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User Interface Design and Knowledge Integration in Electronic Groups: An Attention-Based View

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Keywords: knowledge integration, attention, visibility, prioritization

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ABSTRACT

The theory developed in this study seeks to construct an attention-based view of knowledge integration that underscores the importance of IS interface design. The assumption is that presenting ideas via user interface plays a key role in enabling and motivating knowledge integration in electronic brainstorming groups. Building on the attention-based view and motivation-ability framework, the current theory focuses on two major attributes of user interface: visibility and prioritization. While the first attribute is concerned with enabling knowledge integration via directing attention to a limited set of knowledge items, the second attribute intends to enhance the motivation for knowledge integration by exposing prioritized ideas to individuals' attention.

Knowledge integration at the group level is an essential process for establishing knowledge-based capabilities. To harness the collective value of the knowledge owned by individuals, organizations must facilitate knowledge integration. Lack of knowledge integration significantly reduces the value of knowledge sharing, which has long been the focus of organizational research. Unless attended to, processed, and integrated by recipients, the shared knowledge does not guarantee any benefit to the organization.

However, pervasive use of online collaborative knowledge creation platforms (e.g., discussion boards, technical forums) has brought about an abundance of information that competes for attracting individuals' attention. This information abundance made available electronically, calls for revisiting knowledge presentation via user interface to enhance knowledge integration. If not properly presented via user interface, information abundance distorts individuals' attention and overshadows good ideas that are stored electronically among many others. This distortion will adversely influence individuals' ability and motivation for knowledge integration.

This theory developed in this study is distinct from previous research of computer-mediated knowledge integration in at least two ways: the frameworks explicitly separates knowledge integration and knowledge sharing and focuses exclusively on knowledge integration. Second, the attention-based view of knowledge integration is used to construct a motivation-ability framework for knowledge integration in the context of IS user interface.

Keywords: knowledge integration, attention, visibility, prioritization

INTRODUCTION

Knowledge integration is essential for creating organization's knowledge-based capabilities (Grant 1996a). Knowledge integration in organizations is initiated at the group level where heterogeneous, diverse, or specialized knowledge, which resides within individuals, is processed and integrated (Grant 1996b; Litchfield 2008; Okhuysen & Eisenhardt 2002). Knowledge integration at the group level happens when individuals work together or *ideate* on a task or problem, and the current study focuses on group ideation (Litchfield 2008). Group ideation is defined as generation of ideas or solutions on a problem by more than one individual. Assuming that no one individual has sufficient knowledge to generate the best idea, knowledge integration becomes a key to realizing more fully the value of the individually generated ideas (Dennis 1996; de Vreede, Davison, & Briggs 2003; Robert, Dennis, & Ahuja 2008). Integration is a critical process by which dimensions of more than one individual's ideas are combined at the group level to create integrative complex knowledge (Nonaka 1994; Okhuysen & Eisenhardt 2002). Integration occurs when individuals consider dimensions of others' ideas (recognition) and create conceptual connections among different dimensions (integration) (Gruenfeld & Hollingshead 1993). As many organizations are adopting online collaborative knowledge creation platforms, the current study focuses on computer-mediated ideation.

The current study maintains an *attention-based view* (Ocasio 1997; Simon 1947) of knowledge integration and adopts a *motivation-ability* approach to interface design (Robert & Dennis 2005; Thoemmes & Conway 2007). For ideas to be integrated they must be exposed to brainstormers' attention; also individuals must be able and motivated to integrate these ideas (Thoemmes & Conway 2007).

Since the IS user interface is the point of access to the shared knowledge for individuals in an electronic brainstorming group (Sheppard & Rouff 1994), user interface features play a key role in enhancing individuals' abilities and motivations for knowledge integration (Figure 1) (Dennis *et al.* 1996). The currently developed model proposes that channeling (i.e., directing individuals' attention) through manipulation of visibility of the ideas (i.e., information saliency) and prioritization of the visible ideas influence knowledge integration behavior of the individuals.

Although many previous experimental studies have addressed knowledge-sharing behavior of the individuals in electronic groups (Barkhi 1995; Robert, Dennis, & Ahuja 2008; Wasko & Faraj 2005), little research have been done to examine the extent to which individuals build on the knowledge shared by others. And while the purpose of knowledge sharing is knowledge integration and use (Figure 1), the majority of previous empirical studies have focused extensively, and almost exclusively on knowledge sharing determinants and detriments, taking knowledge integration as given.

