., 2010).

In empirical design collaborations, we often observe conflicts arising from incongruent aesthetic preferences among designers. Aesthetic preference is defined as the degree to which people like a particular visual stimulus or not, or how they rate its beauty (McWhinnie, 1968; Palmer et al., 2011, 2013); and it acts pervasively in people's cognitive mechanisms (Palmer et al., 2013). The aesthetic preferences of designers possibly influence their decision-making process, to determine the aesthetic quality of design products, which is one of the most important criteria for assessing the success of design (Hartmann, 2006).

Extended to those studies, the incongruent aesthetic preference of designers can either promote or hamper the production of creative solutions. First, the different aesthetic preferences of designers can cause cognitive conflict, which is a constructive disagreement to improve the task, based on the diverse worldviews,
knowledge, and expertise of collaborators (De Dreu and Nijstad, 2008; Badke-Schaub et al., 2010). When designers have different aesthetic preferences, on the one hand, they may suggest diverse aesthetic outputs, and the difference may stimulate an interactive cognitive process to discover unexpected solutions.

On the other hand, the conflict stemming from incongruent aesthetic preference can pose the threat of creating irreconcilable conflict and tension between collaborators. Since aesthetic preferences are rooted in the pervasive, cognitive, and psychological mechanisms of each designer, designers can have difficulty in resolving the conflict, by appreciating and sharing the different aesthetic preference in time and schedule constraints of professional design firms. In addition, unlike the cognitive conflict caused by the different knowledge and worldviews of experts (Isakan and Ekvall, 2010), the conflict stemming from incongruent aesthetic preference cannot be shared in a rational process of communication and negotiation. Therefore, incongruent aesthetic preference can hamper the fluent process of collaboration, as the affective and process conflicts do.

In another assumption, the aesthetic preferences of designers possibly affect the production of creative solutions, by influencing the process of building up a mental model among designers. Previous studies mention that the collaborators build up a mental team model, which is a shared thinking structure or frame among team members, to effectively manage the given tasks, processes, goals, and miscellaneous resources (Badke-Schaub et al., 2007). Hence, the shared mental model can influence the collaboration performances and production of innovative and functional outputs (Mark et al., 2002; Lim and Klein, 2006). On the other hand, the different aesthetic preferences of designers may contribute to them avoiding building up a redundant and inefficient team mental model, and thus may facilitate the search for creative solutions.

While aesthetic preference plays a significant role in influencing the success of creative collaboration, the theory and empirical results of the effect of aesthetic preference on creativity in design collaboration are mixed and inconclusive. Therefore, the present study aims to investigate in what ways the congruent and incongruent aesthetic preferences of designers affect the production of creative solutions in design collaboration, and to deduce the nature of conflict arising from aesthetic preference, and its influence on building up a mental model.

2. Theoretical Background
2.1 Conflicts and Aesthetic Preference

Creative collaboration is an interpersonal process of shared creation, with an exchange of ideas among experts or professionals. This process aims to achieve a specific purpose, such as solving a problem, as well as creating or discovering something new (Schrage, 1995; Kalay, 2004). In creative collaboration, the participants have diverse worldviews, educational backgrounds, skills, and even personal traits; and thus, conflicts arising among them are unavoidable. Previous creative collaboration studies reveal that conflict can be either negative or positive for the production of creative solutions, according to its type.

Affective or socio-emotional conflict hampers creative collaboration (Jehn, 1995; Amason and Spienza, 1997). The conflict arises from incompatibility among personal traits or issues of collaborators, and creates negative emotions, and unsatisfactory relationships among collaborators. Affective conflict poses the threat of diminishing interpersonal relationships among collaborators, and it reduces motivation, openness, and communication among collaborators (Amason and Spienza, 1997; Carnevale and Probst, 1998). Another type of conflict, process conflict, which is disagreement about the approach, method, and group processes to the task, obstructs productivity and the quality of solution (Jehn and Mannix, 2008), and thus hampers the production of innovative solutions.

Unlike the affective and process conflicts, Badke-Schaub et al. (2010) discovered that cognitive conflict facilitates innovative solutions in design collaboration. Cognitive conflict is a debate focused on the task contents, and it also refers to task conflict (Isakan and Ekvall, 2010). Cognitive conflict arises from the different views and opinions of collaborators. The authors stated that the production of creative outputs requires constructive disagreement, rather than mainly congruent opinions.

