A Study of User-Analyst Mindmap Divergence: Using the IQA Approach

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Abstract

Despite the high failure rates quoted for information systems (IS), only less than 20% of all failures are related to technical problems. Since different stakeholders may hold different perceptions, we cannot assume that what the system analyst wants to see is the same as what the user wants to see. Many human communication issues may hinder the efforts to accurately capture and clearly understand human interaction. The main purpose of this study is to identify the cognitive divergence between analysts and users during information system (IS) design. Using the Interactive Qualitative Analysis (IQA) approach, we compare how analysts and users' different mindmaps and communicative action theory provide explanations for the divergence. The potential of using a mindmap is to make comparisons and interpretations.

The IQA approach is a very structured and systematic qualitative analysis approach that has been successfully applied in various tasks. After comparing the different mindmaps of analysts and users, we can make some suggestions such as analysts are self-conscious, whereas users are function-oriented. Implications for analysts and users are discussed.

Key words: Interactive Qualitative Analysis (IQA), cognitive divergence, mindmap, selective perception, Theory of communicative action

應用 IQA 方法研究使用者與分析師心智圖之差異

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摘要

面對資訊系統的高失敗率但卻只有不到 20%的失敗是與技術問題有關聯，而不同背景的人擁有不同的認知，因此系統分析師和使用者對資訊系統設計的認知會有所不同。然上述現象又隱藏了系統分析師與使用者之間正確與清楚瞭解的溝通問題。本研究應用交互式質性分析方法(Interactive Qualitative Analysis, IQA)比較系統分析師與使用者對系統設計心智圖(mindmap)的分歧，並以溝通行動理論解釋認知差異的產生原因。

IQA 是一種具有結構化和系統化的質性分析方法且已成功的應用在不同的領域，在比較系統分析師與使用者的心智圖後，做了一些建議：例如分析師是自我意識導向，使用者是功能導向，文中並對其意含進行探討。

關鍵字：交互式質性分析方法、認知差異、心智圖、選擇性知覺、溝通行動理論

1. INTRODUCTION

The characterization of information systems (IS) manifests itself as a competitive weapon (Kumar & Becerra-Fernandez 2007) and the consequences of IS failure have become more acute as organizations continue to invest in IS and application development (Szajna & Scamell 1993). Orlikowski (2000) shows that countless systems are never used to their full potential in organizations, simply remaining “unexplored, rejected, or forgotten.” According to Lin et al. (1996), the successful implementation of IS is related to two major dimensions: technical factors and human factors. However, the high failure rates are quoted for information system implementation, whereas only less than 20% of all failures are related to technical problems (Despont-Gros 2005) and approximately 30% of new IS being underutilized continues to be a major concern for organizations (McDermott 1987).

Many researches have suggested that system failures can be attributed to the lack of clear and specific information requirements (Davis 1982; Cooper & Swanson 1979). Standish Group International (2007) reports that development projects fail about 70% of the time because of insufficient, inaccurate, or outdated requirements. Therefore, full understanding the determinants of system use and IS success has become a cornerstone of IS research (Burton-Jones & Hubona 2006; Gelderman 1998). Most IS researchers have focused IS success on ways of user perception (Etezadi-Amoli & Farhoomand 1996), user satisfaction (Wixom & Todd 2005; Bailey & Pearson 1983; Melon 1990; Siau & Tan 2006), user involvement (Amoako-Gyampah 1997; Ives & Olson 1984; Baronas & Louis 1988), user expectations (Szajna & Scamell 1993), system usage (Burton-Jones & Hubona 2006; Franz & Robey 1986), just to name a few. Unfortunately, these literatures look at only one dimension toward the association of systems users’ attitude toward IS success.

However, IS success is a multi-dimensional concept that can be assessed at various levels (Wu & Wang 2006): either user requirements cannot be fully and accurately defined initially (Jacobson et al. 1999), or user-centered system design does not absolutely provide IS success (Gulliksen 2003). However, communication problems between analysts and users are a consistent finding by researchers and practitioners (Bostrom 1989; Guinan & Bostron 1986).

Different stakeholders hold different perceptions which become problematic and lead to discrepancies (Klein 2003). This possibility, in turn, leads to a cognitive divergence problem. This scenario may lead to a mindmap gap between IS analysts and users for a spectrum toward IS design.

Although some research has been conducted addressing the conflict of social issues both regarding analysts and users (Fang & Sun 1999; Alvarez 2002; Kaiser 1982), none have made perceptions comparison of mindmaps. In this study, we focus more clearly on user-analyst divergence in different mindmaps toward IS design.

Establishing effectual communication throughout the entire information systems development process is important. In order to help analysts and users understand cognitive divergence in IS design, we propose to use the IQA approach to open the dialogue and draw the mindmaps of analysts and users, while providing valuable interpretation of mindmap divergence between them. Finally, bridging the "mindmap" gap and providing remedial action will foster more effective systems development and ultimate implementation.

2. RELATED LITERATURE

Since stakeholders will view their perspectives according to their own schema, as Hackos and Redish (1998) observe, *"Good design happens only when designers understand people as well as technology. . . . Designs that do not meet user's needs will often fail in the workplace or in the market . . ."*. From the user's perspective, Ginzberg (1982) demonstrated when analyst and user work well together and share similar impressions of design problems, thus producing more successful systems. However, the process of system development is fraught with conflict and inconsistencies between users and analysts. Lyytinen (1988) demonstrated that systems analysts' expectations are largely accounted for by their individual interests in the development process. On the other hand, Alvarez (2000) provides empirical support that analysts propose a *technical frame* which conflicts with users' *personal frame*. Fang and Sun (1999) examined the cognitive conflicts of a system between users and system developers. They found some cognitive conflicts between system users and developers in service construct, operational construct, and quality construct. Foster and Franz (1998) postulated a model which tested the different perceptions between IS users and analysts of user involvement. Kaiser and Srinivasan (1982) contend user-analysts communication and user needs focus are two positive relationships related to systems development.

Research supports the position that analysts and users differ across multiple dimensions; i.e., common goals (Christensen 1991), attitudes (Kaiser & Srinivasan 1982; Dos Santos & Hawk 1988), perceptions (Foster & Franz 1998; Franz & Robey 1986), domains meaning (Alvarez 2002), and cognitive conflict (Fang & Sun 1999; Kaiser & Bostrom 1982). It is believed that IS failures attributed to the differences between users and analysts arise out of their incompatible attitudes regarding the system design.

One conclusion that can be drawn from the research reported above is that research in differences between analysts and users suggests that not only should users' perspective be considered, but also analysts' perspective. Yet, research does not provide a clear understanding of the differences between the mindmaps of analyst and user toward the IS design; nor does it clarify the differences in cognitive divergence in system design between the analyst and user. With the information systems failure, the results of cost, time overruns, and the failure of the applications to provide expected features are extremely costly in terms of lost opportunities, competitiveness, and user satisfaction (McGraw & Harbison 1997).

A number of studies have suggested that system failures can be attributed to the lack of clear and specific information requirements (Davis 1982; Cooper & Swanson 1979) and poor user/analyst interactions (Ginzberg 1982). Furthermore, analysts do not understand the business function or system goal (Anderson 1978; Christensen 1991). In contrast, others have concluded that system analysts have a technical orientation, lack knowledge of human needs (Dos Santos & Hawk 1988), and do not share a "consensual domain" (Alvarez 2002). A consistent finding by researchers and practitioners is the perennial "communication problem" between analyst and user (Bostrom 1989; Guinan & Bostron 1986).

The difficulties in communication derive from the lack of a common language among system analysts and users (Siau & Tan 2003), cognitive limitations, and vocabulary differences (Agarwal & Tanniru 1990; Byrd et al. 1992). This possibility, in turn, becomes problematic, leading to cognitive divergence and a mindmap gap between analysts and users.

Successful IS depends upon the amount of common understanding that exists between analysts and users (Foster & Franz 1998; Panko 1987). Therefore, it is necessary to require a corresponding increase in awareness of customer needs and how humans interact with IS (Smart & Whiting 2001).

