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SEARCH BEHAVIOR OF DESIGN INFORMATION FOR CONCEPT DEVELOPMENT

Ding-Bang Luh[1] and Tz-Ying Lin[2]

[1] Department of Industrial Design, National Cheng Kung University, Tainan, Taiwan, luhdb@mail.ncku.edu.tw

[2] Department of Industrial Design, National Cheng Kung University, Tainan, Taiwan, oobb1122@gmail.com

ABSTRACT:

Before starting to formulate design concepts, designers usually gather relevant information to explore design problems and facilitate concept development. The information can also be traced back in the later design stages. The information search is a behavior of comprehensive consideration, which differs from the specific search of design methods.

By exploring related theories, the research analyzes the factors that influence design information search behavior and constructs a general information search behavior structure (the general structure). Based on “organization features” and “personal experience”, eight interview subjects were selected from four design organizations, which were “professional design companies” and

“design departments within businesses” that design IT products and home appliances. One senior designer and one junior designer were selected from each of the four design organizations as interviewees. In-depth interviews were conducted through designed questionnaires. With the code analysis method in Grounded Theory and the Interpretive Structural Modeling approach, a behavior model of design information search (the designer structure) is established.

The designer structure has all the basic components of the general structure (such as internal factors of information demand, objectives of information demand, categorization of information demand, information scopes, sources of information, information acquisition methods, contexts, personal, job, environment, cost and effect, and least effort principle). In addition, it has eight specific components, namely: design target, action strategies, the determination of information categories, information contents, information features, information provided by clients, client features, and product features. The differences in behavioral process mainly occur in “information demand”, “action” and “influential factors”.

In general, the form of design organizations has significant impact on the search behavior of design information. The behavior of designers within businesses is affected by different individual motivations, cost and effect, and least effort principle. The research results can provide design information managers with the reference for information search planning and allow staff who develop design information database to better understand the factors and aspects involved in design information search behavior.

KEYWORDS: Design Information, Search Behavior, Design Knowledge Management, Grounded Theory, Interpretive Structural Modeling

1. INFORMATION SEARCH AS A CRUCIAL WORK BEFORE CONCEPT DEVELOPMENT

Experts point out that Information Systems Strategy is the key for businesses to improve efficacy, efficiency and competitiveness. (Galliers,1987; King, 1987; Sinclair, 1986; Agarwal, 1998). It also helps business survive and gain competitive advantages in the development of strategies (Levy & Powell, 2000). The construction of Information Search Systems (ISS) has major influence on business development (Galliers, 1991; Earl, 1996; Powell; 2000). Current researches focus on general industries (Blili, 1993; Hagmann, 1996; Yetton, 1994; Churchill, 1983). With the emphasis on creative economy and changes in industry structures, the demands for creative industries and

industrial product designs have emerged. Although Levy and Powell (2000) once explored the ISS of architectural design, architectural design and industrial designs have developed into two different professions. There is no obvious compatibility or similarities in content structure. In addition, related ISS literature concentrates on those in the middle and late stages of the production process. However, the key procedure lies in the front-end stage before the concepts of new products develop. This is also a crucial stage when industrial designers exercise their creativity. Concerned researches are rare and directly usable tools are lacking. Anderson and Newland (1997) explored deeply into language communications and knowledge exchanges. Yet product designers communicate with images, products, models, sounds, videos, conceptual codes in addition to language. Designers adopt methods of greater variety and differing nature. Given the great influence of ISS on the innovative design of industrial products before concept development, it is necessary to explore from the designers' viewpoints.

In design activities, "information search" is a general but important behavior. The design information management research report conducted by British Design Information Group (Crossland, 1996) points out that, when designers design, they spend up to 60% of the time looking for design information. The formation of core concepts in design activity requires information, experience and the ability to convert. As Roozenburg and Eekels (1995) suggest in a research on design procedure, designers form concepts based on the information they obtain, make product proposals, start the procedure and go on to turn the proposed ideas into substantial products. The information search before concept development is extensive and comprehensive. In the process of searching information, there are individual differences because each designer has his own considerations. With the passing of time and the accumulation of experience, designers will establish their own searching methods. Such individual differences affect design ability. Kuan (2001) believes that in the stage of concept formation, designers usually design under the interaction and manipulation of subjective experience and objective conditions. The ability to search design information has major influence on the quality of the concept generated at this stage. When designers are less good at searching information, the design ideas will be confined to limited knowledge and experience. If designers acquire better search ability and higher flexibility, they can come up with solutions beyond their original knowledge base and start the process of innovative development. This research explores the information search behavior under subjective and objective influences based on individual behavior. In the era of information explosion, understanding the design information search behavior and the factors it involves will help designers improve their efficacy in searching design information. Such understanding can

also help designers think about how to search information and form valuable concepts, so as to improve individual competitiveness.