In theoretical assumptions, the incongruent aesthetic preferences of designers can facilitate the production of novel and appropriate solutions in design collaboration. Incongruence in aesthetic preference most likely allows designers to experience unseen aesthetic qualities, due to insight gained from a partner, and thus produces more diverse ideas. It is perhaps a similar mechanism to cognitive conflict. Divergent thinking can complement the design competence of each designer to attain as yet unexperienced solutions.

However, from a different view, designers' incongruent aesthetic preferences possibly create irreconcilable conflicts in collaboration, which process discourages creative collaboration. Designers' aesthetic preferences, pervasively ingrained in individuals' visual perception (Palmer et al., 2013), are most likely to be difficult to communicate to others. Therefore, the conflict emerging from incongruent aesthetic preferences easily turns to affective conflict, which arises from personal dislikes and dissatisfaction, or process conflict, which bothers a fluent collaboration mode.

2.2 Mental Model and Aesthetic Preference

Authors also assume that aesthetic preference is related to building up a shared mental model among designers. Badke-Schaub et al. (2007) stated that an
In a design team, a shared mental model is related to knowledge about the task, process, group, competence, and context (Neumann et al., 2006). The authors argued that collaborators share knowledge about particular tasks, called a task model. The task model is a perspective or skill acquired from previous tasks that are similar to the given tasks. The collaborators also share ways in which to resolve the given tasks, called the process model. Fig.1. describes the process of constructing a shared mental model. The process of building up a shared mental model requires the comprehension and interpretation of other participants' mental models stemming from their perception, knowledge, experiences, and needs. Some factors of individual mental models, relevant to personal, innate dispositions, for example perception and memory, are hard to comprehend by other collaborators who do not possess congruent dispositions, and thus may cause affective conflict.

![Fig.1. Building up a Team Mental Model](image)

2.3 Research Questions

In what ways are the aesthetic preferences of designers relevant to the construct of a team mental model? Goldschmidt (2007) stated that designers tend to repeatedly refer to design vocabulary, and an inventory of shape, form, and color-plate, in the design process. In design collaboration, when the designers build up a team mental model, it is inevitable that they share their design inventories, which are highly relevant to the aesthetic preferences of individual designers. The incongruent aesthetic preferences of designers may contribute to building up a competent mental team model, resulting from compromising diverse design inventories to resolve the given design problems, rather than constructing a redundant mental team model.

Contrary to the assumption, the previous studies also mention that the similarity and sharedness of mental models can promote task performance and higher interdependence (Mark et al., 2002; Lim and Klein, 2006). Since the aesthetic preference pervasively stems into the mechanism of each designer's decision-making, building up a shared team mental model on the expected and satisfactory outputs may be difficult. Therefore, it is possible that the participants will build up an incomplete team mental model.

Extended to the aforementioned conflict and mental model studies, the congruent and incongruent aesthetic preferences of designers have equivalent probabilities of facilitating the production of creative solutions in design collaboration. Therefore, this study aims to investigate the question: What is the influence of the incongruent and congruent aesthetic preferences of designers, on the production of novel and appropriate solutions? Does the incongruent aesthetic preference of designers better facilitate those two components of creativity, than their congruent aesthetic preferences? To investigate these questions, this study compared the scores for novelty and appropriateness of a group of collaborators who possess different aesthetic preferences, to the scores of a group sharing the same aesthetic preference. In addition, this study also aims to interpret the reasons for comparison results, based on previous studies about the team mental model, and conflict. For deduction, the present study relies on the retrospective interviews of participants.

3. Methods

To investigate goals, this study compared the novelty and appropriateness of design solutions, produced from the collaborative experiments of incongruent and congruent aesthetic preference groups. For the grouping, this study also conducted aesthetic preference tests, and the Big Five personality tests as an important control measure. External judges assessed the scores for novelty, and appropriateness of outputs. In addition, the retrospective interviews investigated the probable reasons for the results in depth. The research procedure is explained in greater detail, in the following section.