2.1 Theory of Communicative Action

The contribution of communication to successful IS development has received much attention (Janson & Woo 1995, Metsner 1980). The essential communication is not just exchanging information, but is also a crucial instrument in the process of execution and coordination (Moor & Weigand 2007). Haberman (1987) proposed a theory of communicative action, a comprehensive conceptual framework based on the school of critical theory. From Haberman's view of people as social beings, the action of communication is that parties are oriented towards mutual understanding of a situation in order to coordinate their actions. In other word, communication is essential to determining information requirements.

Analysts are interested in how a system should "work" (Landauer 1995), whereas the users of the systems are not interested in how the system works, but in how well it will help him/her carry out a particular task (Wood 1998). Therefore, it cannot be assumed that what the system analyst wants to see in the product is the same as what the end-user wants to see in the product. In the meantime, a problem arises when one person takes over another, resulting in an unequal shift in power. The goal for any person in a communicative process is to step outside of their perspective and achieve a consensus (Richardson et al. 2006). Haberman's theory of communicative action is useful for evaluating computer-based information system design and providing a useful explanation for understanding the social context of the implementation of systems as well as the effects of their use (Dillard & Yuthas 2006). The lack of appropriate communicative action during the design process can cause premature system failure (Janson et al. 1993). With an inadequate philosophy of design, finding failure lies in the conceptual limitations of the concept of interaction (Keeler & Denning 1991).

Effective communication among system professionals and users underlies the success of information systems design; moreover, communicative action can be used to respond to design uncertainty (Janson et al. 1993). For system effectiveness and efficiency, it is necessary to decrease or eliminate the distance by improving communication links between system analysts and users (Christensen 1991).

3. RESEARCH METHODOLOGY

In qualitative research, grounded theory is a popular method for discovering unknown patterns or evidences. The purpose of this study is to use the Interactive Qualitative Analysis (IQA) approach to diagnose the cognitive divergence between two distinct stakeholder groups. This is accomplished by inductive data from two distinct groups: analysts and users.

3.1 What is IQA?

Interactive Qualitative Analysis (IQA) is a systems approach to qualitative research that has been successfully applied in various tasks (Bann 2001; Burrow 2001; Gray 2003; Knezek 2001). Its purpose is to use the meaning of a phenomenon in terms of affinities and the relationships among them. Many qualitative research methods use observation or interview methodology, or data collection, but are relatively silent about analysis

(Northcutt & McCoy 2004). The IQA methodology attempts to reveal truth as constructed by a particular person or constituency by incorporating concepts from the three most important understandings of the meaning of truth: Correspondence, Coherence, and Constructiveness. IQA deliberately incorporates elements of all three theories into its methodology.

The philosophy of the IQA approach is a qualitative data-gathering and analysis process which depends heavily on a group process to capture a socially constructed view of the respondents' reality through the usage of focus groups, brainstorming, and interviews. Since focus group participants have diverse experience in design or use IS and all are representative in our research problem, the focus group process has content validity. IQA study allows a focus group to create its own "interpretive quilt", whose primary purpose is to represent the meaning of a phenomenon in terms of elements and the relationships among them, as the foundation for interpretation.

IQA study proceeds not only from the descriptions of the affinities by focus groups, but also from the respondents' judgments of the cause-and-effect relationships among the affinities and comparison of mindmaps. The reliability is through power analysis to determine how many people agree to the cause-effect the relationship. In general, IQA focuses not just on techniques of fieldwork, but also recognizes design, data collection, and especially analysis to interpreting a mindmap.

A Mindmap is a very useful notion of mental models used in the IQA approach. Fodor (1975) indicates that mental representation is a language of thought. Jonassen's (1995) summary mental models can be represented as networks of concepts, and the meanings for the concepts are embedded in their relationships to others. More specifically, IQA mindmaps are constructed by rules designed by the elements of the representative categories and the links of perceived influence.

IQA data collection techniques assist focus group members close to a phenomenon of interest in describing and labeling their experiences and articulating perceived relationships among these experiences to produce a conceptual map or mindmap. Therefore, we use the IQA approach to try to build channels of diagnosis between IS analysts and IS users, as well as trying to discover how the cognitive mindmaps differ between these two groups. In so doing, we hope to make some interpretations by comparing mindmaps to system designs between two focus groups.

3.2 Why use IQA?

The information systems literature argues that IS development in general is a social practice (Robey & Newman 1996). Kaplan and Maxwell (1994) argue that the purpose of understanding a phenomenon from the point of view of the participants and its particular social phenomena is largely lost when textual data are quantified. Walsham (1993) also asserts that *"interpretive studies generally attempt to understand phenomena through the meanings that people assign to them……and the process whereby the information system influences and is influenced by the context."*

When we compare the IQA approach with the focus group method, the IQA approach not only provides all of the strength that the focus group method has, but also provides the most important "mindmap." The IQA system approach provides the greatest possible assistance in interpretation (Northcutt & McCoy 2004). While the case study method is better in problem exploring, the purpose of our study is to represent the social conflict phenomenon. Furthermore, not only is the IQA approach carried out through the focus group process, but it uses interviews to confirm the outcome of focus groups, thereby providing the best interpretation.

3.3 The IQA approach

IQA study begins with a focus group. A focus group is a small, homogeneous group of people who possess certain characteristics, sharing some experiences and perspectives, or a similar background, who are purposefully selected by the researcher to address a specific topic (Krueger 1994). Since in this study we want to explore differences between IS users and IS analysts, we use two separate focus groups (and subsequent interviews). Each part and each focus group includes six members.

After a group facilitator explains the introduction to the process, the IQA focus groups engage in the first stage, silent brainstorming. During this stage, the moderator of the focus group guides them to write their experiences about the subject on note cards. The participants are given approximately 25 note cards each, and asked to write down one thought or sentence per card, producing as many cards as they can. After everyone finishes writing, an affinity analysis is conducted. The facilitator reads each card and asks each focus group to silently organize the cards into groups of meaning, referred to as "inductive coding." This process is intended to clarify and cluster data into organized groupings, referred to as "affinities." This process continues until the participants come to a consensus. During this process, several affinities will be conducted at each focus group and the participants will give titles which can accurately reflect the meaning of the affinity.

The second step is Theoretical coding, which refers to ascertaining the perceived cause-and-effect relationship (influences) among the affinities in a system and building hypotheses that link each possible pair of affinities. With the affinities clearly defined, the focus group participants are asked to analyze the nature of relationships between each of the affinities. IQA provides the focus group participants with a formal protocol to determine whether or not there is a direct influence on every possible pair of affinities in the system. The participants are asked to record their response in an Affinity Relationship Table (ART), which is a matrix containing all of the perceived relationships in the system. IQA provides a variety of protocols for building the group Interrelationship Diagram (IRD), which contains the information required to produce the group or individual mindmap. The IRD displays arrows that show whether each affinity in a pair is a perceived cause or effect, or whether there is a relationship between the affinities, at all.

The Pareto Principle was developed in the nineteenth-century by economist Wilfredo Pareto. The Principle is a reasonably rigorous and powerful technique for achieving and documenting the degree of consensus in the group's analysis of relationships. The Pareto principle is a statistical method which states that something like 20% of the variables in a system will account for 80% of the total variation in outcomes. The Pareto table provides the key to deciding which relationships should be included or excluded from the group IRD.

3.4 Determining Drivers and Outcomes

Each focus group member was given a blank Affinity Relationship Table (ART) with the appropriate number of affinities. The participants recorded the affinity names in the blanks provided in the ART. They are asked to go down the list one by one and determine if they thought there might be a relationship. If there was a relationship, they were to draw an arrow indicating the direction of the relationship. Relationships recorded in the ART were moved into the Interrelationship Diagram (IRD), were each relationship was recorded twice: once with an up arrow, and once with a left arrow. Arrows facing upward were counted and placed in the *Out* cells of the table. Arrows facing to the left were counted and placed in the *In* cells. Delta (△) was tabulated by subtracting the *Ins* from the *Outs.* Affinities with positive deltas are noted as *drivers* or causes. Those with negative deltas are noted as *outcomes* or effect. The Primary Driver is a significant cause that affects many other affinities but is not affected by others. The *Secondary Driver* is a relative cause or influence on affinities in the system. *Primary Outcome* is a significant affect that is caused by many of the affinities, but does not affect others. The *Secondary Outcome* reveals a relative effect.

