A TOOL FOR FACILITATING SEMANTIC REFRAMING OF SERVICE DESIGN INSIGHT DISCOVERY

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Abstract

Developing a desirable service requires in-depth understanding of customers. However, in the past, discovering insights from customers has usually depended on designers' experiences. It is hard for novice designers and designers at enterprises with G-D logic mindsets to do this well. A partial solution rests on challenging the core design practices of reframing and frame creation. However, it is rare to see how these framing design activities can be supported and analyzed by relevant tools. In this study, we present an IT-based tool with commonsense knowledge in ConceptNet to facilitate a variety of association reasoning methods in the reframing and frame creation process of service design insight discovery. We also propose the concept of insight depth to serve as a metric for measuring the influential extent of insights. This study ends up with an exploration of how the quality of the reframing and frame creation process can be improved for experienced and novice designers when supported by our tool.

Keywords: Service design, innovation, design practice, Information management, design insight depth

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1 INTRODUCTION

Service design is a means to service innovation and is a process aiming to create new or improved (existing) services to make them more useful, usable, desirable for clients and efficient/effective for organizations. Discovering insights from customers and defining design challenges are keys to service design toward contended life. At the end of the insight defining stage, there will be a clear definition of the fundamental challenge or problem to be solved in the following design stages (Design Council, 2014). Consequently, if a problem is not defined with compelling insights, it is hard for customers to accept the design no matter how well the service is developed or delivered. This is connected to situations in which enterprises make service value propositions that are not what customers desire and thus lose their customers as a result.

Meanwhile, both large enterprises and small businesses (SMBs) need a more efficient way to carry out new service development. However, there are gaps between knowing the importance of service design and doing it well. First, for the aspect of management, enterprises should shift their mindsets from Goods Dominant Logic (G-D logic) to Service Dominant Logic (S-D logic) and focus on designing good experiences for their customers. However, enterprises are usually accustomed to selling what they think customers' need, instead of discovering what they need. However, there is not a good way to help enterprises discover insights from customers. The second problem is the lack of tools. Although some studies have been devoted to the expertise of designers (Cross, 2004; Paton and Dorst, 2011), it is hard for novice designers and designers at enterprises with G-D logic mindsets to discover insights from customers. A partial answer rests on challenging core design practices of reframing and frame creation. However, relevant tools to support and analyze the framing of design activities are rare.

In this study, we argue that there should be an IT-based tool to facilitate the process of discovering the design insights of designers, no matter if they are experienced or novice designers. We also present a tool using the commonsense knowledge in ConceptNet to facilitate a variety of association reasoning methods for the reframing and frame creation process of service design insight discovery. The knowledge used in the system comes from ConceptNet, a famous commonsense knowledge base developed by Liu and Singh (2004) at MIT.

2 RELATED BACKGROUND

This section firstly provides the background of service, which is essentially different from goods. Secondly, we review the fundamental design steps and the challenges of reframing and frame creation. We subsequently close this section by providing the background knowledge behind our proposed tool design.

2.1 Service-Dominant Logic mindset

In the current era of the service economy, changes in consumer behavior have increased the importance of service value and competitive strategy. Thus, the importance of these factors has surpassed that tangible physical products, thus making the consumer market more service-oriented. Enterprises should have the mindset of S-D logic to design their services. S-D logic stresses that services are a process rather than an output unit; the focus thus lies in operant resources rather than operand resources. The value of service lies in collaboration involving the provider and consumer rather than the creation and delivery process from the producer to the customer (Vargo and Lusch, 2004). Accordingly, when designing a service, designers (both designers inside or outside of a firm) should make their greatest efforts to understand the context of the customers using services. However, the design process involves both the known part of the knowledge and experiences emerging during the design process and the unknown part of both the problem and the potential solution space within which the answer of the customers' aspired value can be sought (Dorst, 2011).