3.1 Participants

A total of twenty-six sophomore students in an urban design program at H University, Seoul, Korea, participated in the test. The participants had gained equivalent design experiences and skills from previous urban design studios. The average age of the participants was 20.3 (twenty-three of them are 20, three of them are 23). Forty five percent of them were female, and 65% were male. All participants were taking the same urban design course, entitled 'Urban Design Studio III', and they were second year urban design and planning students. As control measures, since the participants were in the same academic year, and experienced equivalent major studies, authors supposed that the age gap does not influence the production of creativity results with any significance (Lindauer et al., 1997).
In this study, authors also supposed that the gender proportion is not a significant influence on the production of creative outputs. The previous studies revealed that it is uncertain that the gender difference between males and females influences creativity (Baer and Kaufmann, 2008). In addition, the proportions of same and different gender teams in the incongruent and congruent aesthetic groups were almost equivalent.

### 3.2 Grouping Phase I: Aesthetic Preference Test

Previous studies on color and shape preferences have also provided methodological insight into the analysis of the synthesized visual stimulus of environmental design products. The visual stimulus of environmental design products generally consists of shapes and materials (e.g. a curvy silver building). Palmer et al. (2013) proposed that color preferences are collated to the degree that viewers like or dislike environmental objects, suggesting that material preferences regarding architecture, landscape, and urban design products are related to the color properties of these products, particularly their hue. Shape preference studies have investigated the relationship between viewers' aesthetic preferences and contour shape curvature (Bar and Neta, 2006; Silvia and Barona, 2009), classifying shape stimuli as curved or angular (rectangular).

The measurement of aesthetic preferences followed the holistic approach of Arnheim (1971). Forty images of modern architecture were used to measure the participants' aesthetic preferences. The images carried the properties of visual stimuli: curvature of shapes (Bar and Neta, 2006; Silvia and Barona, 2009), and hue of materials (Palmer and Scholoss, 2010). In this study, curvature of shapes indicates the curvature of three-dimensional forms, because environmental design products are perceived as being three-dimensional. Ten of those forty images showed curvy buildings, composed of hued materials (i.e. colored); and ten of them showed curvy buildings, composed of materials without hue (e.g. white and gray). Another ten images showed angular buildings, composed of hued materials; and the last ten images showed angular buildings, composed of materials without hue.

Table 1. The Aesthetic Preference Correlations between Team Members

| Congruent Groups | Incongruent Groups |
|------------------|--------------------|
| Participants     | Correlation Coefficient | Participants     | Correlation Coefficient |
| O     | X | 0.58 |    | D | F | -0.29 |
| P     | G | 0.55 |    | T | L | -0.27 |
| M     | J | 0.41 |    | I | Y | -0.19 |
| H     | S | 0.30 |    | E | B | -0.13 |
| Z     | V | 0.54 |    | K | A | -0.19 |
| N     | W | 0.54 |    | Q | U | -0.20 |
| R     | C | 0.28 |    |               |                |

After viewing each image for a few seconds, the participants rated how much they preferred the forms and color of the architecture, on a seven-point Likert scale (1 = very much ugly, very much dislike, 7 = very much beautiful, very much like). Data from the evaluation sheets were inputted into Stata 11, and the correlations between the responses of all participants were computed, allowing for the construction of a correlation matrix of individual aesthetic preference. Based on the correlation coefficients, authors identified seven pairs with congruent aesthetic preference (i.e. positive correlation of aesthetic preference scores), and six pairs with incongruent aesthetic preferences (i.e. negative correlation of aesthetic preference scores) (Table 1).

### 3.3 Grouping Phase II and Control Measure: The Big Five Test

To observe the pure relationship between aesthetic preferences and creativity in collaboration, authors controlled for the personality traits of the members in each pair. Because personal traits can influence the production of creative outputs (Silvia, 2008), authors analyzed the participants' Big Five domains of personality (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism), which are now some of the most widely accepted and used models of personality in the field of psychology (Costa and McCrae, 1992). Each domain has six items on a four-point scale (1=disagree, 2=slightly disagree, 3=slightly agree, and 4=agree). The score of each domain was calculated as the sum of ratings of its six items. Hence, the possible maximum and minimum scores of each domain were 6 and 24, respectively. Examining the Big Five scores of each pair revealed that none of the members had different personality traits (i.e. a negative correlation of the Big Five scores) from those of their partners.

