

# The Differences in Design Concept Thinking Outputs between Trans-disciplinary and Single-disciplinary Design Teams

Kuan Ping Huang \* Li Hui Lee \*\*

\* TAICHUNG, R.O.C, name92kimo@hotmail.com

\*\* TAICHUNG, R.O.C, lihui823@go.thu.edu.tw

**Abstract:** The field of sociology discusses the relation between people and the society. If there is a chance for sociologists to join a design team at the stage of product concept development, more social issues can be discussed. This research conducted an experiment to explore the effects and how it happened. There were respectively three experimental groups and three control groups. Each experimental group included three members, and two of them were sociology majors. All members in the control groups were design majors. Both the experimental and the control groups were given the same subject, which was “elder’s happiness”. Ultimately, this research probed it with the qualitative analysis and concluded two points: 1. The experimental groups comprehended the subject from multiple perspectives and discussed more about experiences and theories. The control groups focused more on their personal experiences, and their comprehension was simple; 2. The experimental groups paid more attentions to the relation between elders’ various backgrounds and their happiness, but the control groups did not.

**Key words:** *Sociology, trans-disciplinary, design thinking.*

## 1. Introduction

There have been different evaluations on viewing the outcomes of trans-disciplinary teams. Trans-disciplinary teams can inspire various achievements and creativity, bring forth diverse thinking contexts, and allow people to view things from multidisciplinary aspects than from one single viewpoint. However, the variety of backgrounds makes collaboration a challenging task for trans-disciplinary teams. Hence, further research is required.

The viewpoint of this research is to consider industrial design from a social perspective. Originally the field of design pays attention to the relation between products and the society and believes that products are designed to be used by people. In the field of sociology, Tim Plowman stated that many socialists criticized consumption a lot but gave little thought to the production aspect. Since there is a lack of close contact between socialists and designers, the potential contribution from socialists is limited. Accordingly, this research hypothesized that if there was a chance to have socialists join design teams at the stage of product concept development, more social issues could be discussed during the progress.

## 2. Literature Review

In order to know the differences in conceptual thinking between trans-disciplinary and single-disciplinary design teams, this research discussed and clarified the issue from the following two aspects. Firstly, it discussed

how sociology affected a design team. Secondly, it explored the methods of collaboration and essential factors required by a trans-disciplinary design team.

## **2.1 The Procedure and Medium of Introducing Social Sciences into Industrial Design**

The application of social sciences to industrial design is involved in three aspects: viewpoints, methods, and professionals. Social viewpoints give no direct help to the research of design. However, by understanding the relation between the society and products, a designer can tell the effects of a product on the society. In the aspect of social methods, ethnography is often mentioned in studies of design, and it is also utilized to discover problems and substantiate concepts, etc. Lastly, in terms of introducing professionals, IDEO emphasizes the importance of T-shaped professionals at the stage of problem identification, research and opportunities discovery.

## **2.2 Essential Factors for the Cooperation of Trans-disciplinary Design Team**

Some researchers point out five important elements of trans-disciplinary collaboration, and one of them is "interdependence". It means that the members must be aware of the roles they play and what they can contribute to the team. Regarding that there are rare chances for industrial designers and sociology professionals to cooperate with each other, it is suggested that researchers emphasize the perception about the contributions from the two fields. Based on the literature review, the research put emphasis on the aspect of trans-disciplinary teams and conducted an experiment to explore the features of thinking context of trans-disciplinary design team.

## **3. Research Method**

### **3.1 Experiment Design**

The research conducted an experiment to observe the development process of product concepts and explore the differences in thinking contexts between trans-disciplinary and single-disciplinary design teams. The experimental groups (trans-disciplinary design teams) and the control groups (single-disciplinary design teams) of the experiment were given a subject and required to develop product concepts. The process of the experiment was videotaped. In the end, the research discovered the differences by comparing the product concepts and discussion process of these two groups.

For the convenience of the experiment, this research selected students as design team members. There were three experimental groups and three control groups in order to discover their respective features in common. Since three make a group, each team was constituted with three members. Each experimental group was constituted with one industrial design major and two sociology majors since this research expected that the sociology majors could exert more effects on the team.

