dJOE: design Jigsaw On sitE

A Computational Interface of Displacing Ideas in the Design Productive Process

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Abstract. Design is similar to figure out of displacing jigsaw. Designer often inspires from figures of site. Mobile facility is convenient in nowadays, design is not an activity beside desk anymore. In this paper, We attempt to develop a mobile application to assist designer to understand the underlying structure of assembling ideas in the early design productive process. Designer can use this tool for displacing ideas as playing jigsaw in time.

Keywords: jigsaw, displacing, puzzle making, mobile, design on site.

1 Design as Jigsaw

Design process as a complex human artifact combines both creative and logic ability. Addition to scientific approach, regarding design as a puzzle-making process (Archea 1987) is a common framework in design researches. Consequently, Chang(2004) tried to use puzzle, the game, to model the interaction sequences between designers and their artifacts—design. One observation is that designers often decompose the design into different attributes, and then use specific rules to organize the different attributes in their design spaces(Mitchell,1990). This is similar to put together the pieces of puzzles to try to define the problem. Such as during a process of puzzle-making, a designer often applies the combinational rules to organize different attributes within ideas based on their relationships within the puzzle-like design space for defining problems.

Further, Design Puzzles classified by (Chang, 2004) map the operation of puzzle games onto specific types of design problems that have the characteristics of puzzle game as well as some specific design process. Among those, jigsaw is one of frequently used design puzzles that can support the purpose of this research. The mapping between jigsaw and design is simple. The player will recognize the attributes such as shapes, colors, images from vast amounts of jigsaw pieces, and then assemble the jigsaw pieces through grouping, matching and combining (Lo, Lai and Chang, 2010&2011). Then by assembling these pieces, a design or a design-like outcome can

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then be generated. Following this mapping, this research starts to apply jigsaw onto design process and explore possible design aid around this type of process.

2 The Features of Site as a Key of Jigsaw

Following the jigsaw metaphor, the features of jigsaw will be important for inspiring players. Similarly, designers often use feature on site as metaphor for their design inspiration in the early stage of design. Design outcome also inspired by feature of site. For example, the design of Sydney Opera House is affected by sailing stop by Darling harbor. Architect Toyo Ito analogs tree shape at Omotesandou in Tokyo as concept to design form and structure of Tod Flag store (figure 1).

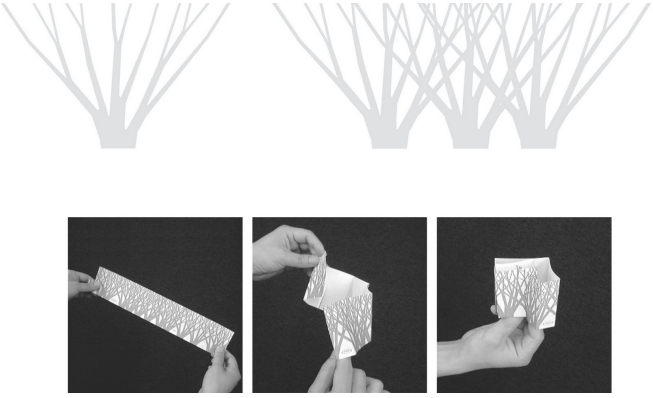


Fig. 1. The inspiration of Tod Flag store

Through the clues of site to link knowledge that metaphor reveals, designers can understand the relationships between diverse ideas and design outcomes (Antoniades, 1992). Schon (1966) points out that designers often apply metaphor to displace different ideas. This is done to solve design problems through linking their constructive knowledge in their memory. Antoniades (1990) argued that designers use the phrase "architecture is . . ." to link and generate ideas. By using the phase effectively in the design process, designers can have creative design outcomes.

Oxman (2004) claimed that only through a concept structure of the entire knowledge linking network can we understand the analogy reasoning pattern in the thinking process. For this reason, the objective of this research is to explore these linking patterns by discovering the displacement process used by designers.

3 Displacing Design as Figure Out of Jigsaw

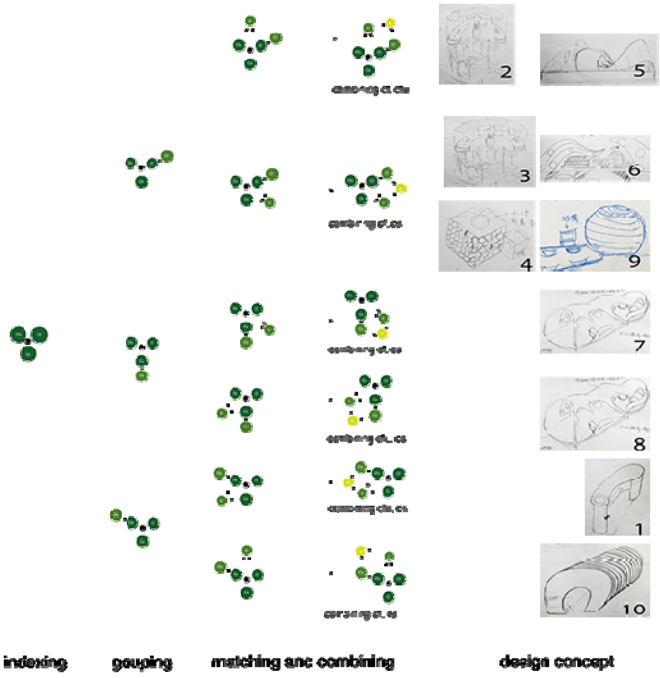
In order to understand the jigsaw-making process and its corresponded displacing design process of participants during design, we conduct an experimental observation.