Lastly, authors examined whether there were significantly different personalities between the congruent and incongruent aesthetic preference groups. Two-sample t tests with unequal variance were performed, to compare the average Big Five scores of the two groups (Table 2. ). The results showed that the Big Five scores (Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism) of the congruent aesthetic group were not significantly different from those of the incongruent aesthetic group. Therefore, in this study, the participants' personality differences were not related to the production of creative outputs.

Table 2. The Big Five Scores between Congruent and Incongruent Aesthetic Preference Groups

| M (SD) | Mean Diff. | P |
|--------|------------|---|
| Openness | (n=14) | (n=12) | 1.25 | 0.17 |
| Conscientiousness | (2.35) | (2.14) | 1.82 | 0.06 |
| Extraversion | (2.34) | (2.26) | 1.60 | 0.15 |
| Agreeableness | (1.90) | (1.94) | 0.76 | 0.33 |
| Neuroticism | (2.82) | (4.54) | -0.35 | 0.82 |
3.4 Collaboration Experiments

The thirteen pairs of designers were asked to carry out a collaborative design task, to measure the influence of aesthetic preferences on creativity in collaboration. The redesign of current street furniture, located in a street near H University, was assigned as the main collaboration task. The participants were asked to design the street furniture that possesses a roof, seats, and tables, for pedestrians' temporary resting. The size of the site is approximately twenty-five by twenty-seven meters. There are small retail shops around the site, and the majority of users are young people in their 20s and 30s.

The required design tasks were to design a structure with sunshades and awnings. The tasks also included developing chair and table designs. In the tasks, the participants were to organize the chairs and tables with the street furniture, to create a holistic form. Because curvature of forms and color of materials were criteria used to classify the aesthetic preferences of the participants, we also emphasized the novelty and appropriateness of the street furniture's form and color of materials. Since a structure of street furniture can be designed to have a novel form and material, including its functionality, authors supposed that a street furniture design is a valid task to assess both novelty and appropriateness.

The participants were provided with four site photographs, color pencils, black pens, and translucent tracing paper. Each pair was asked to produce at least two drawings on the tracing paper, within one hour. Supplementary texts explaining the design schemes were allowed. Authors asked the participants to propose one unified solution. Essentially, the participants worked on shared sketches. Samples of the collaboration outputs of the congruent and incongruent aesthetic preference groups are illustrated in (Fig.2).

![Fig.2. Samples of Collaboration Output](image)

The purpose of the collaboration experiments was hidden from the participants. Authors introduced that collaboration was one of the class activities, and conducted the experiments in the regular class time. The screening is valid, to prevent the participants' anxiety, arising from anticipated evaluation. Baer (1997) stated that anticipated evaluation hampers female students' creativity. Therefore, in this study, the collaboration duration was fitted to the class hour, and due to the screening, voice and video recording devices and relevant research methods (e.g. protocol analysis) were not applied to the present study. Although this study focuses on short-term collaboration, it is still valid that the design task was simple, as the participants manage and experience the entire collaboration procedure, from the initial exposure to the partner's aesthetic preference, to the production of one solution, including the attempts to converge different opinions.

3.5 Creativity Assessments

Creativity is assessed by the novelty and appropriateness of a product. The tangible products of creativity can be evaluated by expert judges, who are familiar with the domain in which a given product was created (Amabile, 1996; Kaufman et al., 2008). In the field of design, recent research refers to the assessment method of creativity, called CAT: the consensual assessment technique (Amabile, 1996), to investigate the capacity of design media (Goldschmidt, 2010). In this study, authors focus on the ways in which the aesthetic preferences of designers influence those two components of creativity.

As the CAT, nine external reviewers (Ph.D. students in the urban design program) rated the novelty and appropriateness of the collaborative outputs of the seven congruent and six incongruent pairs on a seven-point Likert scale (1= very banal or very inappropriate, 7= very novel or very appropriate). Authors explained to the judges the given design problems and contexts of the site, and asked them to assess the novelty and appropriateness of the design outputs' form and color, which means uses or compositions of hued materials, as the results of problem-solving. Authors emphasized that they should consider the problem-solving, rather than merely the appearance of the outputs. In addition, authors asked the judges to focus on the evaluation of novelty and appropriateness, and not on other factors, such as the technical quality of the sketches, or personal favorite styles. In order to compare the congruent and incongruent groups, taking into account the variability among the judges, who repeatedly rated the outputs of the thirteen pairs, authors used two-way ANOVA (Analysis of Variance) with replication, which determines whether there is a statistically significant difference between the means in two groups. Specifically, two-way ANOVA with replication compared novelty and appropriateness scores between the congruent and incongruent aesthetic preference groups. Inter-rater reliability was calculated using Cronbach's alpha. The alpha coefficient was 0.701, indicating that the reliability among the 9 reviewers is reasonably acceptable (Kaufman et al., 2008).