2. LITERATURE REVIEW ON INFORMATION SEARCH BEHAVIOR

2. 1. INFORMATION DEMAND

Information search is a human “behavior”. Demand for information is the motivation for search behavior. Users must have a demand for information, otherwise they will not start searching. No matter through what sources, users must obtain the information before they can use information, satisfy their needs and complete a series of process , i.e., information demand- search- utilization- satisfied needs (Sheng, 2004). Krikelas (2001) believes that when individuals realize their knowledge is insufficient in coping with certain problems, information demand will occur. Bouazza (2002) thinks that information demand is a message generated by human system so that individuals can carry on with their work, research or motivation.

In addition to defining information demand, scholars also discuss information demand from different perspectives: Voigt (2001) categorizes the objectives of such demand into three categories, namely, to remain updated, to obtain certain information and to obtain all related information. Mike (2003) divides the functions of information demand into “application demand” and “nutrition demand”. The former seeks solutions to certain problems, while the latter aims to maintain the capability of individuals. Krikelas (2001) categorizes information demand according to the degree of urgency: “immediate demand” must be satisfied with immediate actions, while “demand that can be postponed” does not require immediate actions.

Through an overview on the definitions and categorizations of information demand, we can assert that information demand has four aspects: internal reasons, objectives, degree of urgency and scope of information. “Internal reasons” refer to individuals’ understanding of their insufficient knowledge, or the realization of clashes between their original knowledge and their ongoing mission, in which situations, information demand will occur. “Objectives” refer to demands from work, solving certain problems, making decisions, understanding certain things, maintaining individual capability and satisfying physical, emotional or cognitive needs. “Degree of urgency” depends on whether information demand can be satisfied immediately. “Scope of information” refers to certain information or all the related information.

2. 2. INFORMATION SEARCH BEHAVIOR

Behaviors conducted to satisfy information demand are information search behaviors. Fu (2004) points out that information search behaviors include the sources of information and the method of information search. Krikelas (2001) believes that information search behavior can be generated in two ways. The information already obtained or received can serve immediate needs due to the occurrence of events or environmental factors. Solutions can also be sought with external (literature review or direct personal contacts) or internal (observation or memories) methods. Ellis (2001) believes that Information search behavior is consisted of the following 8 activities: (1) Starting: the methods users adopt to start searching, such as asking other users; (2) Chaining: chaining the notes and abstract of the literature to their existing knowledge base; (3) Browsing: using semi-directed or semi-structured methods to search information; (4) Monitoring: keep searching for the latest information; (5) Differentiating: differentiating the sources of information and filtering all the information obtained; (6) Extracting: selecting related information among the information sources; (7) Verifying: verifying the accuracy of information, and (8) Ending: concluding the search behavior. Although the sequence of these activities are not specified, it can be understood that preliminary activities such as attention, contact, browsing, focus on new directions and filtering will take place before information is obtained and utilized.

2. 3. FACTORS THAT AFFECT INFORMATION SEARCH BEHAVIOR

Information search behaviors vary from person to person and from situation to situation. There are many factors that may affect information search behavior. This research manages to categorize the factors proposed by major scholars (Lin & Garvey, 1972; Mike2003; Wilson, 1999; Hardy, 2000; Paisley, 2001; Bouazza, 2002; Sheng, 2004; Hewins, 2002; Lancaster, 2004; Fu, 2004) into seven categories.

(1) Context factors: The context is different when search behaviors are performed, for example, different research projects or design projects.

(2) Personal factors: individuals' understanding of information, personality, recognition of the value of information, experience, motivation, professional backgrounds, work ethics, state of mind, emotions and education backgrounds.

(3) Job factors: job types, the roles and functions within organizations, the degree of urgency of the information required, the stage of projects and the standards of accomplished missions.

(4) Environment factors: work environment, organization features, the communication network within organization, organization structure, the managers' attitudes towards information, politics, economics and culture.

(5) Group factors: reference groups and associations.

(6) Cost and effect factors: Sources of information are chosen based on the expected efficacy and costs.

(7) Least effort principle factors: Users expect to use the minimal efforts or costs in choosing information sources.