There are three key considerations for member selection:

- a. Team members should be graduate students (their major in college should be industrial design as well.) or senior students. The educational backgrounds of the experimental and control groups should be equal as much as possible in order to grasp the professionalism and thinking depth of members.
- b. In order to establish friendship quickly, the team members should be acquaintances to each other or should be extroverted in personality. Hence, members could start to discuss key points earlier, which would increase the reliability of the experiment.
- c. In order to simplify the experiment, some factors, such as genders, family backgrounds, and learning attitudes, were not taken into consideration.

Communication and trust in trans-disciplinary teams could not be established in a short term, thus this research focused on the differences in viewpoints and discussion sequences of different members and if any feedbacks were given to their statements. Time was not the most important factor when the experimental data was analyzed, and it was taken as the partial/uncontrolled factor.

	Group	Member 1 code	Member2 code	Member 3 code
Experimental Group	A	ID grad 1 d 1	SS senior s2	SS senior s3
	B	ID grad 2 d1	SS PHD s2	SS grad 2 s3
	C	ID grad 4 d 1	SS grad 3 s2	SS senior s3
Control Group	A'	ID grad 3 d 1	ID grad 1 d 2	ID grad 1 d 3
	B'	ID grad 4 d1	ID senior d2	ID senior d3
	C'	ID senior d1	ID senior d2	ID senior d3

Figure.1 Member's information

### 3.2 Experiment Subject and the Principles of Selection

- (1) This research chose a topic which has been frequently discussed in the fields of industrial design and sociology. It was reckoned that the students were likely to contribute more opinions about the topic.
- (2) In order to highlight the differences between the two fields, this research was designed on a future-oriented basis. For example: In an aging society, the leisure demands and leisure satisfaction of elders should be paid more attentions to, and the products should be designed to promote the value of life.
- (3) For the convenience of data analysis, the subject was restricted to product. Eventually, the subject was determined as "Elder's Happiness –Design Leisure Products"
- (4) The purpose of the retrospective questionnaire was to further understand members' individual differences and patterns of thinking.

### 3.3 Experiment Procedure, Time, and Location

Experimental equipment and environment: The experiment took place in a 144-square-foot room equipped with four long tables, ten chairs, one video recorder, and one laptop computer.

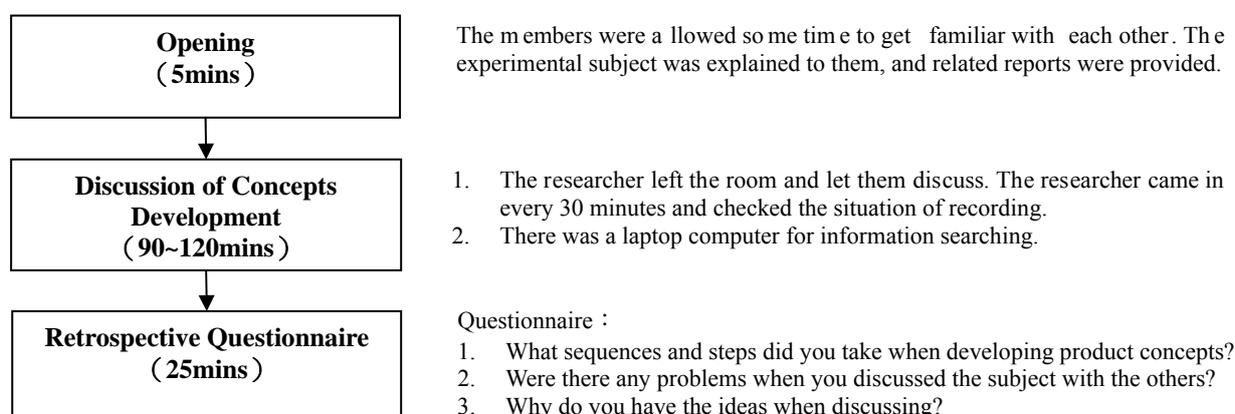


Figure.2 Experiment steps

※Considering that the time needed by concept development was not easy to be controlled, and that there were different extents of familiarity among members, this research did not set time limit. Basically members were allowed to complete the process within 1.5 to 2.5 hours.