3.6 Retrospective Interviews

Retrospective interviews were conducted, to interpret the statistical analysis results of novelty and appropriateness evaluations, with respect to the outputs.
gathered from the congruent and incongruent aesthetic preference groups. Incongruent and congruent aesthetic preference groups participated in the interview. The interviews were conducted individually, for approximately twenty minutes.

The questions were as follows: (1) Is the design collaboration output novel? Which elements of your design do you think are novel? (2) Is the design collaboration output functionally appropriate? Which elements of your design do you think are appropriate? (3) Do you think that the collaboration with your partner contributed to the novelty and appropriateness of your design product? If yes, could you explain specific examples? (4) Have you had any conflicts or complications with your partner, during the design process? If so, what was the reason? If not, what makes the collaboration free of conflict? (5) Have you had any conflict or disagreement on the form and color of your proposal? If so, how did you reach a compromise?

4. Results
4.1 Novelty Assessment
The comparison of creativity factors using two-way ANOVA with replication failed to detect significant differences in novelty factors between the two groups, at the 0.05 significance level (p value) (Table 3). The novelty scores were subjected to a two-way ANOVA. The novelty scores of the two elements (form and color) between the congruent aesthetic preference group and the incongruent aesthetic preference group were not significantly different. Consequently, the analysis identified no significant difference in the average novelty scores between the congruent group and the incongruent group.

Table 3. Two-way ANOVA with Replication Results Comparing Means of the Congruent and Incongruent Aesthetic Preference Groups

|                      | Congruent group | Incongruent group | F (1,99) | p     |
|----------------------|-----------------|-------------------|---------|-------|
| Novelty              |                 |                   |         |       |
| Form                 | 4.87 (1.14)     | 4.76 (1.01)       | 0.35    | 0.557 |
| Color                | 4.75 (1.09)     | 4.65 (1.14)       | 0.24    | 0.629 |
| Average              | 4.81 (0.99)     | 4.70 (0.97)       | 0.36    | 0.549 |
| Appropriateness      |                 |                   |         |       |
| Form                 | 4.87 (0.99)     | 4.35 (0.80)       | 11.54   | 0.001 |
| Color                | 4.60 (1.04)     | 4.15 (0.94)       | 6.76    | 0.011 |
| Average              | 4.74 (0.95)     | 4.25 (0.73)       | 11.29   | 0.001 |

4.2 Appropriateness Assessment
The appropriateness factor scores of the congruent aesthetic preference group were statistically higher, than those of the incongruent aesthetic preference group, at the 0.05 significance level (Table 3). The congruent aesthetic group's two appropriateness scores (form and color) were statistically higher, than those of the incongruent aesthetic preference group. The average appropriateness score of the congruent group was statistically significantly higher, than that of the incongruent group.

4.3 Interpreting the Conflicts and Shared Mental Models
4.3.1 Conflicts and Shared Mental Models of the Congruent Aesthetic Preference Group
The interviewees in the congruent aesthetic group reported that they regarded their partners' proposals as a contribution to enhancing the novelty of their design solutions. They interpreted their partner's abstract adjectives, such as "neat" and "clean", which describe conditions of form, without challenge. In addition, the interviews indicated that the congruent aesthetic preference groups were inclined to accept their partners' proposals, without different opinions and conflicts. Additionally, the participants also distributed design tasks, and mutually integrated the distributed work.

Deduced from the interviews, authors assumed that the participants in the congruent aesthetic groups perhaps established the mental team models with high sharedness and shared importance. The sharedness of a team mental model is influenced by the overlapping knowledge of collaborators (Klimoski and Mohammed, 1994). Since the participants preferred similar design vocabularies, the participants perhaps possessed overlapping knowledge and interest of particular types of design inventory.