Hardy (2000) sorted out two models for choosing information sources: Cost and Effect Model and Least Effort Model. Many successive researchers (Paisley, 2001; Bouazza, 2002; Mike2003; Sheng, 2004; Hewins, 2002; Lancaster, 2004; Fu, 2004) support the second model because they believe information users often choose the convenient information sources at the expense of some degree of information quality.

2. 4. RELATIONSHIPS AMONG THE PERSPECTIVES OF GENERAL INFORMATION SEARCH BEHAVIOR

According to the above literature review, the relationships among the perspectives of general information search behavior can be illustrated as Fig. 1. Based on the four perspectives of "information demand" (internal factors, objectives, degree of urgency, scope of information), the two perspectives within "action" (choosing the source of information and the method of obtaining information) and the seven "influential factors" (context, personal, Job, environment, group, cost and effect, and least effort principle) form the thirteen basic perspectives of general information search behavior. General information search behavior is driven by the internal factors and objectives of individuals. The degree of urgency and the scope of information are also different. The actions taken are the choice of information source and selection on the method of obtaining information. These factors may affect either the actions or the information demand.

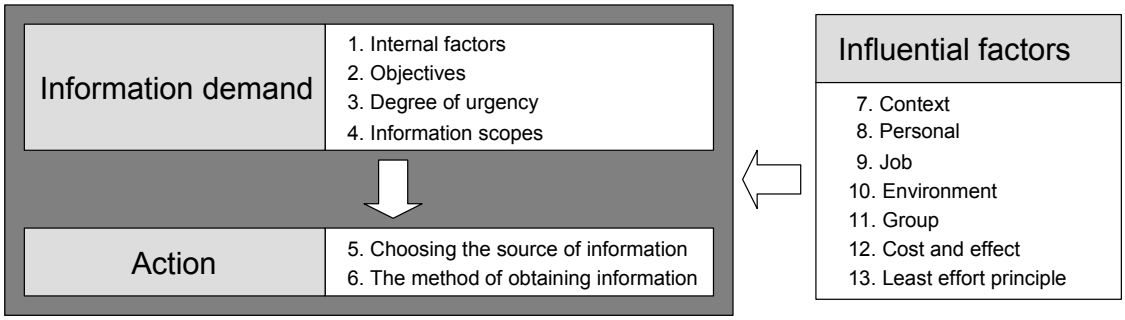

Figure 1: The relationship between the perspectives of general information search behavior.

3. RESEARCH FRAMEWORK

One of the most scientific methods among all qualitative research methods is Grounded Theory approach proposed by authoritative sociology scholars Strauss and Corbin (1997). This research uses its coding procedure to analyze the preliminary data obtained through interview; the relationships between factors are then determined with Interpretive Structural Modeling (ISM) method. (Fig.2)