The final step is to draw the SID (System Influence Diagram) which is a visual representation of an entire system of influences and outcomes. It also is the representation that is grounded in the specific experiences and logic of the participants' mindmap. SID highlights relationships among affinities. It is considered as a set of qualitative structural equations or as a path diagram. However, it is distinguished from traditional path diagrams, in that recursion or feedback loops are allowed. The methodology is outlined in Fig. 1.

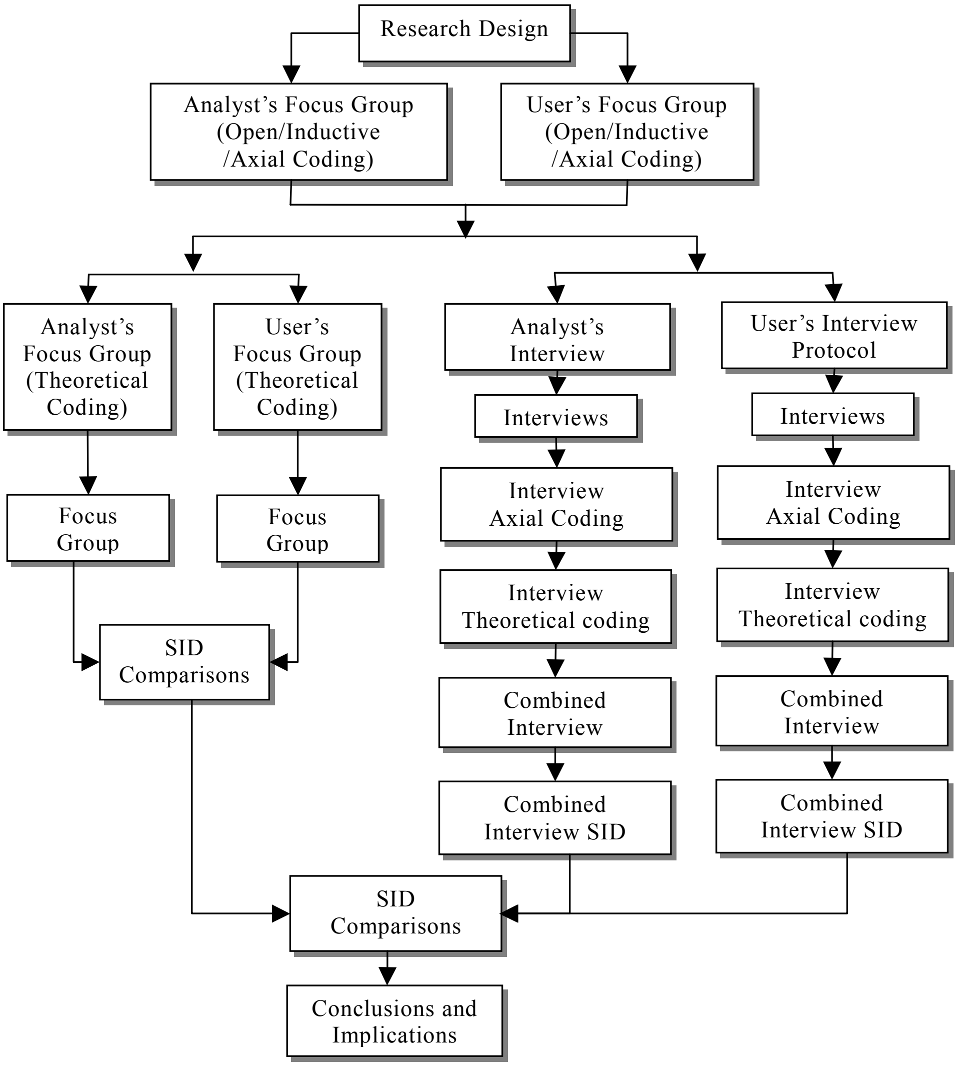

Figure 1: IQA Research Flow

4. DATA COLLECTION AND ANALYSIS

4.1 Focus Group (Open/Inductive/Axial Coding)

Having decided to conduct a series of focus groups session with system analysts and users, this study began to recruit two focus group participants, six participants for each focus group. The focus group members have a similar background in their work or life and share some common experiences vis-à-vis the phenomenon. All 12 participants volunteered to participate in the focus group sessions. Of the six analysts, four were female and two, male with the age distribution from 27 yeas old to 35 years old. Five analysts had IS design experience over 6-years. There were two analysts who had IS design experience over 9 years. All had college degrees and were well trained. Users all had at least 2 years of experience in IS usage and three of them had used the system for over 6 years. Including five males and one female, all of them had a two-year college or postgraduate degree. The usage of IS included financial accounting information systems, enterprise resource planning (ERP), computer numeric control (CNC), computer aided design (CAD), and school administration systems.

Table 1: Affinities by IS analysts from the focus group

Affinity	Definition and Meaning
Self-consciousness (SC)	Analysts with subjective holding and viewpoint toward system design, *such as developer is a grateful God, users are pigs, mission impossible …etc.*
System planning (SP)	Using a graphic drawing to show an idea, draft, …etc.
System analysis (SA)	User information requirement analysis and requirements negotiations, *such as interview, communication,…etc.*
Developmental capability (DC)	The capability of design system.
Analyst habit (AH)	Habit of designer, *such as chosen development tool,…etc.*
System function (SF)	Function provided by system, *such as system security, update management, and data security,…etc.*
System development (SDv)	*Including programming, database design and system,… etc.*
System administration (SAd)	Administration of system, s*uch as System monitoring, auto-copy mechanism,…etc.*
Interface design (ID)	Design of user interface, *such as about whether interface is easy to use and easy to read.*
System efficiency (SE)	The efficiency of system, *such as system speed, size of file, database,…etc.*

Two questions were developed for the focus groups. The question for the users' focus group was: "What are the users' concerns when they use IS?" The question for the analysts' focus group was: "What are the analysts' concerns when they design IS?" During the focus group process, 10 analysts' affinities (Table 1) and 7 users' affinities (Table 2) were conducted and named as follows

Table 2 : Affinities by IS Users from the focus group

Affinity	Definition and Meaning
System function (SF)	Function provided by system, *such as system security, update management, data security, remote control, the data reporting provided by the system, the degree of customization,… etc.*

Management function (MF)	Management function provided by the system, *such as process reduction by the system, providing future planning,… etc.*
User perception (UP)	The perception of users when or after they use the system, *such as the perception that IS can provide help in doing a task, it costs money, and is not easy to learn,…etc.*
System design (SDs)	A process of defining the *hardware and software architecture, components, modules, interfaces, and data* for a system to satisfy specified requirements
User habit (UB)	Habit of users.
System efficiency (SE)	The efficiency of the system, *such as system speed, size of file, database,…etc.*
Interface design (ID)	Design of user interface, *such as whether the interface is easy to use and easy to read.*

4.2 Data analysis

After all affinities were decided, the next step was to create theoretical coding and draw SID. In this section, we followed 3 steps to complete the data analysis process.

1. Process of Affinity Relationship Table (ART)

Each focus group member is given a form and asked to determine the nature of the relationship between all possible pairs of affinities, then asked them to fill in the arrows showing relationships according to their experience. The next issue to be addressed is how to organize the group for filling out ARTs. Asking each member to fill out an individual ART will result in a greater volume and range of data. The Pareto Protocol is to use a simple majority vote while in the focus group to determine the direction of each relationship and the purpose of Power Analysis is to minimize the number of affinities. Therefore, in this study IQA uses the Pareto rule of thumb operationally to achieve consensus and analytically create a statistical group composite.

2. Pareto and Power Analysis

Pareto and Power Analysis are carried out after all of the focus group participants have completed an individual ART. The fist step in calculating frequencies is to record the total number of votes for each relationship pair in the order of affinity. In this study, a total of 146 votes were cast for a total of 90 possible relationships for the analysts' group and another total of 100 votes were cast for 42 possible relationships for the users' group. Then, the next step is to sort the relationships in descending order of frequency and to calculate cumulative frequencies (146 for analysts and 100 for users) and percentages in terms of both the total number of relationships (90 for analysts and 42 for users) and the total number of votes.