Authors also deduced that the congruent aesthetic preference of designers was perhaps relevant to a shared cognitive filter. A noticeable role of mental models is to efficiently filter and reconstruct new information. The shared cognitive filter indicated that the participants built up shared decision-making criteria, to judge and discern the importance of tasks.

Among the five team mental models (Neumann et al., 2006), these interviews found that the participants in the congruent aesthetic preference group at least built up a competence model that shared task acceptance and the expected quality of outputs, and a process model that mutually managed and distributed tasks.

4.3.2 Conflicts and Shared Mental Models of the Incongruent Aesthetic Preference Group
In contrast, the interviewees in the incongruent aesthetic preference group reported that they had spent time and effort to understand the other partner's design intentions. Authors deduced that the reason was that they did not possess overlapping knowledge on the design inventory, and thus they interpreted the partner's adverbs differently, or could not imagine the terms' visual shapes. In addition, when one represented her design inventory, the other disliked the form and color that the partner expected. The cognitive insonance about the expected quality of solutions filtered each one's design vocabularies, and thus may have obstructed building up a shared mental model.

The lack of overlapping knowledge, and the different cognitive filter to judge the design quality, may have hampered building up a shared mental model; and thus it obstructed the task performance, in the search for creative solutions.
In addition, in collaboration, the interviewees were aware that they had different preferences in design vocabularies from the partner, and experienced salient conflicts. They described that the nature of conflict arising from the incongruent aesthetic preferences was hard to resolve by rational explanation. Therefore, as one way to manage the conflict and maintain their social relationship, one partner gave up her preferred design vocabularies, and passively accepted the other partner’s proposal; or one took charge of the aesthetic part, while the other supported the functionality of the part. Generally, the interviewees in the incongruent aesthetic group reported that they mainly discussed the appropriateness of the design, rather than its novelty. When a participant disliked the other partner’s proposed form and material, a rational way to express their objection was to make criticisms of their appropriateness.

In consequence, the miscommunication and inconsonant filters in sharing mental models was perhaps one reason why the incongruent aesthetic preference group did not produce more novel and appropriate solutions, compared to the other group. In addition, the statistical results were relevant to the nature of conflict arising from aesthetic preference, which was incomunicable in rational discussion, and thus the communication barriers caused the avoiding and accommodating of conflicts.

5. Discussion and Conclusions

5.1 Is Diversity Always Good for Creativity in Collaboration?

It is true that many previous co-design and creative collaboration studies proved that diversity among team members facilitates the production of a creative solution (Jehn, 1997; Badke-Schaub et al., 2010; De Dreu and Nijstad, 2008). Interestingly, our findings were different from those of previous studies. Why were the results in our study different from the research precedents?

One reason perhaps rests on the assumption that the nature of conflict between the previous studies and the present study was different. In the interpretation of interviews, authors assumed that the nature of conflict arising from the different aesthetic preference was close to affective conflict, rather than cognitive conflict. The nature of conflict arising from aesthetic preference was perhaps initially involved in cognitive conflict, when the participants were aware of the different preference. However, since the aesthetic preference was not easily shareable, such conflict rapidly turned to affective or process conflict.

While the findings of this study were different from the previous studies focused on the effects of conflict, several mental model studies emphasized that the similarity of mental models has a positive effect on performance and interdependence among collaborators (Marks et al., 2002). In addition, those studies argued that some kinds of knowledge should be shared. Extended to the mental model studies, authors can deduce that the congruency of aesthetic preference among designers may have a lesser risk for performance, in the search for novel and appropriate solutions. When the preference level-filters of designers do not collide with each other, their diverse knowledge, expertise, and skill may enhance the production of creative solutions.