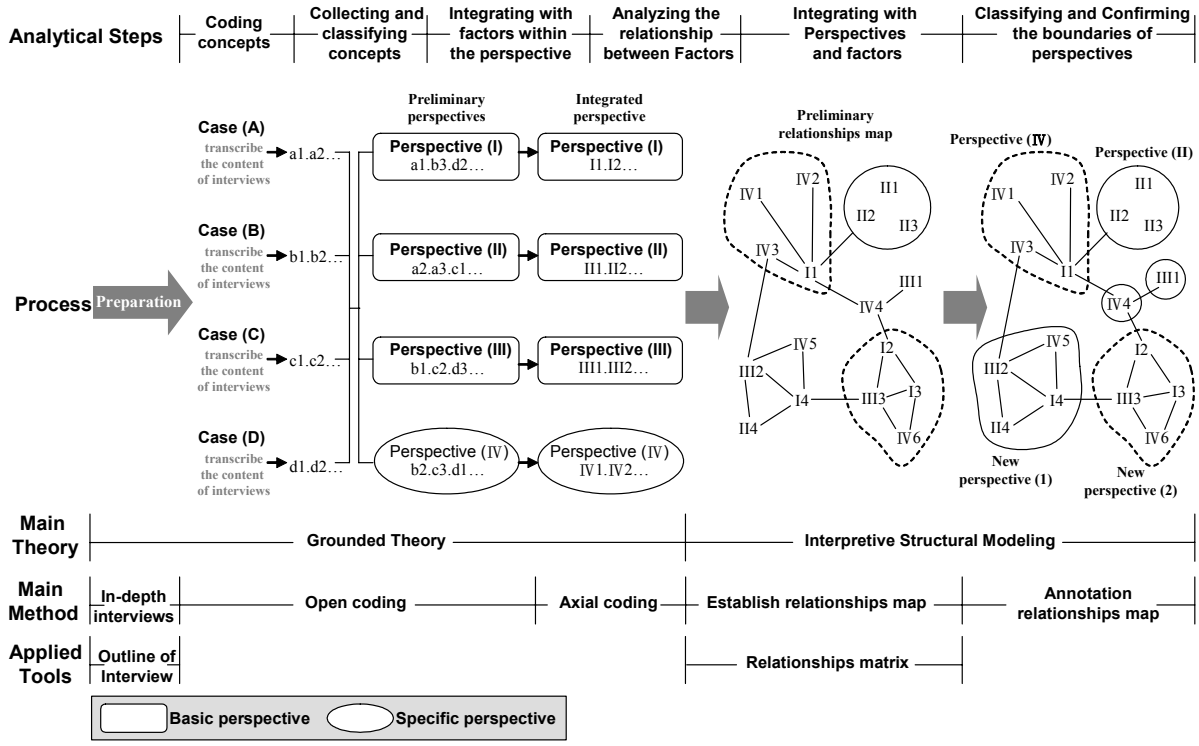

Figure 2: Research Framework

First, the coding procedure was adopted. The transcripts of case interviews that represent individual viewpoints were coded by concept. Many concepts relating to design information search behavior (for example, a1 and a2 in Fig. 2) were obtained. These concepts were then categorized and organized based on the basic perspectives (represented with I, II and III) generated through literature reviews to establish “preliminary perspectives”. Developing the content of perspectives that is integrated from the viewpoints in each case interview within each perspective (for example, a1, b3 and d2 of perspective I), and extracting the factors of it (for example, I1 and I2 in perspective I of “integrated perspective”).

ISM is then adopted to examine one by one to see whether certain relationships exist between each factor to make an original relationships matrix. The shifted relationship matrix was deduced according to the principle, “If a is related to b and b is related to c, then a is related to c”. The coordinates of each factor on the relationships map can be rendered by adding and subtracting the sum of relationships in rows and columns. Also according the relationships of the original matrix get the factor’s linkages so as to establish an “initial relationships map”. Lastly, perspectives were adjusted and renamed based on the relationships between factors.

The selected interview subjects of this research are considered by the influential factors of the information search behavior. There are seven perspectives from literature reviews as the influence factors: context, personal, job, environment, group, cost and effect and least effort principle. Due to without the content of former four factors and the factor, least effort principle , before the interview, the interview cases were selected by the experience factors and organization features factors which have most diversity with objectivity in the personal and environmental perspectives.

Based on experience factors, subject designers were chosen by years of design experience they had, and numbers of products they designed. For organization feature factors, designers were selected by the configuration of the organizations they belong and the type of products they design. The main configuration of design organizations in Taiwan have two major types: professional design companies and design departments within businesses. The type of projects designers get will be influenced by the features of their clients, and the category of products. The clients of design organizations in Taiwan are mainly brand businesses and ODMs. On the type of products, most of the products in Taiwan’s design projects are IT products or home appliances. The two categories accounted for 64.1% of all the designed products, which is found in the

analysis report on the operation of industrial design company in the “Development Index for Industrial Design Industry in Taiwan ” conducted by Taiwan External Trade Development Council in 2001.

This research selected eight interview subjects from four design organizations, which were “professional design companies” and “design departments within businesses” that design IT products and home appliances. One senior designer and one junior designer were selected from each of the four design organizations as interviewees.

Before the interview, the researchers contacted the target design organizations and asked them to recommend suitable designers for interviews. The researchers then enquired the designers’ willingness for interviews and then arranged time and venue. Two researchers, a doctorate candidate and a master student, were responsible for in-depth interviews. Questionnaires and electronic recording devices were prepared in advance. Designers were interviewed one at a time for 60 to 90 minutes. The researchers first explained the object of the interview and obtained the interviewees’ approval for recording sounds and images. Later on, the researcher started asking questions from the first three groups of the questionnaires which interviewees are familiar with. The interviewees could come up with answers for these easy questions and settled in quickly to facilitate the process of interviews. Other questions were raised in different sequence depending on the situations of each interviewee. Other related questions were raised during the process. For example, an interviewee mentioned that if the target consumers of the design are female college students, he would start searching the products attractive to college girls. The researchers could continue to ask how the subject knew what brands are attractive to college girls.