How should a cutoff point be determined for affinities that attract relatively few votes? In order to decide which relationships should be included in the group IRD, the decision involves optimizing a trade-off between two criteria: The composite should account for maximum variation in the system while minimizing the number of relationships in the interest of parsimony. According these two criteria, we find that the first 40 (42% of the total) relationships (Fig. 2) account for 88% of the total variation (Fig. 3) in the IS analysts' group and the first 18 (43% of the total) relationships (Fig. 4) account for 74% of the total variation (Fig. 5) in the IS users' group. The power curve peaks at a value of 43.8 (Fig. 2), which is associated with 88% of the total variance (Fig. 3) in the analysts' group and the power curve peaks at a value of 30.9 (Fig. 4), which is associated with 74% of the total variance (Fig. 5) in the users' group.

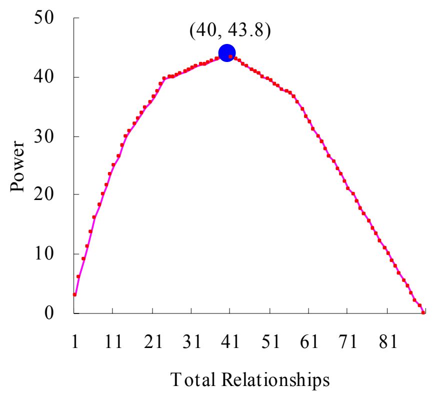

Fig 2: Power-Total Relationships diagram of the analyst focus group

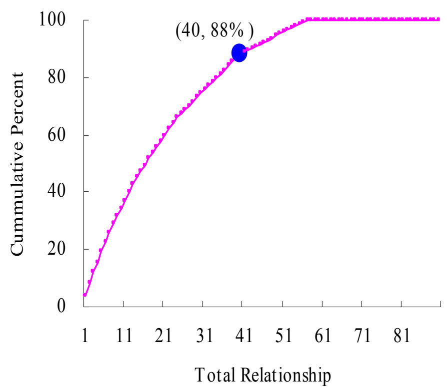

Fig 3: Cumulative percent-Total Relationships diagram of the analyst focus group

In the analysts group, Power reaches a maximum at 40 relationships, which accounts for 88% of the variation; therefore, 40 relationships would be a defensible choice for inclusion in the analyst group IRD because it is an optimal number in the sense of the MinMax criterion. On the other hand, Power reaches the maximum of 18 relationships, which accounts for 74% of the variation; therefore, 18 relationships would be a defensible choice for inclusion in the users' group IRD because it is an optimal number in the sense of the MinMax criterion.

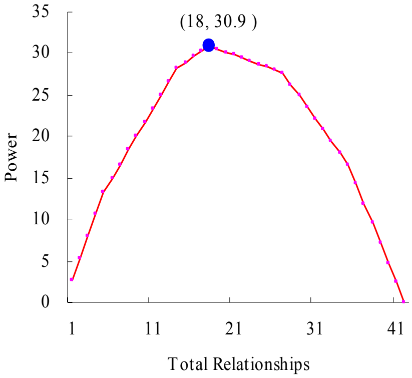

Fig 4: Power-Total Relationships diagram of the user focus group

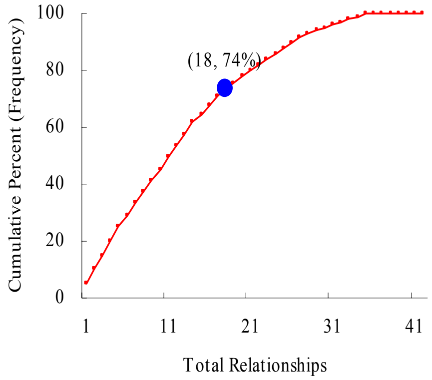

Fig 5: Cumulative percent-Total Relationships diagram of the user focus group

3. Creating a group System Influence Diagram (SID)

Power reaches a maximum at 40 relationships in the analysts' focus group, and 18 relationships in the users' focus group and the frequency of each relationship can be recorded in a table. The form allows the facilitator to quickly record the vote on each relationship as well as the theoretical code assigned to each pair of relationships. They all are an optimal number in the sense of the MinMax criterion in the group of the Interrelationship Diagram (IRD) of analysts (Table 3) and users (Table 4), which are sorted in descending order of delta. The Tentative SID Assignments chart is used to identify the placement of affinities in the SID (see table 5 and 6).

Table 3: Focus Group Tabular IRD of Analyst

	SP	ID	SA	SDv	DC	SE	SF	DH	SC	SAd	Out	In	△
SC	↑	↑		↑			↑	↑	*	↑	6	0	6
DC		↑		↑	*	↑	↑			↑	5	0	5
SP		↑	↑	↑		↑	↑		←	↑	6	1	5
SA	←	↑		↑		↑	↑			↑	5	1	4
DH		↑		↑		↑	↑		←		4	1	3
SF	←	↑	←	↑	←	↑		←	←		3	5	-2
SDv	←	↑	←		←	↑	←	←	←		2	6	-4
SAd	←		←		←				←		0	4	-4
SE	←		←	←	←		←	←			0	6	-6
ID	←		←	←	←		←	←	←		0	7	-7

❖ Count the number of up arrows (↑) or Outs.
❖ Count the number of left arrows (←) or Ins.
❖ Subtract the number of Ins from the Outs to determine the (△) deltas.
❖ △ = Out –In.

Table 4: Focus Group Tabular IRD of User

	MF	UP	UH	SDs	SE	SF	ID	Out	In	△
SF	↑	↑		←	↑		↑	4	1	3
MF			↑	↑	←	←	↑	3	2	1
UP			↑	↑	←	←	↑	3	2	1
SDs	←	←	←		↑	↑	↑	3	3	0
UH	←	←		↑			↑	2	2	0
SE	↑	↑		←		←	←	2	3	-1
ID	←	←	←	←	↑	←		1	5	-4

Taking the two focus groups through the IQA process beginning with silent brainstorming, axial/ theoretical coding, followed by interviews of analysts/users on the affinities developed yields the SIDs showing the composite mindmaps of analysts and users as in Figures 6 and 7, respectively. The SID is drawn with all Drivers on the left and all Outcomes on the right. Indeed, many cognitive gaps are apparent between the two groups' SIDs.

Table 5: Focus group Tentative SID Assignments of Analysts

Affinity Name	Determinant
Self-consciousness	primary driver
Development capability	primary driver
System planning	secondary driver
System analysis	secondary driver
Analyst habit	secondary driver
System function	secondary outcome
System development	secondary outcome
System administration	primary outcome
Interface design	primary outcome
System efficiency	primary outcome

Table 6 : Focus group Tentative SID Assignments of IS users

Affinity Name	Determinant
System function	Primary Driver
Management function	Secondary Driver
User perception	Secondary Driver
System design	Circulator
User habit	Circulator
System efficiency	Secondary Outcome
Interface design	Primary Outcome