5.2 Limitation and Future Research

The number of teams in the present study was relatively small. This study was based on the rigorous processes of grouping: aesthetic preference test and personality test. Consequently, while more numbers of class students were involved in the experiment, only twenty-six students satisfied both tests for team-up. However, this study recruited a greater number (nine) of judges than CAT standard (Kaufman et al., 2008). In addition, while this study teamed up only two persons, the pair-type of creative collaboration was not limited to demonstrate the relationships between aesthetic preferences, creativity, and arising conflicts and mental model construction. In previous creative collaboration studies, the pair-type of collaboration was widely accepted to investigate the impacts of collaboration on creativity (John-Steiner, 2000; Fernie, 2006). In addition, the pair-type of collaboration is perhaps succinct to control and prevent social and power dynamics, caused from many participants’ involvements (Pearsall et al., 2008). In addition, this study only focused on urban and street furniture design, and thus it is unknown whether the results are generalizable to other forms of design. Next, the participants of this study were undergraduate students, and again it is also unknown whether the results can be generalized to more experienced designers. As explained in the method section, authors only relied on retrospective interviews for interpretation, without recoding the collaborative processes, to screen the experiments. Future studies will examine the listed limitations. In addition, while this study examined the short-term exposure of aesthetic preference to the collaborators, it is worthwhile to investigate ways in which the long-term exposure to incongruent aesthetic preference influences the production of creative solutions.

5.3 Implications and Contribution

Despite the above limitations, this study proposed a novel theoretical frame, research methods, and relevant empirical results to comprehend the influence of aesthetic preferences on the production of creative solutions in design collaboration, in reflection of the conflict and mental model theories. This issue has not been treated hitherto in the collaborative design studies. Based on the findings of this study, in short-term design collaboration, when the design products need to be appropriate and functional, it may be a less
risky condition that the collaborators share congruent aesthetic preference. In addition, when a design task requires high collaboration performance, like less affective and process conflicts, fluent procedure, efficient management, and interdependency, it is recommended that designers who possess similar aesthetic preference be teamed up. While this study failed to find whether the congruency of aesthetic preference among designers promotes the production of novel outputs, or not, deduced from the previous conflict and mental model theories, designers can provide better novel solutions, when they share similar aesthetic preference, yet possess diverse knowledge, expertise, and skills. This means that diversity within the congruent preference perhaps prevents unconstructive conflicts, and provides more opportunities to complement each other, in the search for novel and appropriate solutions. The results of this study can also be extended to understand the nature of conflict arising from the incongruence of other types of perceptual preference, and thus they are available for conflict management in the design industry.

Acknowledgments

This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Korean government (MSIP) (2013R1A1A1057772). This work was also supported by the National Research Foundation of Korea grant funded by the Korean government (MSIP) (NRF-2010-0028693).