4. RESULTS ANALYSIS

4. 1. PERSPECTIVES SPECIFIC TO DESIGN INFORMATION RESEARCH BEHAVIOR

After analyzing the raw data of interview, there are eight specific perspectives besides the basic perspectives proposed in previous literature: “design objective”, “action strategy”, “how to decide information scope", “information content”, “the features of information itself”, “information provided by customers”, “features of the customers” and “features of the products”. These eight perspectives could categorize into three items based on their property – “personal beliefs of the

designer", "feature of the information", "customers and products". These three items will be further explained as follows:

(1) Personal beliefs of the designer: This category includes three specific perspectives: "design objective", "action strategy" and "how to decide information scope". "Design objective" is the personal ideals or concepts of the designer. It is every designer's own definition of a successful design. For example, most designers wish the products they design to sale well in the markets and give users positive experience; some designers thought the mechanism must be designed well and products' appearance is less important; still others believe that designers must have innovation on the products' appearance and the problem of mechanism design have to be solved by another team. From "action strategy", the actions of designers that after considerate to various factors can be predicted. These actions include: how to obtain information, how frequent is information searched, whether searches are made at work or after work, whether searches are made actively or passively, the scopes of the information being searched and their differences. The perspective of "how to decide information scope" includes three methods: estimation based on the designers' impression, group discussions within the organization and extensive research of the existent information scope.

(2) Feature of the information: This category includes two specific perspectives- "information content" and "the features of information itself". The former refers to what designers actually see, such as features in appearance, changes in trends, product functions and ways of use. "The features of information itself" can be further divided into forms, quantities and property of time. In addition to pictures and texts, the actual product is also a form of information specific to design information search behavior. For quantities, many designers need lots of design information to stimulate ideas and sum of the current trends. Property of time includes fast-changing information about fashion or slowly-changing concept of the time.

(3) Customers and products: This category includes three specific perspectives- "information provided by customers", "features of the customers" and "features of the products". "Information provided by customers" refers to design subject which customers provide to designers in the early stages of design projects. Some customers only specify the product, while some customers describe the target consumers, set the target price and provide a detail list for the specifications of each components. "Features of the customers" mainly refers to operation feature of the customers. Some designers design for international brand names, while some other designers design for domestic manufacturers. "Features of the customers" also includes the relationship between

customers and design organizations. For instance, customers and designers who have cooperated for a long time could trust and support each other. “Features of the products” refers to the different product features result in the different product life cycle, design objectives and users. For example, cell phones have shorter product life cycle because they belong to fashion products, so cell phone designers pay special attention to fashion trends. Home appliances have longer product life cycle, so designers focus on the practical value.

4.2. STRUCTURE OF THE RELATIONSHIPS BETWEEN PERSPECTIVES OF DESIGN INFORMATION SEARCH BEHAVIOR

After analyzing and comparing the relationships between the basic perspectives rendered from literature review and interviews, a major structure of design information search behavior can be established. “Information demand →action” corresponds to the conclusion of the literature review. The different are changes in the factors within “information demand”, “action” and “influential factors”. “Influential factors” can be further divided into “major influential factors” and “secondary influential factors”. Designer-specific perspectives affect “secondary influential factors” and “action” (Fig 3).