### 3.4 Experiment Results

The experiment data includes "the transcription of the recorded experiment procedure", "the retrospective questionnaire", and "the product concept sketches". Part of the contents of the "transcription of the recorded experiment procedure" and the "retrospective questionnaire" were included in the "experiment analysis". The following figures indicate concept directions, and the titles of product concepts (Figure. 3), and product concept sketches (Figure. 4):

Group	Concept Direction	Concept 1	Concept 2	Concept 3	Concept 4
Exp. Gro. A	The focuses in elders' lives	Diet vegetable sprouts	(stage) competition karaoke machine	Image & video controller	none
Exp. Gro. B	Companionship, self-fulfillment	Time Jewel Box	none no	ne	none
Exp. Gro. C	Psychology, outdoor fitness equipment	Interesting massage chair	none no	ne	none
Con. Gro. A'	Communication, creating new things	Plant container	none	none	none
Con. Gro. B'	Hobbies, self-fulfillment	New generation elder applaud machine	none no	ne	none
Con. Gro. C'	Sense of security, communication and companionship	Electric petri dish	Digital wallet	seat	Reaction stickers

Figure.3 Concept direction and title of product concepts

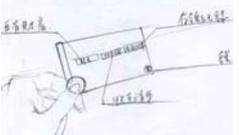
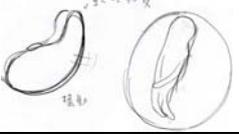
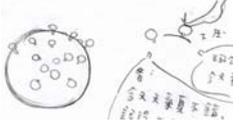
Title	Concept sketch	Title	Concept sketch	Title	Concept sketch
Diet vegetable sprouts		Interesting massage chair		Digital wallet	
(stage) competition karaoke machine		Plant container		seat	
Image & video controller	1. About the size of an iPod, not too heavy. Buttons on the keypad should be big and easy to press. 2. With a neck strap in case of the hand fatigue caused by holding the controller over long period	New generation elder applaud machine		Voice companion	
Time Jewel Box		Electric petri dish		Reaction stickers	

Figure.4 Concept Developing Sketch

## **4. Experimental Outcome Analysis**

### **4.1 Definitions of Terms of Thinking Context**

It was the discussion process taking place before design concept, and this research classified the discussion process into thinking concept steps. Furthermore, this research integrated the thinking contexts of the three experimental groups and created a “mutual thinking context”. If two out of the three groups (the majority) followed a particular step, the step was included into the mutual thinking context of the experimental groups. The same principle was applied to the control groups.

This research integrated the discussion process during the experiment and divided it into several steps. Each step represented the goal of discussion.

#### **“Defining subject”**

At the beginning of the experiment, if the members had any doubt about the subject or what they were going to do, they redefined the subject from their own perspectives or consulted the other members in order to understand the subject clearly.

#### **“Cross-disciplinary communication (only in experiment groups)”**

Cross-disciplinary communication took place only in the experiment groups. There were both sociology and industrial design majors in the experimental groups, so the members were given the chance to exchange their ideas. Cross-disciplinary communication allowed people with different learning backgrounds to know more about the others' knowledge or personal characteristics (because personal characteristics were internalized during knowledge learning). Both knowledge and personal characteristics were considered during the cross-disciplinary communication.

#### **“Proposing departure points of thinking” and “starting discussion”**

The entire procedure from the start to the end of discussion could be defined as “discussion process”. This research particularly highlighted the beginning of the process when “the departure points of thinking” was proposed because it found that it was a key point about how people from different fields initiated the discussion. The discussion process was divided into two steps: “propose departure points of thinking” and “start discussion”.

#### **“Converging”**

This step reduced the large amount of ideas or concepts through selection or integration..

#### **“Confirming product concept direction”**

Before forming products concepts, related problems should be clarified. Considering that there were so many causes and influential factors of a problem, and that it was impossible to solve all problems in one single product concept, it was necessary to screen and induce several important directions, which were called product concept directions.

#### **“Substantiating concepts”**

This step substantiated abstract ideas and made them become concrete concepts.

#### **“Sketch concepts”**

This step sketched product concepts. The product concepts were not finalized yet in this step, and the appearances and functions of products required modifications, so the sketch of product concepts at this stage was called concept sketch.