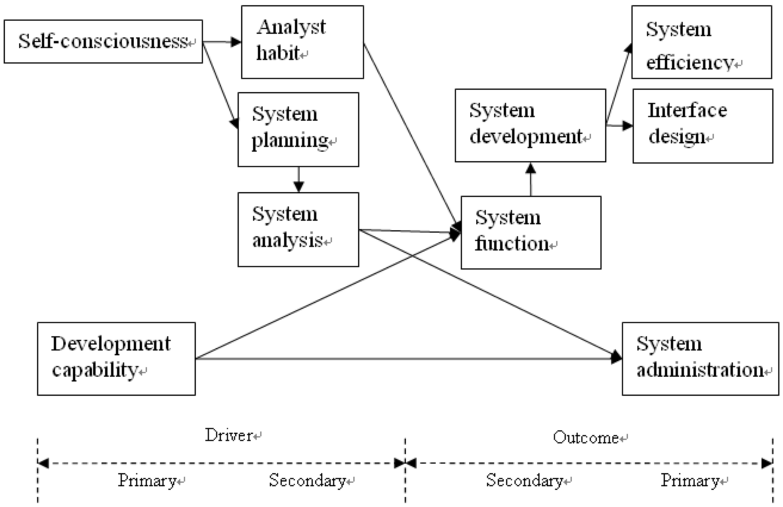

Figure 6: Focus group uncluttered SID of IS Analysts

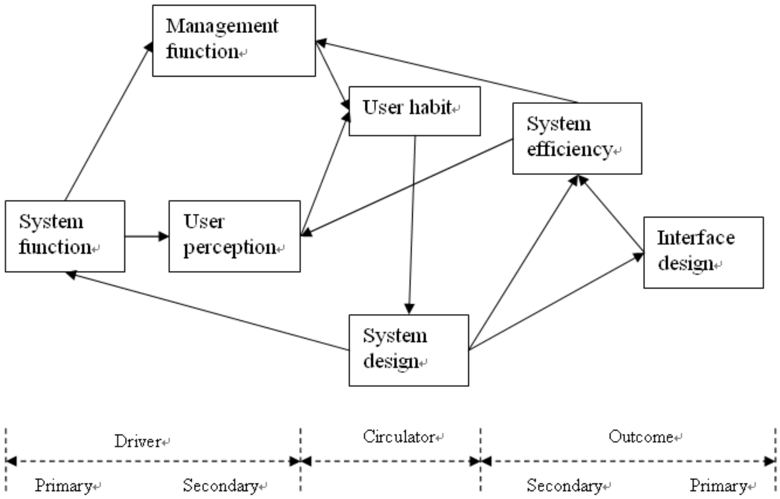

Figure 7: Focus group uncluttered SID of IS users

4.3 The Interview stage

The purpose of the interview protocol is to use the affinities identified through focus group data collection and analysis to inform and shape questions for the second round of data gathering. In the interview stage, we invite another 12 participants (6 members for user interview and another 6 members for analysts' interviews represented). IQA interviews produce a richer, deeper, and a more robust picture from their individual perspective. The IQA focus group and the IQA interview have a parallel structure. Similar to the focus group data, individual interview data are coded first axially, to produce a richer and deeper description of the ways in which the affinities acquire a personal meaning for different individuals. Each interview is also theoretically coded so that the perceived relationships among the affinities are articulated for each individual. Just as in the focus group, theoretical codes are documented in an ART and then tabulated into an IRD for each individual to produce an individual mindmap.

The IQA interview process is consistent with the focus group procedure. The focus group serves as a pilot study to guide further research and allows the researcher to ensure that each affinity is explored thoroughly and consistently. Two SIDs (mindmaps) of the interviews are shown in Figures 8 and 9, analysts and users, respectively.

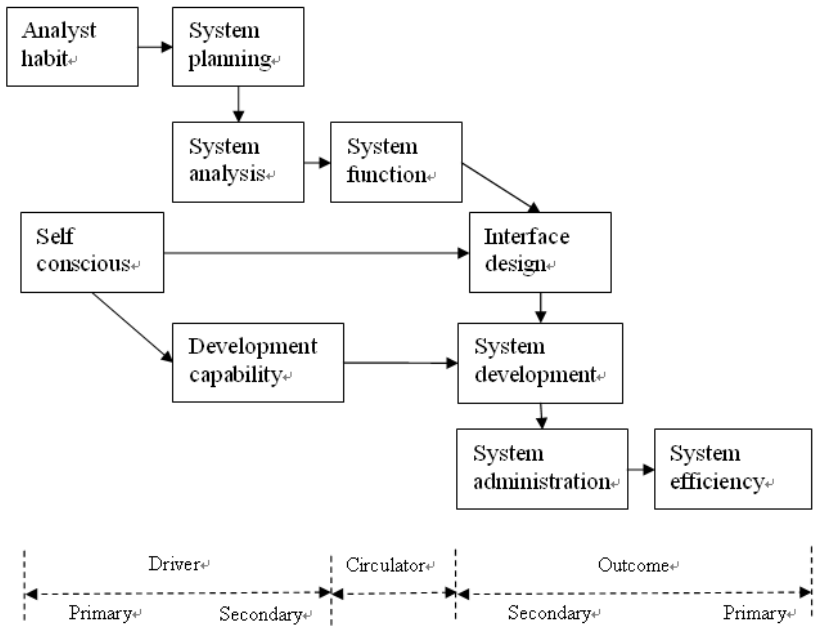

Figure 8: Uncluttered SID of IS Analysts

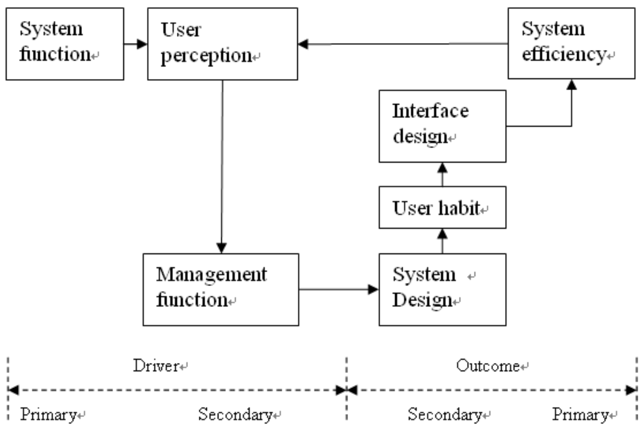

Figure 9: Uncluttered SID of IS Users

4.4 Discussion of the gap between analysts and users

(1) The first difference between IS analysts and users' mindmaps is that the analysts' construction toward system design begins with *self-consciousness* affinity, which is contrary to the users' *system function* driver (see Fig. 10 and Fig. 11). According to Beck (1996), self-consciousness is a subject's intuition, which is mediated through an inference drawn from the subject's ordering representations of the external world in accordance with the inherent concepts and categories in the mind. Well-established studies in social cognitive and cognitive psychology findings refute the relationship between personal experiences, belief structures, and perceptions (Fiske and Taylor 1991). Figure 10 shows that analysts take *self-consciousness* as the starting-point for future system design. In addition, the user requirement does not appear at the beginning of analysts' mindmap toward IS design; therefore, we can infer that analysts are self-oriented. This finding is consistent with the analysts' interview results (see Fig. 12).

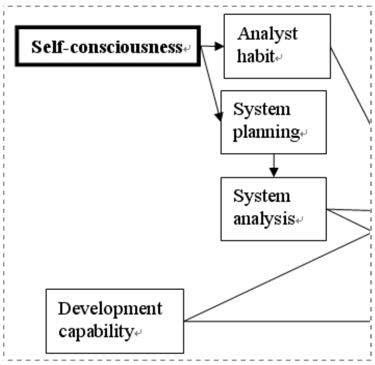

Figure 10: Focus group Analysts

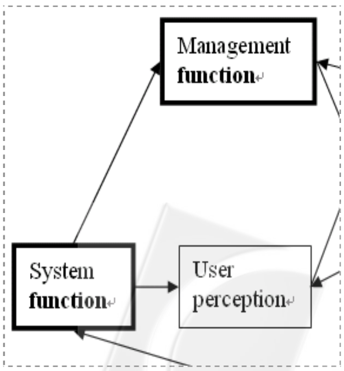

Figure11: Focus group Users

However, IS *users* take *system function* as the starting-point when they use IS. This is also consistent with users' interview results (see Fig. 13). Therefore, we can infer that users are function-oriented. In sum, IS design is derived from analysts themselves, not from users' functional requirements.