2.2 Design Thinking process and insight discovery

The core of design thinking is to understand the process and method that designers use to carry out user-centered design and learn to solve problems like them. Following the guidelines of design thinking, everyone can act like a designer to solve problems in their daily lives. Moreover, businesses can elevate innovation at a higher level. According to the Design Council (2014), there are four stages

of the design process – discover, define, develop and deliver (4D's). Designers' approaches to divergent and convergent thinking can be seen in each stage. This study focuses on the discover and define stages, and the purpose is to assist designers in identifying the design problem, opportunity and needs to be addressed through design and also build rich knowledge resources with inspiration and insights (Design Council, 2014). The creation of insights then rests on abductive sensemaking and reframing (Kolko, 2010). That is, to continuously understand the connections among people, places and events and then attempt to find a new perspective (Klein et al., 2006).

2.3 Tools for Reframing and Frame Creation

Since the insight discovery process requires intensive human efforts, this study argues that it is important to have relevant tools to support designers in the insight discovery process. This process is a form of meaningful learning for creating new knowledge, which requires the ability to form and process mental imagery. When carrying out design insight synthesis, in order to discover insights, designers iteratively try to bridge what they observe (the design context) to what the already know (their past experience). A frame is a product of mental knowledge and meaning structures (Reckwitz, 2002). As mentioned before, frames are very subjective. Designers make subjective value judgments to build up their perspectives of the design situation. Hence, frames are usually very person-specific based on the designer who interviews subjects and the people who have been interviewed or observed. In view of this, designers have to reframe the design challenge to jump out of the box and generate some innovative thoughts. The initial frame is the foundation of new frames. Reframing is to construct a new frame by changing the perspective by which the design situation is viewed (Paton and Dorst, 2011).

When the system model and the context are very clear, designers may see how the new perspective influences the situation. New frames for viewing a certain service or action in a new context help designers discover hidden links and chances (Kolko, 2010). Jon Kolko (2014) suggested that, in order to discover new chances, designers can view things in new environments, from new user perspectives and as new embodiments. When framing a situation, designers can utilize different tools, such as a concept map, to facilitate human thinking and make senses of data. Some scholars suggest that a clear definition can be obtained only under proper facilitation (Ahlberg & Ahoranta, 2004). A concept map is a tool for capturing explicit and tacit knowledge and facilitating creative works; such maps make human learning much easier under any context (Novak, 1998).

In this study, we aim to design a new tool utilizing the commonsense knowledge of ConceptNet to recommend objective, problem-specific frame parts for designers to facilitate their insight discovery process with more empathy for customers toward contended life. ConceptNet is a machine-usable commonsense knowledgebase that was structured as a network of natural language fragments (Liu and Singh, 2004). So far, it has been upgraded to version 5 (Speer and Havasi, 2012). The representation of ConceptNet is a directed graph. Every assertion can be seen as nodes connected by edges. Nodes are words or phrases that represent concepts and edges are relations of linked concepts as illustrated in Figure 1. For example, in the figure we can find that a 'restaurant' is used for 'satisfying hunger' while a cake, which is one kind of 'dessert' with 'sweet' taste, is also used for 'satisfying hunger'.

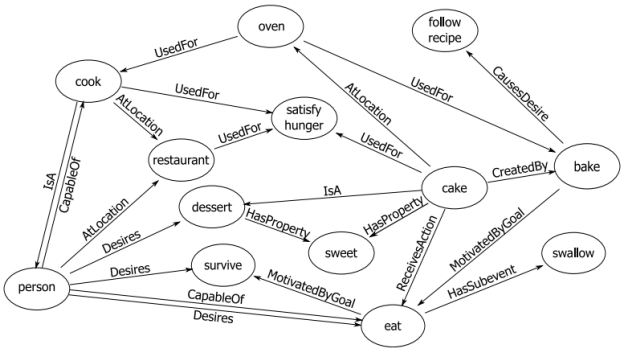


Figure 1. Knowledge of related concepts in ConceptNet (Speer and Havasi, 2012)