Experimental group ( trans-sociology )				
Group A	Group B	Group C	Mutual thinking context	
Confirm the subject	Recognize subject & confirm direction	Confirm what to do in the experiment	Confirm what to do in the experiment	
The elder's pleasure (to several parts)	SF ask for ID some experience	SF presents after ID	Different field communication	
ID ask SF about "live alone"	SF presents their opinions			
Personal hobbies of design	ID turns to subject "Leisure"	Start : Space, festival	The start of thinking	
SF's perception of ID	ID : accompany	ID : accompany	Perception to the other side	
SF's opinion: factors of elder's happiness	SF concrete their original concept	ID : Internet survey		
SF's concern: spirits of elder' happiness		ID : Ask what society field is	Inter-discussion	
Product direction : Creating life focus	Concept concrete : —usability		Product concept direction decided	
Concept development	Concept Product -vization	Concept development : SF (free thinking)	Concept development	
			Concept concrete	
Concept Sketch	Concept Sketch	Concept Sketch	Concept Sketch	

Figure.5 : Thinking context analysis (control groups)

Thinking context analyze ( control group )				
Group A'	Group B'	Group C'	Mutual context	
Confirm that what is need to be achieved	Confirm the subject	The topics are connected to the products straightly	Confirm the subject	
To separate subject into several parts	Brainstorming	Point cut : daily life	The start of thinking	
The reasons of unhappiness	The reasons of unhappiness	1. Concluding the identity of elder	Inter-discussion	
Thinking about what can make elder happy	The reasons of happiness	2. Find out one can be developed continuing		
The reason of feeling illness	Leisure activity			
To associate "elder" in thinking	Internet survey		Convergence	
How the elders take their leisure time	Convergence	Convergence	Product concept direction confirm	
Awareness			Concept development	
Product concept : Creating, planting	Product concept : Interest, fulfillment	Product concept : Communication, safety	Concept development	
Concept development : receptacle(Modular)	Concept development : Game machine	Classification : communicate	Concept development	
Concept concreted : Function	Concept concreted	Classification : Safety		
Design conditions : Planting scope, all		Concept development		
Awareness			Concept Sketch	
Concept Sketch	Concept Sketch	Concept Sketch	Concept Sketch	

Figure 6 : Thinking context analysis (experimental groups)

## 4.2 Thinking Context Analysis

It was discovered from the analysis that basically the thinking contexts of the control groups A', B', and C' were similar, but the thinking contexts of the experimental groups were quite different from one another. The comparisons between the experimental groups and the control groups were divided into three parts, "the steps followed both by the experimental groups and control groups", "steps followed only by the experimental groups", and "steps followed only by the control groups".

### (1) The steps followed both by the experimental groups and control groups

To make a further description of the divergence and the same parts among these items

#### a. Confirming Subject

Both the experimental groups and the control groups confirmed the subject at the beginning.

#### b. Deciding the points of departure

When deciding the points of departure, the control groups used brain storming. Two of the control groups started by considering "the reasons why elders were unhappy", and the other control group considered "elders' daily lives" (the group reckoned that elders would not easily change their behavior, so they began from the elders' daily lives). The experimental groups, on the other hand, started discussions right away without using any particular design methods. Experimental group A started by considering "elders' happiness" (proposed by d1). The other two Experimental groups, based on their own experiences with the elders in the families, discussed the social systems regarding the lack of leisure space for elders in Taiwan.

It was discovered that members with sociology background could help industrial design majors to understand those whom they designed products for. For example, the experimental group C's s2 had knowledge about elders' average age, which was helpful to the discussion of elders' lives.

#### c. Starting discussion

(a) During the discussion, members with sociology background pointed out many details not preset, trying to explore the subject in a more specific manner. For example, one of the sociology majors in experimental group A asked "What is your so-called elders when you talk about elders' happiness?"; "do the elders live with their families or live alone"; and "do they have dynamic or static leisure activities?" The sociology majors believed that different backgrounds affected people differently, so they wanted to consider these details before starting discussion. Members with design background were more general in these settings. For example, the elders they referred to included both those who lived alone and those who lived with the families, and they would set conditions like: "the elders we talk about should be active, healthy, and do not have severe illnesses", "the leisure activities they take can be both dynamic and static", etc. The industrial design majors emphasized creative thinking, and they were not in a hurry to explain, categorize, or organize. Therefore, they could keep their minds open and free, accept all possibilities calmly, and generate new ideas eventually. The industrial design majors emphasized horizontal thinking and considered things from a more general aspect. If there were any conditions to be preset, these conditions were usually related to physical and psychological aspects and scarcely about social relationships.