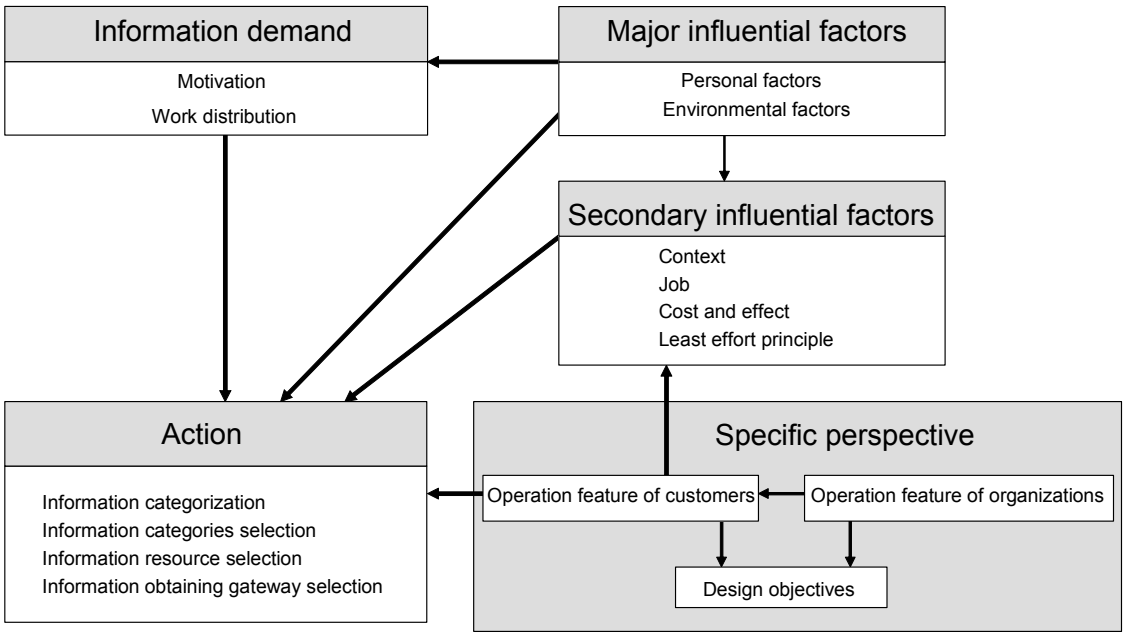

Figure 3: Structure of design information search behavior.

The “actions” of design information search behavior are the result of “information demand”, “major influential factors”, “secondary influential factors” and “specific perspectives”. Under various influences, designers would take four “actions” after consideration: determining on the information categorization, deciding information categories selection, choosing information resource selection and information obtaining gateway selection.

“Major influential factors”, include “personal factors” and “environmental factors”, will directly affect “actions” and “secondary influential factors”. “Personal factors” even affect “information demand” directly. “Secondary influential factors” affect “actions” after being affected by “major influential factors”. Design information search behaviors are still pushed by “information demand”. In other words, designers make design information searches due to their job requirements, the needs to stimulate different thoughts, know about users and apply to the design directly.

The “operation feature of organization” within specific perspectives, “environmental factors” within major influential factors, “job requirements” within secondary influential factors and “work distribution” within “information demand” perspective all affect the “action” perspective. This shows that design organizations have critical effect on the information search behavior of designers. Designers of the same design organization will have similar information search behavior. The differences in information search behavior may result from “personal factors”. Designers may have different considerations on “motivation”, “cost and effect” and “least effort principle” to take different actions. Based on the analysis of relationships between perspectives, “choice of information scope” within “action” is affected by most of other factors and has less impact on other factors. In other words, the differences in information search behavior of designers within the same organization is mainly resulted from different personal considerations on “motivation”, “cost and effect” and “least effort principle”. Such considerations may cause designers to choose different information scopes.

5. CONCLUSION

The research includes former study research, reality comparison, individual subject’s behavior observation, and subject’s behavioral developments integration. Also, the research overcomes the difficulty of complex relations construction by integrating Grounded theory and ISM approach and can lead to the conclusions listed as follows.

(1) The pattern of design information search is mainly equivalent to general information searching pattern except the modification of the perspective of influential factor belonging, which can be further divided into three categories: “influential factors of specific perspective”, “major influential factors”, and “minor influential factors”.

(2) Specific perspective includes “operation feature of organization”, “operation feature of customers” and “design objectives”. The feature of organization will affect the feature of customer (Ex: international brands and OEM companies), which therefore affects designer’s design destination and sub-category “action” under minor influential factors.

(3) The cause of designer needing different information is affected by the sub-categories “personal factor” and “environmental factor” under major influential factor. Also, actions can be varied because of different information needs, major influential factors, minor influential factors and specific perspective.

(4) Minor influential factors can be divided into “context”, “job”, “cost and effect” and “least effort principle”. Designer’s behavior within four sub-categories listed above will be affected by major influential factors and specific perspective.

(5) Concerning the behavioral framework of the pattern of design information search, the major information requirement of designer is “personal motivation” and “shared responsibility within organization”. The actions triggered by these information needs can be divided into four types: information categorization, information categories selection, information resource selection, and information obtaining gateway selection.

(6) The critical perspectives that have greater influence upon design information searching behavior are operation feature of organization, resources and regulations of the organization, operation feature of customers, individuals and work distribution within organization. Design organization determines designer’s information searching behavior. The information searching behavior differences between designers within same organization is mainly caused by different personal decision on “motivation”, “cost and effect” and “least effort principle”.

As space is limited, we have concentrated on search behavior of design information, and paid scant attention to practical industry feedback, method application, and theory instruction. Fuller discussion will be presented in the next paper.

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