3 BASIC CONCEPTS

3.1 Association reasoning

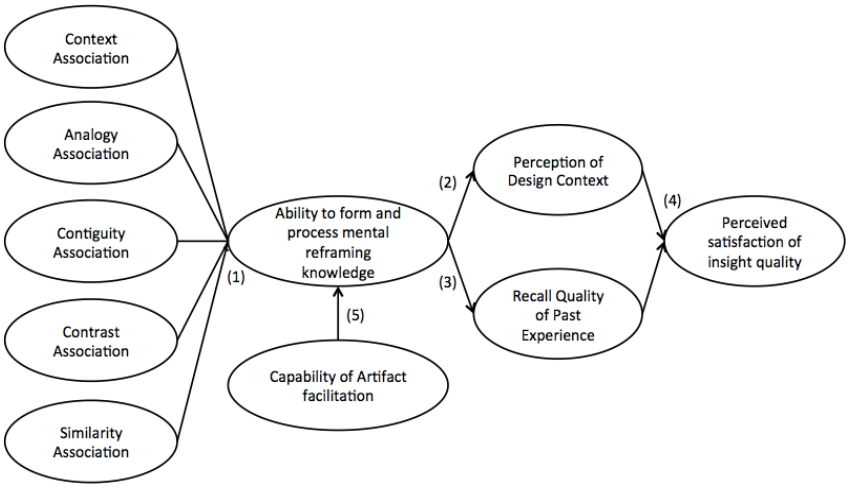


Figure 2. Conceptual framework of our study

Table 1. Types of associations adapted from (Dawson and Medler, 2010)

Type of association	Definition	Examples
Context association	The relations between two concepts with a causal or sequential relation.	Hot → Sweat Wake up → Brush Teeth
Analogy association	The relations between two concepts with some shared meaning.	Life → Drama Final Exam → War
Contiguity association	The relations between a series of concepts in contact or in proximity.	Transportation → Bike, Bus, Train, Ship, Plane
Contrast association	The relations between two concepts with inversed properties.	Happy → Sad Hot → Cold
Similarity association	The relations between two concepts that share lots of similar properties.	Bowl → Cup Hotel → B&B

The insight discovery process iteratively combines what you see and what you already know., i.e., the process of framing and reframing. The ability to link newly found phenomenon with existing knowledge is very important when discovering insights. When framing design situations, designers are actually manipulating their mental imagery and trying to make sense of data using associations. This is a new knowledge creating process and we examine this process from two perspectives. The first is the ability to make associations; the other is the synthesis process of combining what people see with what they already know. Figure 2 shows our conceptual framework showing the underlying concepts behind our tool. These concepts and their relationships will be described below. To examine mental imagery processing ability, we categorize the associations into five types based on the law of association (Dawson and Medler, 2010), including context association, analogy association, contiguity association, contrast association and similarity association (Table 1).

3.2 Insight quality

The purpose of discovering insights is to develop new service concepts satisfying customers' latent needs toward contended life, drawing upon the capacities and influences of service providers. In this study, we adapt the 3-dimension value proposition space proposed by Kwan and Yuan (2011) for measuring the maximum influence extent of the derived insights from the macro view.. The model has three dimensions including stakeholders, value (strategy) directions, and customer empowerment stages. Each dimension has several nominal values, and a point or an area in the space is the extent of

the influence of a potential value proposition. As mentioned above, our main ideas of embedding S-D logic emphasize the value co-creation between service providers and customers. For the purpose of co-creating with customers to maximize the value, service providers tend to let customers take control of variables that are conventionally pre-determinant. In other words, service providers empower customers in order to increase involvement and responsiveness. As a result, we only focus on designing services with high customer empowerment . Furthermore, we order the nominal values of each dimension based on the extent of horizontal influence. The adjusted model is then shown in Figure 3, which we call the insight depth map. Each point or area on the map represents an insight. The distance between the insight and the origin is the insight depth, which indicates the scope of the influence of the insights.

$$\text{Insight depth} = \sqrt{S^2 + V^2} \quad (1)$$

(S: influence extent level of stakeholders / V: influence extent level of values)