It aims to probe into the structure of the relationship between portion of idea, called *idea pieces* (IP), combinations, to observe how ten participants translate scattered ideas into vast amount of co-related IPs. Thus using jigsaw metaphor, for finding the underlying structure of displacement via mapping the linking behavior, this research applies a graph-like knowledge structure mapping mechanism and an observation method with a design tool DIM (Dynamic Idea Map) over the experiment. DIM based on the ICF schemata proposed by Oxman (2004). An Map composes of IPs and the similarity linking relationships among IP. Each IP includes three attributes. They are Issue (I), Concept (C) and Form (F) which are represented and visualized by keywords, texts and image photos respectively. Further from the rule of metaphor (Ricour, 1963), we divided Concept into three arguments: form(Cf), function(Cfu), and structure(Cs). Designer is able to use conceptual sketches as a hint to understand design operation of displacing ideas.

4 Experimental Results

After the above-mentioned test, 10 design concepts were created by every participant within a 30 minute period. From the 10 IP jigsaws, each participant found an object that could be displaced by IPs. From translating the protocol analysis and analyzing the code and data, some patterns were observed (Table 1).

Table 1. the patterns of jigsaw-making process



Following the experiments outcome, design jigsaw-making process within the patterns include indexing, grouping, matching and combining as described below.

- Indexing: designer uses simple sketch to find out a key of site in order to apply the key as a clue of design.
- Grouping: IPs based on an Form (F) which is the key feature of site.
- Matching and Combining: IPs according to preferred values of concept- Cf, Cfu,Cs. Each design concept could gain several possibilities from the matching and combination of Cf, Cfu, Cs. The designers' self-limits can be exceeded by these possibilities, and the result of operation can be used as a new source of reference.

Therefore, a computational model called "Design Jigsaw" has been developed. This model supports designers to converge vast ideas effectively as well as reveal the constructive meaning within the graph-like knowledge structure of design thinking. From the observations, the way of designing is often similar to "put the jigsaw together".

5 Toward a dJOE Framework

With the scenario based on idea generation for site visiting, a mobile device for amplifying the displacement design process of idea generation is developed. The design Jigsaw On Site(dJOE) is a mobile interface combined LBS (location-based service) and AR(Augmented Reality) to assist designers produce linked and volume design concepts that are specific displacement of design jigsaw behaviors on site. The dJOE framework (seen in Figure 2) consists of eleven computational components. They are Log in, LBS, User data repository, Input, Indexing, Rule bases, IP Map repository, Dictionary, Grouping, Matching and Combination, AR. The workflow of a typical user query is explained as follows:

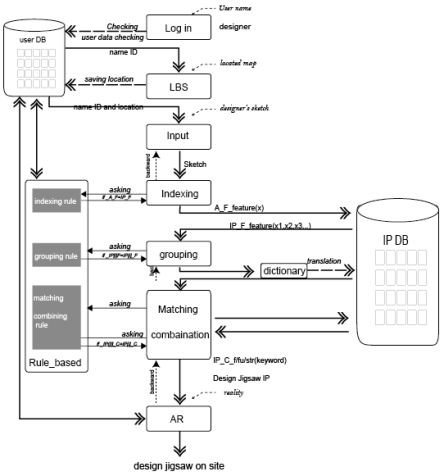


Fig. 2. The Architecture of dJOE

1. The user loges in and locates the site to confirm user's data and location record.
2. The user draws the feature of site on mobile device and tries to figure out the hint of jigsaw-like knowledge. Then the IPs cluster with the feature of F is indexed.
3. The user's index request is sent to the remote server. The server is designed to deal with computations such as grouping, matching and combing IPs.
4. There are twenty-seven possible design jigsaw outcomes will generate depend on user's choice and system's automatic suggestion.
5. Finally, return the result of IPs on site by AR to user's mobile device.

6 Mock Up of Interface of dJOE

For emphasized the design jigsaw mode of design process, we apply popularity tablet iPAD as platform of dJOE. The application written in Objective-C, combined with Google Map API and AR Layar API. The purpose of this tool is to assist designer to get volume linked concepts at once. This tool can be carried out in the investigation process on site. The interface operating step as Figure3:

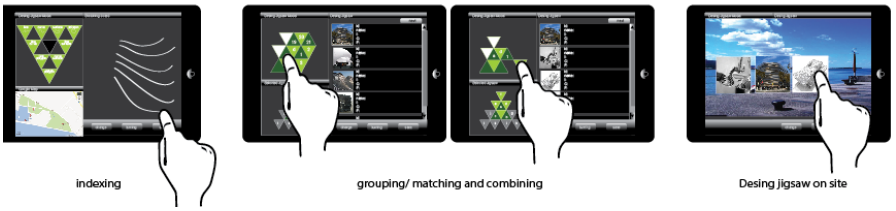


Fig. 3. The interface of dJOE

This interface allows designer records location by Google Map, sketching and indexing to get the first piece which contains many IPs of design jigsaw. Follow by grouping process to match and combine IPs by rules. Finally designer get a reference of IPs superimposed for real environment via AR.

7 Conclusion

How to displace the characteristic of site is an important ability of an architectural designer. The dJOE is an innovative idea of integrating computational tool for designer to understand the underlying structure of assembling ideas from a jigsaw-like knowledge on site. In this paper, we focus on how designer's process of displacing ideas in the design productive phase and how to represent it on interface. We are finalizing design jigsaw model of displacing process then the design Issue will reveal to aid designer define design problem. Therefore, we plan to conduct more surveys to test it in different location for collect more location-based design information in the future.

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