Experimental group C's s1 believed it would be easier to design household appliances. The members with sociology background thought the abstract terms, "happiness" and "leisure", were too original. However, the purpose of using these terms for the subject was to have group members bring their talents into full play. Nevertheless, it seemed that it was easier for members with sociology background if they were given a decided product type.

(b) Members with sociology background proposed that elders wanted to make their memories become culture assets and pass them on to the next generation.

The research inferred that the Experimental Group B's s1 proposed to regard elders' oral memories as cultural assets because it was related to her learning background.

- The Experimental Group B's s1 proposed to integrate elder safety reporting system to product concept ; the Experimental Group C's s2 proposed to combine medical care to product concept.
- Two out of the three experimental groups proposed the product concepts should be integrated with elder security system since it was important for elders' health. However, experimental group B's d1 believed if the product was integrated with the system, it became a social product did not fit the subject of this experiment. However, experimental group B's s2 believed it was important to consider the health of elders, so it was necessary to combine elements of medical care into the product. However, s1 and d1 disagreed with it. They asserted that leisure should stress on psychological happiness instead of guidance and assistance. Facing the divergent opinions, d1 comforted s2 by letting him know that his idea was also a way of thinking. However, d1 was also favored the idea that the product concepts should fit the subject of leisure.
- At the stage of deciding concept directions: there were various ideas and it was hard to decide one.

Experimental group B's s1 repeatedly mentioned that the subject was very difficult. s1 proposed a wide variety of ideas such as space, festival, game, baseball experience center, virtual dragon boat competition, bicycle, small mountain, the existing equipment and facilities in the park. However, she could not settle on any of the directions, so she was unable to make the discussion contents become organized and consistent. Experimental group C's d1 helped the others to come back on track and continue when the discussion departed from the subject.

- When searching information on the Internet, experimental group used key phrases related to characteristics of elders' lives, society systems. The control groups referred to existing products.

Experimental group C's d1 looked for information about characteristics of elders' daily lives and leisure products for elders, which supported their ideas generated during the discussion process.

- The control groups thought from the aspect of products right at the beginning, but the discussion of the experimental was guided by the members with design background step by step

In experimental group A, d1 led the discussion process. s1's and s2's learning background was more related to theories, so they focused less on product design. Therefore, in a trans-disciplinary team, the member with design background should be the one who reminds the other members of the subject and the products. At beginning, during, and at the end of the discussion, d1 asked several questions, such as: "what products did you have in mind as soon as you were giving the subject?", "what products did you want to design when you knew the subject?", and "let's us think about what products we should design".

Originally, experimental group B's d1 wanted to guide the discussion direction back to the subject of leisure, so he proposed his experience about an elder's happiness. His experience is about a school principal in Gukeng who gained the self-achievement by planting coffee trees. s1 responded to d1's idea and shared a similar case in Japan. In this case, a group of elder tree experts were respected and valued despite their old ages. But s2 pointed out that things might be different in different types of occupations. She believed that some jobs like those related to literatures or business were not likely to be life-long occupations. She also pointed out that, unlike Japan, there were fewer rural areas in Taiwan, so very few elders in Taiwan could live the life like that of the elders in

Japan. At this point, the discussion departed from the leisure aspect, so s1 continued the original concept about the retrospect of personal history. Not until the stage of substantiating products did the experimental group B integrate leisure functions into product concepts, and it was not a very good way to achieve design purpose. Hence, for trans-disciplinary cooperation, it is necessary to emphasize the consistency of design purposes and the design directions.

Experimental group C discussed the lack of leisure space for elders, which was one of the issues in social welfare system. s1 focused only on the lack of leisure space for elders and kept stressing that homes for elderly people were not a leisure space. However, d1, with her professional background, integrated this particular issue to product design and proposed the idea of designing leisure facilities for elders.