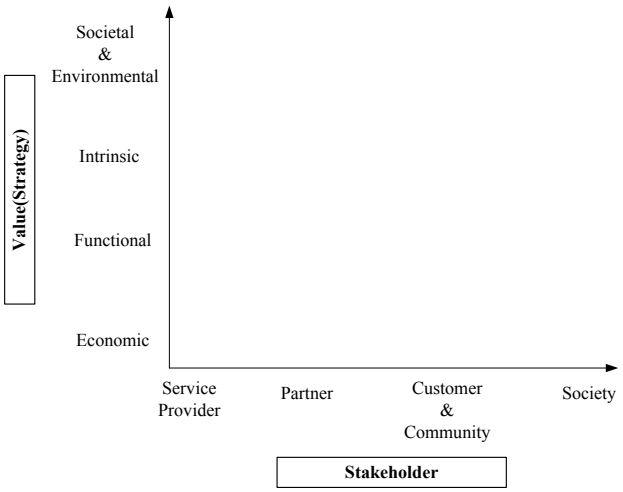


Figure 3. Insight depth map

4 THE TOOL - DISCOVER+

Our tool is called Discover+. This tool serves as an artifact (Figure 4) to facilitate insight discovery. The original input is the data obtained through interviews and observation. After processing, a few insights are generated. In addition to the data retrieved from stakeholders, we also gather some external data using Google search to ensure the data is sufficient. The sense-making knowledge mainly comes from ConceptNet, which has been used for commonsense reasoning for years (Liu and Singh, 2004; Shen et al., 2007). We chose ConceptNet as the knowledge base of Discover+ because its structure of concepts connected with relations can be utilized to perform contextual reasoning, which is the core of theme and frame recommendation of our tool, as depicted in Figure 5.

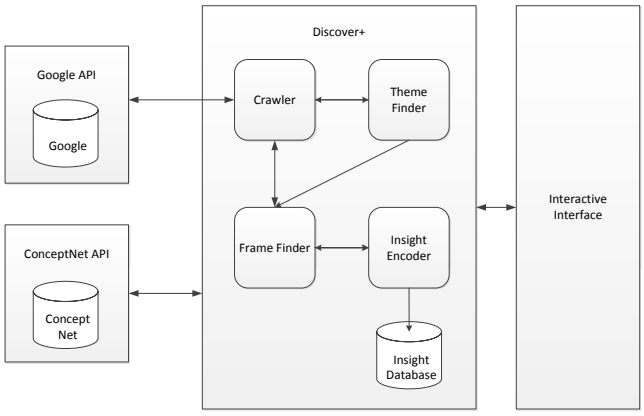


Figure 4. Discover+ Framework

4.1.1 Theme finder

The data obtained from the stakeholders and the data from the external source are excessive and messy. The theme finder aims to find themes from this data. In the past, designers have had to organize the data by themselves. This is waste of time and some details may be ignored. We refine this process by using the knowledge in ConceptNet to facilitate theme finding. We use a heuristic method to calculate the most probable themes.