References

1) Amabile, T. M. (1996) Creativity in context. Boulder, CO: Westview Press.
2) Amason, A. C. and Sapienza, H. J. (1997) The effects of top management team size and interaction norms on cognitive and affective conflict. Journal of Management, 23 (4), pp.495-516.
3) Arnetz, R. (1971) Art and visual perception. Berkeley, CA: University of California Press.
4) Badke-Schaub, P., Goldschmidt, G. and Meijer, M. (2010) How does cognitive conflict in design teams support the development of creative ideas?. Creativity and Innovation Management, 19 (2), pp.119-133.
5) Badke-Schaub, P., Neumann, A., Lauche, K. and Mohammed, S. (2007) Mental models in design teams: A valid approach to performance in design collaboration? CoDesign, 3 (1), pp.5-20.
6) Baer, J. (1997) Gender differences in the effects of anticipated evaluation on creativity. Creativity Research Journal, 10 (1), pp.25-31.
7) Baer, J. and Kaufman, J.C. (2008) Gender difference in creativity. Journal of Creative Behavior, 42 (2), pp.75-105.
8) Bar, M. and Neta, M. (2006) Humans prefer curved visual objects. Psychological Science, 17, pp.645-648.
9) Carnevale, P. J. and Probst, T. M. (1998) Social values and social conflict in creative problem solving and categorization. Journal of Personality and Social Psychology, 74, pp.1300-1309.
10) Costa, P. T. Jr. and McCrae, R. R. (1992) Revised NEO personality inventory (NEO-PI-R) and NEO five-factor inventory (NEO-FFI) professional manual. Odessa, FL: Psychological Assessment Resources.
11) De Dreu, C. K. W. and Nijstad, B. A. (2008) Mental set and creative thought in social conflict: Threat rigidity versus motivated focus. Journal of personality and social psychology, 95 (3), pp.648-661.
12) Fernie, J. (2006) Two Minds: Artists and Architects in Collaboration. London, Black Dog Publishing.
13) Goldschmidt, G. and Sever, A. L. (2010) Inspiring design ideas with texts. Design Studies, 32, pp.139-155.
14) Goldschmidt, G. (2007) To see eye to eye: The role of visual representation in building shared mental models in design teams. CoDesign, 3 (1), pp.43-50.
15) Hartmann, J. (2006) Assessing the attractiveness of interactive systems. CHI’06 Extended Abstracts on Human Factors in Computing Systems, pp.1755-1758.
16) Isaksen, S.G. and Ekvall, G. (2010) Managing for innovation: The two faces of tension in creative climates. Creativity and Innovation Management, 19 (2), pp.73-88.
17) Jehn, K. A. (1995) A multimethod examination of the benefits and determents of intragroup conflict. Administrative Science Quarterly, 40, pp.256-282.
18) Jehn, K. A. (1997) A Qualitative Analysis of Conflict Types and Dimensions in Organizational Groups. Administrative Science Quarterly, 42, pp.530-537.
19) Jehn, K. A. and Mannix, E. (2001) The dynamic nature of conflict: A longitudinal study of intra-group conflict and group performance. Academy of Management Journal, 44, pp.238-251.
20) John-Steiner, V. (2000) Creative collaboration. New York, NY: Oxford University Press.
21) Kalay, Y. E. (2004) Architecture's new media: Principles, theories, and methods of computer-aided design. Cambridge, MA: The MIT Press.
22) Kaufman, J. C., and Sternberg, R.J. (2000). The Cambridge handbook of creativity. New York, NY: Cambridge University Press.
23) Kaufman, J. C., Plucker, J. A. and Baer, J. (2008) Essentials of creativity assessment. Hoboken, NJ: John Wiley & Sons, Inc.
24) Klimoski, R. and Mohammed, S. (1994) Team mental model – construct or metaphor. Journal of Management, 20 (2), pp.403-437.
25) Lim, B.C. and Klein, K.J. (2006) Team mental models and team performance: A field study of the effects of team mental model similarity and accuracy. Journal of Organizational Behavior, 27 (4), pp.403-418.
26) Lindauer, M.S., Orrwell, L. and Kelley, M.C. (2011) Aging artists on the creativity of their old age, Creativity Research Journal, 10 (2&3), pp.133-152.
27) Marks, M.A., Sabella, M.J. Burke, C.S. and Zaccaro, S. J. (2002) The impact of cross-training on team effectiveness. Journal of Applied Psychology, 87 (1), pp.3-13.
28) McWhinnie, H. J. (1968) A review of research on aesthetic measure. Acta Psychologica, 28, pp.363-375.
29) Neumann, A., Badke-Schaub, P. and Lauche, K. (2006) Measuring shared mental models in design teams. Proceeding of the 9th international design conference, pp.1491-1498.
30) Palmer, S. E., Schloss, K. B. and Sammartino, J. (2013) Visual aesthetics and human preference. Annual Review of Psychology, 64, pp.77-107.
31) Pearsall, M. J., Ellis, A. P. J., and Evans, J. M. (2008) Unlocking the effects of gender faultlines on team creativity: Is activation the key?. Journal of Applied Psychology, 93, pp.225-234.
32) Schloss, K. B. and Palmer, S. E. (2011) Aesthetic response to color combinations: Preference, harmony, and similarity. Attention, Perception & Psychophysics, 73, pp.551-571.
33) Styhre, A., and Gluch, P. (2009) Creativity and its discontents: professional ideology and creativity in architect work, Creativity and Innovation Management, 18 (3), pp.224-233.
34) Runco, M. A. and Jaeger, G. J. (2012) The standard definition of creativity. Creativity Research Journal, 24, pp.92-96.
35) Schrage, M. (1995) No more teams! Mastering the dynamics of creative collaboration. New York, NY: Doubleday.
36) Silvia, P. J. (2008) Discernment and creativity: How well can people identify their creative ideas?. Psychology of Aesthetics, Creativity, and the Arts, 2, pp.139-146.
37) Silvia, P. J. and Barona, C. M. (2009) Do people prefer curved objects? Angularity, expertise, and aesthetic preference. Empirical Studies of the Arts, 27, pp.25-42.