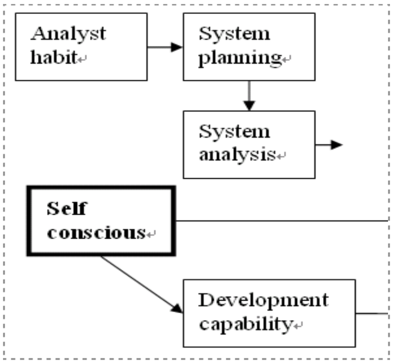

Figure 12: Interview Analysts

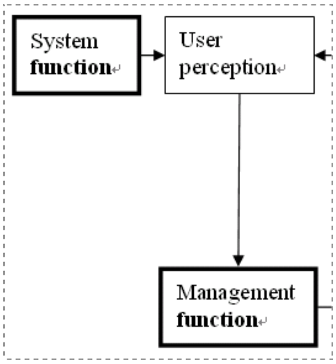

Figure 13: Interview Users

(2) We find that analysts' *system planning* affinity leads to *system analysis* affinity in the analysts' focus group (see Fig. 14). It implies that analysts already have their own system planning workflow or framework in mind when they are designing IS. Moreover, analysts undertake *system planning* in advance, before doing *system analysis*. This result also is found in the analysts' interview mindmap (see Fig. 15).

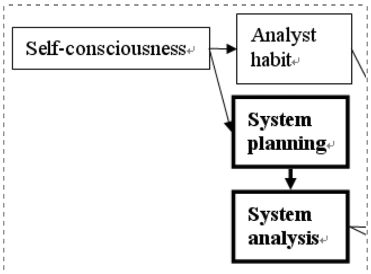

Figure 14: Focus group Analysts

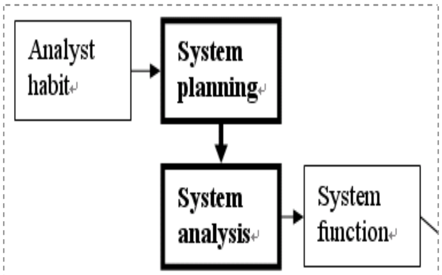

Figure 15: Interview Analysts

(3) By comparing the focus groups of users and analysts, *"habit"* appears in both groups' world. It can be explained as the important role that habit plays in analysts' and users' cognition in IS design. Figure 16 indicates *user habit* through *system design* influence *system function* to reach *management function* and becomes the first feedback loop. In addition, *user habit* leads to *system design, system efficiency,* and *management function* in a series of interlocking feedback loops that evolve into the second loop (see

Fig.17). Figure 18 also shows the third feedback loop which is associated with *user habit*, which through *system design* changes the *interface design,* then influences *system efficiency* to achieve *management function*, becoming a circular feedback loop. This finding is consistent with the users' interview results (see Fig. 19).

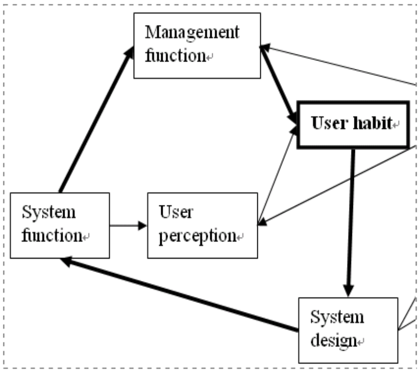

Figure 16:Focus group-users
(The first loop)

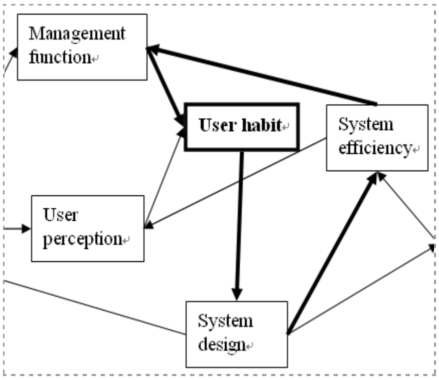

Figure 17:Focus group-users
(The second loop)

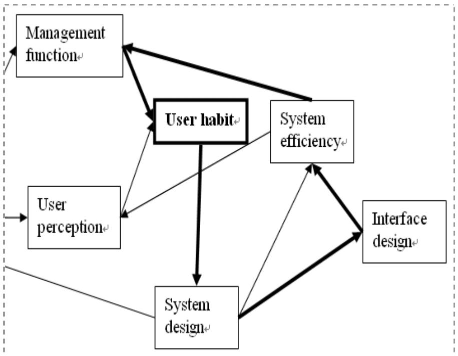

Figure 18: Focus group-users
(The third loop)

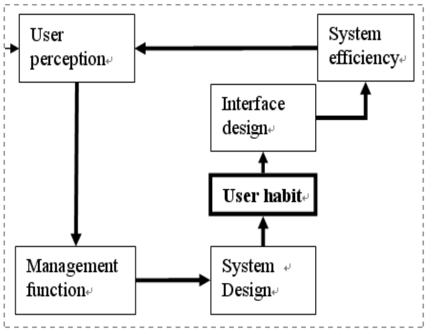

Figure 19: Interview-users

In sum, user habit plays an important role in users' functional orientation. On the other hand, *analysts' habit* plays a role as the driver leads to *system function* (see Fig. 20), which is consistent with analysts' mindmap of interview results. Moreover, *analyst habit* emerges as the primary driver (cause) in analysts' interview (see Fig. 21). Therefore, we infer that divergence happens between users and analysts because analysts consider their own design habits as the driver instead of concerning users' actual needs.

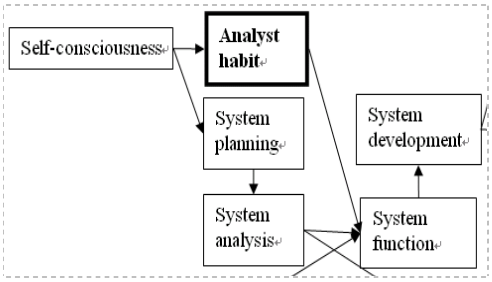

Figure 20: Analysts' focus group

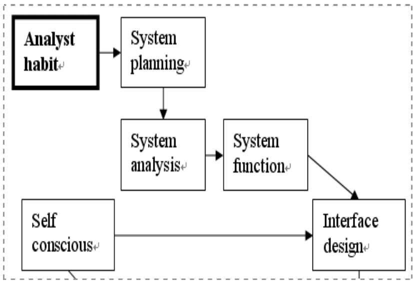

Figure 21: Analysts' interview

(4) Finally, another interesting theme emerged as we noticed that *interface design* and *system efficiency* appeared as outcomes in both analysts' and users' mindmaps (see Fig. 6 and Fig. 7). However, from the analysts' mindmap (Fig. 22), we see that both *interface design* and *system efficiency* are flowing out of *system development*, but there is no direct relationship between them. This finding is consistent with the analysts' interview results (see Fig. 23).

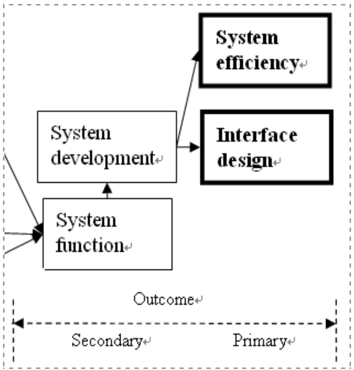

Figure 22: Focus Group Analysts

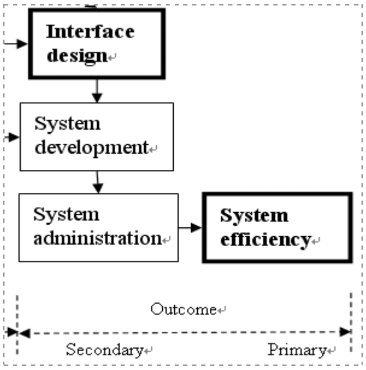

Figure 23: Interview Analysts

Contrary to the users' mindmap, *interface design* and *system efficiency* serve not only as outcomes. *Interface design* will influence *system efficiency* (see Fig. 24) and this finding is also consistent with users' interview mindmap (see Fig. 25).

It should be noted that users are concerned that interface design influences system efficiency, which will lead to management function. To reach a high degree of user satisfaction, analysts should pay attention to the phenomenon and be aware of users' need to be not only technically oriented.