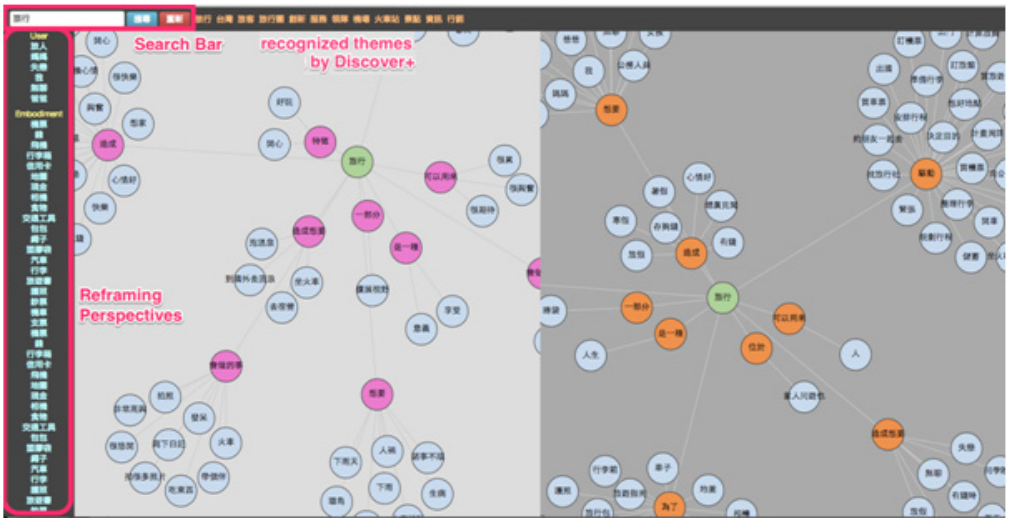


Figure 5. Interactive interface of the frame-finder of Discover+

4.1.2 Frame finder

The frame finder aims to find and construct frames that are relevant to themes and objectives from the stakeholders' point of view in terms of the facilitation of different kinds of association reasoning. We divide the concept of framing into four parts - user perspectives, environments, embodiments and user goals, as suggested by Kolko (2014). These various parts are described in detail below:

- User perspective:

Using environment as an aspect to conduct reframing helps designers to think about various scenarios in different environments. In continuation of the above example of a design challenge, to find potential user environments, we search for 'AtLocation' and 'LocatedNear' edges in ConceptNet, which show the spatial relationship between things and their ordinary locations (Liu and Singh, 2004).

For example, if we are designing the experience of using a bathroom in a hotel, we can find that 'bathroom' is spatially connected to 'school', 'theater', 'gym', 'plane', 'library', etc., at the 'AtLocation' edge, which means bathrooms usually can be found in these places. We can think of a lot of places with bathrooms like these. This utilizes our abilities of making similarity associations to find potential new environments. Hence, before designing a bathroom for a hotel, designers can think about experiences of using bathrooms in these different environments to find some inspiration. The system generates a list of potential use environments to simulate designers' reframing process.

- Embodiment:

For finding new embodiment, the idea is to find different things for the same goal. The 'UsedFor' edges are the source of this knowledge. This type of edge reflects the functional connections of things and their functions, namely, their purposes when people use them (Liu and Singh, 2004).

For example, one of the goals of using a 'bathroom' is to 'relax' while 'energetic music', 'movie', 'party', 'vacation' are also connected to 'relax'. Hence, when re-designing the bathroom use experience, designers can add some energetic music or films to build up the relaxing atmosphere. Furthermore, reframing the experience of using a bathroom to be an experience like having a party or having a trip could also offer inspiration. Designers can make some analogy associations, connecting the source with a target with similar meaning, to find more new embodiments.

- User goal:

In order to discover insights, identifying the users' goals is also very important. If the target users are businessmen, knowing what they desire may be important information for an insight. This can be

aided by finding the relations of 'desires' in ConceptNet, since the 'desire' edges are the relations between users and things they desire. Previously we used only the relations of 'desires' to identify different user perspectives. Here we put more emphasis on identifying what these potential users want to achieve and want to prevent in a certain context. For example, designers may find that businessmen want a meeting space in a hotel and do not want the room to be too noisy. Knowing this helps designers to achieve better designs. To discover more user goals, designers may also utilize context associations to reveal the real reason behind people's behavior.

4.1.3 Crawler

The crawler helps fetch data on the Internet by using Google Search API. News articles, blog posts, or forum discussions are the target data. These articles may contain some market trends and customer insights. The system uses the recommended themes or frame parts as keywords to do the search. For example, using 'businessman + hotel' as the keyword, the search result contains some terms such as 'meeting room', 'free parking', or 'assistant' that might not appear in the original input. The crawler also uses the TF-IDF method to extract important terms in these data (Salton and Buckley, 1988). The newly found terms are added into the theme finder and the frame finder as inputs in the beginning of these modules. This can broaden the designers' viewpoint when discovering insights.