#### **d. Confirming product directions**

During the discussion, the experimental groups stuck to one concept and discussed along with this concept; they did not separate the process into the two stages of “confirming product direction” and “developing product concept”. On the contrary, the control groups, with their design background, confirmed product direction at the beginning” and then developed product concept, and usually they developed several product concepts.

#### **e. Developing product concepts**

By comparing the concept thinking outputs, there is no obvious difference between them.

#### **f. Substantiating concepts**

There were two ways to discuss product concepts. The first one was that the members confirmed product directions and then developed product concepts and details together. The second one was that after confirming product directions, the members developed their own concepts separately. The second way generated more concepts, but these concepts were not complete and detailed enough. Basically, both ways were adopted by the experimental and the control groups.

### **(2) Items only in experimental group**

#### **a. Both sides had bias with each other**

The members with design background knew very little about sociology, and the members with sociology background had prejudice against the field of design. The design majors did not understand the work of sociology majors and mixed them up with social workers. The members with sociology background in experimental group A explained the differences between sociology and social works: “Sociology discusses ordinary issues in people’s daily lives from different perspectives. Social workers visit elders in homes for elderly people, and sociologists explore the situation of elders.” Regarding their conception of the field of design, the members with sociology background in experimental group B admitted that they knew nothing about design at all.

The members with design background in experimental group C’s d1 asked those with sociology background, “what do sociologists research?”, and the question came right after they search on the Internet. The researcher reckoned that the members wondered the purpose of trans-disciplinary cooperation and wanted to know more about sociology and how sociologists could contribute to the design.

#### **b. Exchanging knowledge is helpful to the field of design**

Past studies have indicated that the more people from the two fields understand each other, the easier it is for trans-disciplinary cooperation. There were very few chances for trans-disciplinary cooperation between the fields

of sociology and design. After this experiment, the researcher came to know more about what problems might emerge during the actual contact between people from different backgrounds.

### **c. Good collaborative interaction**

When it came to trans-disciplinary cooperation, members from the two fields tended to consider things from their respective professionalism. In the experimental groups B and C, the members with sociology background considered that they knew elders better and developed product concepts actively. However, they knew little about product design, so they consulted those with design background before providing their own opinions. The members with design background also offered professional helps when it saw fit. The cooperation basically went very well.

### **(3) Steps followed only by the control groups**

#### **Convergence**

Both control groups B and C used brainstorming, which generated many ideas. Therefore, converge these ideas was necessary.

## **4.3 Sub-conclusions**

This research conducted a preliminary comparative analysis on the respective thinking contexts of the experimental and the control groups. It was discovered that there were many differences between trans-disciplinary and single-disciplinary design teams. However, the difference in viewpoints was not concrete enough. It is suggested that future research adopt the ground theory, re-analyze research contents, induce research types, and demonstrate the differences between the two kinds of design teams in a more systematic manner. It is expected that future research can more specifically understand sociologists' contributions to design teams, and that the topic of "having sociologists join design teams" can be continued to be studied to realize the ideal of "design for the society".

## **5. Conclusions**

This research conducted a preliminary comparative analysis on the respective thinking contexts of the experimental and the control groups. It was discovered that there were many differences between trans-disciplinary and single-disciplinary design teams. However, the difference in viewpoints was not concrete enough. It is suggested that future research adopt the ground theory, re-analyze research contents, induce research types, and demonstrate the differences between the two kinds of design teams in a more systematic manner. It is expected that future research can more specifically understand sociologists' contributions to design teams, and that the topic of "having sociologists join design teams" can be continued to be studied to realize the ideal of "design for the society".

## **6. References and Citations**

- [1] Tim Plowman(2003), "Ethnography and Critical Design Practice", Design Research.
- [2] Stefano Marzano (1990), 《飛利浦設計：價值創造者》，王鴻祥譯，台北，田園。
- [3] Tom Kelly (2002), 《IDEO 物語》，徐峰志譯，台北，大塊文化。
- [4] 單承剛、何明泉 (2002), 《設計經理人與跨領域設計團隊之傳達研究》，台北，設計學報。