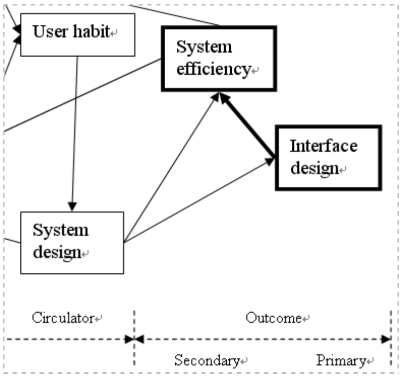

Figure 24: Focus Group Users

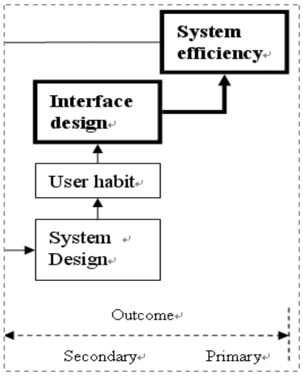

Figure 25: Interview Users

4.5 Managerial implications

The two mindmaps provide insight into the cognitive divergence of analysts and users. To summarize, this paper has shown that analysts are self-oriented in system design; in contrast, users are functionally oriented. Both Dos Santos and Hawk's (1988) case studies and Kaiser and Srinivasan's (1982) research resonate with this finding. The analysts' self-oriented driver provides an asymmetrical relationship with users' functional orientation. Comparing users' and analysts' mindmaps shows that they indeed lack communicative practices during IS design. Habermas's theory of communicative action indicated that communicative action is oriented towards mutual understanding of a situation for coordinating actions. The inability to understand user needs and problems has been a major reason attributed to many system failures (Kaiser & Srinivasan 1982). In addition, users can view IS as a product. Thus, it is important to understand its customers before considering the products and the technology that it offers them (Panko 1987). It is also necessary to bridge the gap particularly effectively in improving communications between analysts and users in order to achieve successful IS design and implementation.

It is important to keep in mind that user requirement is the most critical phase in IS development. The fulfillment of user requirements is an important prerequisite for the development of successful IS (Rexfelt & Rosenblad 2006; Cavaye 2000; Nielsen 1993; Jordan 1998). In this study, the analysts' mindmap shows that analysts are characterized by IS's emphasis on their own experience, habit, or belief structure as the starting-point to design a system and is less concerned with the users' wants and needs in advance. Moreover, analysts go through the system planning stage before system analysis. It is surprising that they violate what we learn from information systems training and education, in which the analysis process should be carried out before system planning. This means that analysts do not have a mutual understanding of the complete picture of users' needs and wants. This violation will cause selective perception (Dearborn & Simon 1958; Robbins & Coulter 2004) and selective perception that happens in IS design may cause intentional blindness of user request. Analysts should know that users are customers, and products can solve users' problems or can give users unique benefits considered to be superior products on the market (Cooper & Kleinschmidt 2000). As we know, pleasing the customer is where it is at these days, and analysts should be urged to be cautious especially when they develop IS that is not based on customers' needs or wants.

Analysts' mindmap does not show the relationship between *interface design* and *system efficiency*; however, it merges in the users' mindmap. This implies that if analysts pay attention to good interface design, it may have a positive measurement in system efficiency. Analysts should think about how well interface design can support system objectives and how it can gain an advantage in IS success.

In sum, self-consciousness toward IS design must first be improved. Second, analysts must keep users' requirements in mind, since the fulfillment of customer satisfaction is a fundamental issue of IS success.

5. Conclusion

This paper considers the gaps that occur between user and analyst by using the IQA approach to the dialogue and discussing the cognitive divergence between them. This process involves a comparison of mindmaps and provides a window into the cognitive divergence between analysts and users. Four cognitive divergences are proposed.

First, analysts' mindmap is derived from "self-consciousness", in contrast to users' "system function." In addition, users are functionally oriented, whereas analysts are self-oriented. These are the key points of cognitive divergence that arose at this time.

Second, analysts violate the proper order of the systems development life cycle (SDLC) by doing system planning before system analysis, which may cause intentional blindness of user request.

Third, "habit" appears in both users' and analysts mindmaps. This indicates that habit plays an important role in both design or user IS. Howeover, *analyst habit* emerges as the driver (cause) in the analysts' mindmap. In consequence, we infer that divergence happens between users and analysts because analysts consider their own design habit as the driver instead of eliciting user need toward IS design.

Four, there is no relationship between interface design and system efficiency in analysts' mindmap, whereas users' mindmap shows a relationship. Therefore, analysts should pay attention to good interface design, which may have a positive effect on system efficiency.

In summary, information system analysts should have a full understanding of what users really need and want, which is an important prerequisite for developing successful products. Also, these critical user-analyst divergences should be the focus of remedial action, to have a systems design of superior quality. It is necessary to decrease or eliminate the distance between users and analysts. If this is accomplished, not only will IS be more effective and efficient, but the IS users will be happier. To reduce the failure of information systems, there indeed needs to be more accurate understanding of the interaction of user and analyst toward IS design.

References

1. Agarwal, R., and Tanniru, M. R. "Knowledge acquisition using structured interviewing: an empirical investigation," *Journal of Management Information Systems* (7:1) 1990, pp: 123-140
2. Alvarez, R. "Confessions of an information worker: a critical analysis of information requirements discourse," *Information and Organization* (12:2) 2002, pp: 85-108
3. Amoako-Gyampah, K. "Exploring Users' Desire to be Involved in Computer Systems Development: An Exploratory Study," *Computers in Human Behavior* (13:1) 1997, pp: 65-81
4. Bailey, J. E., and Pearson, W. "Development of a tool for measuring and analyzing computer user satisfaction," *Management Science* (29:5) 1983, pp:530-545
5. Bann, E. F. *Effects of media representations of a cultural ideal of feminine beauty on self body image in college aged women: An interactive qualitative analysis*, Unpublished doctoral dissertation, University of Texas at Austin, 2001
6. Baronas, A. K. and Louis, M. R., "Restoring a Sense of Control during Implementation: How User Involvement Leads to System Acceptance," *MIS Quarterly*, March 1988, pp. 111-124
7. Beck, G. "From Kant to Hegel-Johann Gottlieb Fichte's Theory of Self-consciousness," *History of European Ideas* (22:4) 1996, pp: 275-294
8. Bostrom, R. P. "Successful application of communication techniques to improve the systems development process," *Information & Management*(1:16) 1989, pp:279-295
9. Burrow, B. A. *The vertical extension of Florida's community college system: A case study of politics and entrepreneurial leadership*, Unpublished doctoral dissertation, University of Texas at Austin, 2002
10. Burton-Jones, A. and Hubona, G. S. "The mediation of external variables in the technology acceptance model," *Information & Management* (43) 2006, pp:706-717
11. Byrd, T. A., and Cossick, K. L., and Zmud, R. W. "A synthesis of research on requirements analysis and knowledge acquisition techniques," *MIS Quarterly* 16(1) 1992, pp: 117-138
12. Cavaye, A.L.M. "User participation in system development revised," *Information & Management* (37) 2000, pp:283-295