4.1.4 Insight encoder

The insight encoder module concludes the result of the above processes and helps designers come up with proper insights toward contented life. Designers are suggested to follow the format below to complete the insights.
{user perspective} needs *{design challenge}* because *{user goal, environment, embodiment}*.
For example, an insight generated state:

"Travelling businessmen need to have a good bathroom use experience in a hotel because a party-like bathroom with energetic music can eliminate their tiredness after a day of conferences."

5 EVALUATION OF DISCOVER+

5.1 Exploratory experiment design

In order to get the data for justifying our propositions, the plan of exploratory experiments has four phases from the 30 experimental subjects' point of view.

Phase1: Framing based on experiences

At first, the subjects were given a case as the brief of a design challenge and were asked to do concept mapping to frame the situation based on their own experiences. The aim of this phase is to derive one or more insights.

Phase2: Framing with inspirations provided by Discover+ and Google

In this phase, the subjects can use Discover+ and Google Search to seek inspirations to reframe the situations. They can freely switch between the two systems and add frame parts or new connections to their concept map as they wish. In order to recognize which parts and connections are newly added in this phase, they are requested to use another color to revise the concept maps. At the end of this phase, they come up with new insights which are the revised versions of previous ones or totally new ones. Moreover, they are asked to record two kinds of data. The first is are the proportions of the usage of Discover+ and Google Search in this phase. They give a percentage, for example, 70% for Discover+ and 30% for Google Search. Other data to be recorded includes the proportions of the sources of inspirations in these two phases. They will give a percentage as well. For instance, 40% from Discover+, 20% from Google Search, and 20% from one's own experience. As a result, we can do further analysis of the facilitation capability of Discover+.

Phase3: Labelling the types of associations

After two rounds of concept mapping, there will be a concept map with lots of nodes and lines representing the relations between concepts. In phase three, the main purpose is to find out the proportions of use of every kind of association designer in design synthesis. First, we give the definitions and examples of the five types of associations. And then the subjects are asked to label the types of associations of all the connections on their concept maps if they think the relationship belongs to one or more type of association. The reason why we ask the subjects to do the labelling task instead

of doing it by ourselves is because the person who builds up the map should be the one who understands the map. Rather than guessing, it is better to let designers label them by themselves.

Phase4: Filling in the questionnaire

In the final phase, the subjects are requested to fill in questionnaires. There are three purposes of the questionnaire. The first one is to identify the profile of the subjects in order to analyze the impact of different professions. Second, we want to analyze what the subjects think about their method of doing design synthesis. For instance, we ask the subjects *'Do you think it is important to engage yourself in the environment when framing a design context?'* At last, we ask some questions to examine the facilitation ability of the system as well as some open questions to gain some feedback above the system.

5.2 Evaluation results

5.2.1 Associations in service design

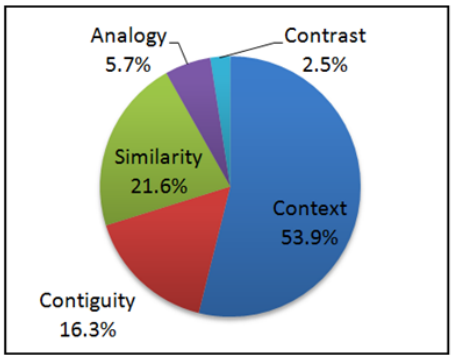
Proposition 1: The ability to process mental imagery, which is used by service designers in framing and reframing the design situation to discover insights, contains five types of association abilities, namely, context association, analogy association, contiguity association, contrast association, and similarity association.

As mentioned in Section 3, designers' ability to process mental imagery can be categorized into five types. To verify whether these five types include all of the association abilities that service designers use in design synthesis, we ask the subjects to label the connections between the concepts on their concept maps. According to the collected data, all of the associations can be categorized into at least one of these five types of associations of designer competence.

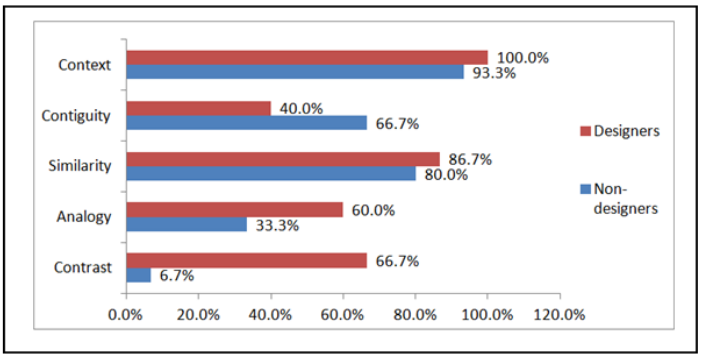
As for the composition of the usage of these abilities, a statistic is shown Figure 6(a). The most used association is context association. It accounts for about half of the associations. Moreover, similarity and contiguity association are also commonly used. The percentages are 16.3% and 21.6%. At last, analogy and contrast association are seldom used. Only 5.7% of relations are analogy associations and another 2.5% are contrast associations.

Furthermore, for the purpose of understanding whether there are differences in the association competence between designers and non-designers, we analyze the proportions of subjects using each type of associations. The percentages represent how many of the subjects use that type of association (Figure 6(b)). For example, 6 out of 15 subjects in the designer group used contiguity association, so the percentage is 40%. We can find that there is no significant difference in context and similarity associations between the two groups of subjects. However, non-designers like to list a series of concepts to make their views more holistic so that their percentage of using contiguity association is higher than that of designers.

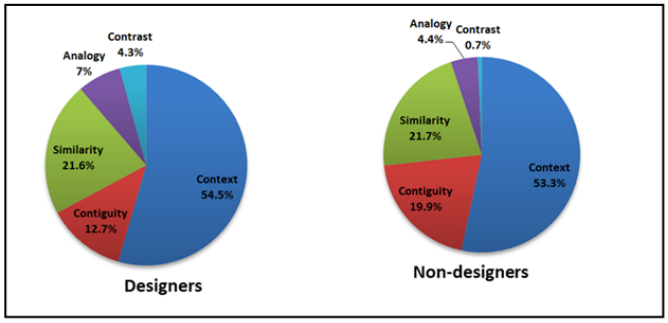
By looking into the composition of associations applied on the concept maps (Figure 6(c)), we can also derive the same conclusion that designers use more analogy and contrast comparison than do non-designers while non-designers use more contiguity associations than do designers.



(a)Composition of each type of associations



(b)Percentages of associations used by different groups of subjects



(c)Composition of each type of associations for different groups of subjects

Figure 6. Evaluation results of Proposition 1

5.2.2 Insight depth of derived insights

Proposition 2-A: The tool we propose to facilitate the insight discovery process can increase the insight depth of derived insights.

As shown in Figure 7, the bolded numbers with stars represent the subjects whose insights in phase 2 are deeper than those in phase 1. Namely, these insights have a larger scope of influence in terms of the value or stakeholders' perspective. We can find that 56.7% of subjects (17 out of 30) enhanced their insight depth after reframing in phase 2 while no subjects attained a smaller scope of influence.