13. Christensen, D. M. “The Gap Between Systems Developers and Users,” *Information Systems Management* 8(4) 1991, pp: 73-75
14. Cooper, R. B., and Swanson, E. B. “ Management information requirements assessment: the state of the art,” *Database*, (10) 1979, pp:5-16
15. Cooper, R.G. and Kleinschmidt, E.J. “New Product Performance: What Distinguishes the Star Products,” *Australian Journal of Management* (25:1) 2000, pp:17-46
16. Davis, G.B. “Strategies for Information Requirements Determinations,” *IBM Systems Journal* (21:1) 1982, pp: 4-30
17. Dearborn, D. C. and Siman, H. A. “Selective perception: A note on the departmental identifications of executives,” *Sociometry* (21) 1958, pp: 140-144
18. Despont-Gros, C. D., & Mueller. H., and Lovis, C. “Evaluating user interactions with clinical information systems: A model based on human-computer interaction models, ” *Journal of Biomedical Informatics* (38) 2005, pp:44-255
19. Dillard, J.F. and Yuthas, K. “Enterprise Resource Planning Systems and Communicative Action,” *Critical Perspectives on Accounting* (17:2-3) 2006, pp: 202-223
20. Dos Sanatos, B. L., and Hawk, S. R. “Differences in analyst’s attitudes towards information systems development :Evidence and implications,” *Information & Management* 14(1) 1988, pp: 31-41
21. Etezadi-Amoli, J. and Farhoomand, A. A. “A structural model of end user computing satisfaction and user performance,” *Information & Management* (30) 1996, pp:65-73
22. Fang, K. T. and Sun, C. L. “Study of misconstructions during the communication between users and system developers,” *Chinese Management Review* (2:7) 1999, pp.93-105
23. Fiske, S.T. and Taylor, S.E. *Social Cognition*, McGraw-Hill, Inc., New York, 1991
24. Foder, J. *Language of Though*, Thomas Crowell, New York, 1975
25. Foster, S. T. and Franz, C. R. “On the Differences between Information Systems’ Users and Analysts: Managing Perceptions of systems Quality,” *Journal of Quality Management 3(1) 1998, pp:63-77*
26. Franz, C. R. and Robey, D., “Organizational Context, User Involvement, and the Usefulness of Information Systems,” *Decision Sciences*, (17:3), 1986, pp: 329-356
27. Gelderman, M. “The relation between user satisfaction, usage of information systems and performance, “ *Information & Management* (34) 1998, pp:11-18
28. Ginzberg, M.J. “Early diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions,” *Management Science* (27:4) 1982, 459-478
29. Gray, S. H. *The role of community college presidents in vision building for rural community development*, Unpublished dissertation, University of Texas at Austin, 2003
30. Guinan, P.J. and Bostron, R.P. “Development of Computer-Based Information System: A Communication Framework,” *Database* (17:3) 1986, pp: 3-16
31. Gulliksen, J. ”Key principles for user-centered systems design,” *Behavior & Information Technology* (22:6) 2003, pp:397-409
32. Haberman, J. *The theory of communication action*, Vol. Two, Boston: Beacon Press, 1987
33. Hackos, H. T. and Redish, J. C. *User and Task Analysis for Interface Design*, Wiley, New York, 1998
34. Ives, B. and Olson, M. H. “User Involvement and MIS Success: A Review of Research,” *Management Science* (30:5), 1984, pp: 586-603

35. Jacobson, I., Booch, G, and Rumbaugh, J. *The Unified Software Development Process.* Boston , Addison-Wesley, 1999
36. Janson, M. A. and Woo, C. C. and Smith, L. D. "Information systems development and communicative action theory," *Information & Management* (25:2) 1993, pp:59-72
37. Janson, M. A., and Woo, C. C. "Comparing IS development tools and method: using speech act theory," *Information & Management* (28:1) 1995, pp:1-12
38. Jonassen, D.H. "Operationalizing Mental Models: Strategies for Assessing Mental Models to Support Meaningful Learning and Design-supportive Learning Environment," 1995 Available from: http// www. cscl95.indiana.edu/cscl95/jonassen.html
39. Jordan, P. W. An Introduction to Usability. Taylor and Francis, London. 1998
40. Kaiser, K. and Srinivasan, A. "User-Analyst Differences: An Empirical Investigation of Attitudes Related to Systems Development," *Academy of Management Journal*, (25:3) 1982, PP: 630-646
41. Kaiser, K. M. and Bostrom, R. P., "Personality Characteristics of MIS Project Teams: An Empirical Study and Action-Research Design," *MIS Quarterly*, December 1982, pp: 43-60
42. Kaplan, B. and Maxwell, J.A. *Qualitative Research Methods for Evaluating Computer Information Systems,* Sage, CA, 1994
43. Keeler, M. A. and Denning, S. M. "The challenge of interface design for communication theory: from interaction metaphor to contexts of discovery," *Interacting with Computers* (3:3) 1991, pp:283-301
44. Klein, G. "The Impact of Information System Personnel Skill Discrepancies on Stakeholder Satisfaction," *Decision Sciences* (34:1) 2003, pp: 107-129
45. Knezek, E. J. *Supervision as a selected instructional leadership behavior of elementary principals and student achievement in reading*. Unpublished dissertation, University of Texas at Austin, 2001
46. Krueger, R.A. *Focus Groups: A Practical Guide for Applied Research* (second edition). Thousand Oaks, Sage Publications, 1994
47. Kumar, K., and Becerra-Fernandez, I. "Interaction technology: Speech act based information technology support for building collaborative relationships and trust," *Decision Support Systems* (43) 2007, pp: 584-606
48. Landauer, T. K. *The Trouble with Computers*, MIT Press, Cambridge, 1995
49. Lin, T. C., Hwang, J. A., and Chu, C. S "The effectiveness of Communication between System Developers and end Users: From the Perspective of End User," *Information Management Research* 1(1) 1996, pp: 19-36
50. Lyytinen, K. "Expectation Failure Concept and Systems Analysts' View of Information System Failures: Results of an Exploratory Study, " *Information & Management* (14:1) 1988, pp: 45-56
51. McDermott, J. "Improving Productivity Through Technological Innovation, " *Merck Bulletin* (67) 1987, pp. 3-5
52. McGraw, K., & Harbison, K. *User-Centered Requirements: The Scenario-Based Engineering Process*, Lawrence Erlbaum Associate, Inc., 1997
53. Melone, N. "A theoretical assessment of the user-satisfaction construct in information systems research," *Management Science* (36:1) 1990, pp:76 -91
54. Metsner, A. J. *Don't Slight Communication: some Problems of Analytical Practice*, Wiley Press, New York,1980
55. Moor, A., and Weigand, H. "Formalizing the evolution of virtual communities, " *Information System* (32:2) 2007, pp:223-247

56. Nielsen, J. *Usability Engineering*, Academic press, San Diego, 1993
57. Northcutt, N., and McCoy, D. *Interactive Qualitative Analysis: A systems method for qualitative research*, Thousand Oaks, CA: Sage. 2004
58. Orlikowski, W. J. "Using technology and constituting structures: a practice lens for studying technology in organizations," *Organization Science* (11:4) 2000, pp: 404-428
59. Panko, R.R. "Directions and Issues in End-user Computing," *INFOR* (25:3) 1987, pp: 181-197
60. Rexfelt, O. and Rosenblad, E. "The progress of user requirements through a software development project," *International Journal of Industrial Ergonomics* (36) 2006, pp:73-81
61. Richardson, s. M., Courtney, J. F., and Haynes, J. D. "Theoretical principles for knowledge management system," *Decision Support Systems* (42) 2006, pp:1321-1337
62. Robbins, S. P. and Coulter, M. *Management*, Pearson Education 2004
63. Robey, D. and Newman, M. "Sequential Patterns of Information Systems Development: An Application of A social Process Model," *ACM Transactions on Information Systems* (14:1) 1996, pp:30-63
64. Siau, K., and Tan, X. "Information Systems Requirements Determination and Analysis: A Mental Modeling Approach," *Ninth Americas Conference on Information System* (AMCIS'03), Tampa, FL. 2003 pp: 1370-1379
65. Siau, K., and Tan, X. "Using Cognitive Mapping Techniques To Supplement UML and UP in Information Requirements Determination," *Journal of Computer Information Systems* (46:5) 2006, pp: 59-66
66. Smart, K.L. and Whiting, M.E. "Designing systems that support learning and use: a customer-centered approach," *Information & Management* (39) 2001, pp:177-190
67. Standish. Extreme CHAOS. 2007 (cited 2004 1-19-2004); Available from: http://www.standishgroup.com/ sample_research/PDFpages/extreme_chaos.pdf.
68. Szajna, B. and Scamell, R. W. "The Effects of Information System User Expectations on Their Performance and Perceptions," *MIS Quarterly* 17(4) 1993, pp: 493-516
69. Walsham, G. *Interpreting Information Systems in Organizations*, John Wiley & Sons, Inc., New York, 1993
70. Wixom, B. H., and Todd, P. A. "A Theoretical Integration of User Satisfaction and Technology Acceptance," *Information System Research* (16:1) 2005, pp:85-102
71. Wood, L. E., *Use Interface Design: Bridging the Gap from User Requirements to Design*, CRC Press, Florida, 1998
72. Wu, J. H. and Wang, Y. M.,"Measuring KMS success: A respecification of the DeLone and McLean's model," *Information & Management* (43) 2006, pp: 728-739