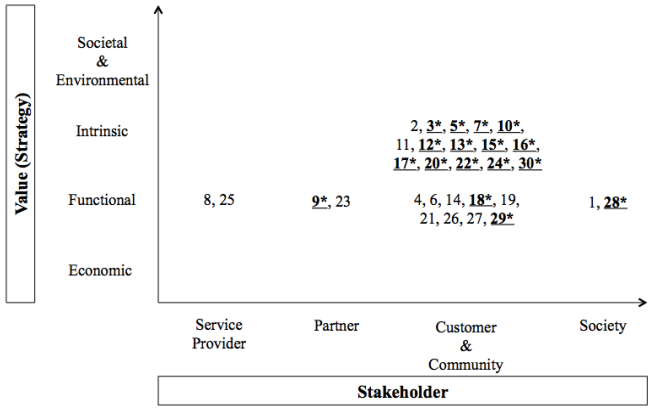


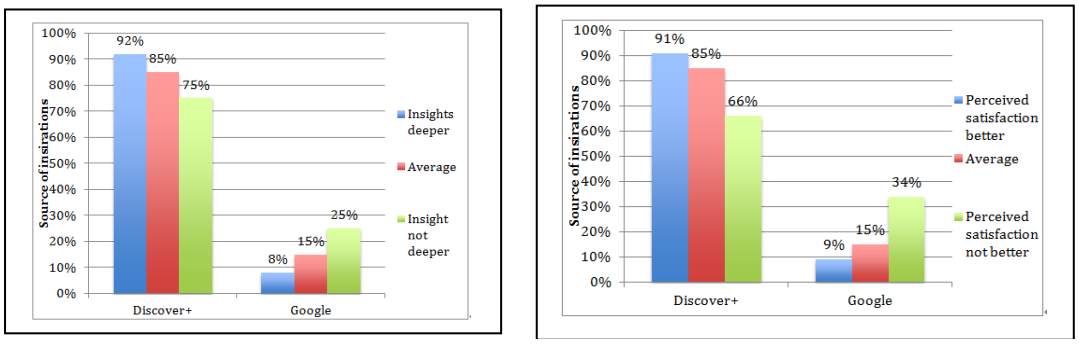
Figure 7. The insight depth map of the insights in phase 2

5.2.3 Perceived satisfactions of derived insights

Proposition 2-B: The tool we propose to facilitate the insight discovery process can increase the perceived satisfactions of derived insights.

According to the Figure 8(a), we can find that an average of 85% of the inspirations come from Discover+ and the other 15% come from Google Search. Furthermore, we also examine the averages of subjects whose insights go deeper and do not go deeper in phase 2. Discover+ inspired 92% of the

subjects who derived deeper insights while Google Search only accounted for 8%. On the other hand, for the subjects whose insights did not go deeper in phase 2, 75% were inspired by Discover+ and 25% were inspired by Google Search. We found that the subjects who deepened their insight depths in phase 2 perceived more inspirations from Discover+ than those whose insights did not go deeper in phase 2. The results (Figure 8(b)) show that the subjects with higher perceived satisfaction were inspired by Discover+ 91% of the time and by Google Search only 9% of the time. As for the subjects with lower satisfaction, 66% were inspired by Discover+ and 34% were inspired by Google Search. It can thus be inferred that the more the subjects were inspired by Discover+, the better the quality of the insights.



(a) Sources of inspirations (insight qualities from the macro view) (phase 2)

(b) Sources of inspirations (insight qualities from the micro view) (phase 2)

Figure 8. Evaluation results of Proposition 2

6 CONCLUSION

This study presents an IT-based tool named Discover+ that is designed to facilitate the insight discovery process in service design. It can be applied to many contexts, including big enterprises, SMEs, startups or even non-profit organizations toward contended life. Service designers in all of these contexts can take advantage of Discover+ to make their tasks easier. The evaluation results illustrate the ability of our tool to make derived insights more innovative and complete. Once the insight quality is good, the service to be developed can become more feasible, desirable and viable. The proposed insight depth map can also be adopted in practice to measure the scope of influence of insights. Service designers can formulate strategies including marketing, pricing, alliances, etc., if they are able to grasp the insight depth earlier, before services are delivered to the market. In addition, it can also help to position the service to be developed in the market and recognize competitors. In addition, the evaluation results show that the most used associations are context association, contiguity association and similarity association. Another two types of association – analogy association and contrast association are used much less, especially by people who are not from design schools. Therefore, if we can urge service designers to try to use these two types of association, it could refresh their perspectives and stimulate new thoughts they have not thought of before. This study still has some limitations and shortcomings, such as a limited number of subjects under study. It is also worthwhile to investigate the varied performance of different usage-extent combinations of our tool (built on the limited-sized ConceptNet) and Google search. For the purpose of generalizing the results, future research should engage more participants from different fields with various kinds of work experience on the creation of services for contented life.

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