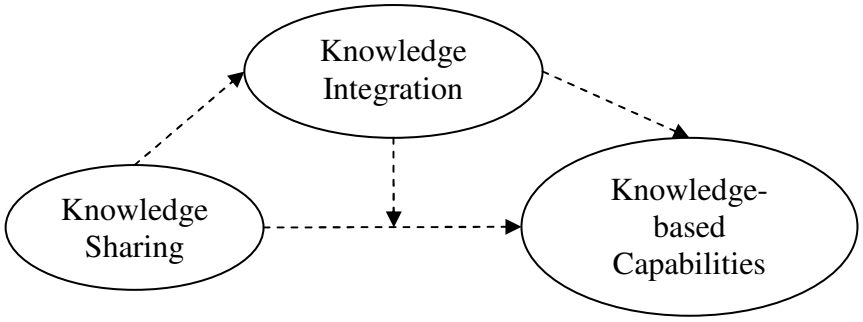

Figure 1: Knowledge integration and knowledge-based capabilities

The current study, however, pursues a different path and thus focuses on knowledge integration. It is important to note that knowledge sharing neither guarantees knowledge integration & use, nor provides any benefit to the organization's success if the shared knowledge is not attended to, processed or integrated by the recipients (Grant 1996b). The current framework also maintains that knowledge sharing and integration are different processes with different antecedents and different consequences (Okhuysen & Eisenhardt 2002).

Examining knowledge integration in electronic groups using the current paper's developed framework contributes to the resolution of the paradox of group brainstorming. Despite many benefits of group brainstorming (e.g., enhanced idea generation), there is still much debate concerning the effectiveness of group brainstorming (Davidson *et al.* 2007). The proposed framework calls attention to knowledge integration as one key process that differentiates group ideation from individual ideation (Dennis 1996; de Vreede, Davison, & Briggs 2003; Homan *et al.* 2007; Robert, Dennis, & Ahuja 2008). If within groups, individuals do not attend to each others' ideas or they are not able and motivated to integrate ideas, not much will be gained from working in groups. Using IS interface features to channel individuals' attentions and to enable and motivate individuals to integrate ideas in groups is the major contribution of IS that will help distinguish group outcomes from those of individuals.

The framework developed here contributes to the IS research literature on electronic knowledge creation and brainstorming in at least three ways. First, building upon Simon's (1947) logic for attention as a scarce resource in organizations, this framework links IS interface attributes to the creation of firm's knowledge-based capabilities in the era of Enterprise 2.0 (McAfee 2006). Second, building upon electronic brainstorming literature (Boland, Tenkasi, & Teeni 1994; Dennis *et al.* 1996; Desanctis & Gallupe 1987), the proposed framework extends use

of interface attributes for enhancing brainstorming productivity through promoting knowledge integration. Third, it creates the foundation for further empirical studies that contribute to managerial decision making for deploying Web 2.0 technologies, which improve collaborative knowledge creation within organizations.

In the next part of the paper, an attention-based view of knowledge integration is presented. I note links between user interface attributes and knowledge integration. The remainder of the paper then will focus on conceptualizing each of the constructs in the proposed framework (Figure 2).

KNOWLEDGE INTEGRATION

Knowledge integration within ideation groups is realized through idea integration. For the purposes of this paper the concept of an *idea* is defined more narrowly than would perhaps be needed in other contexts. Specifically, in the current paper, an *idea* is defined as a basic element of thought that consists of at least one testable proposition (Simon 1976). A statement is also considered an idea if it is a mixture of ethical statements and testable propositions (Simon 1976). However, if the shared information consists of only ethical or imperative statements like "I prefer solution A" or "I believe we should adopt solution B", it is not considered an idea. Also, if the shared information is a definition or description of an object, event or a process that does not include individual's perspective on it and does not provide any indication of relevance to the topic discussed in the group, it is not considered as an idea (Baker-Brown *et al.* 1992).

Integration of ideas, also referred to as combination or synthesis, is considered the most fruitful phase of the creative process (Osborn 1953). The current study maintains that idea integration is a critical process that has dimensions of both convergent and divergent thinking (Guilford 1956). Integration involves divergent thinking in that individuals consider different

perspectives of the shared ideas; integration involves convergent thinking in that individuals must create the connections among different dimensions of the various ideas to frame an integrated view.

Some research (see Table 1) identifies knowledge integration as the outcome of *elaboration*, which is described by information exchange, information processing at the individual level, and then integration at the group level (Homan *et al.* 2007). To make a distinction between different levels of knowledge integration ranging from mere reference to others' ideas to completely connecting the alternative ideas, the current paper defines knowledge integration based on the well-studied concept of *integrative complexity* in social psychology (Gruenfeld & Hollingshead 1993; Suedfeld, Tetlock, & Streufert 1992).

Table 1: Studies of knowledge integration at group level

Study	Dependent Variable	Definition of the Construct	Approach
Dennis (1996)	Information use	Use of unique information owned by others	Information recall-exchange- processing and use framework
Okhuysen & Eisenhardt (2002)	Knowledge integration	Use of unique knowledge pieces owned by others	Use of formal interventions for directing and switching attentions
Homan et al. (2007)	Information elaboration	Elaboration on task-relevant information and perspectives	Pro-diversity as integration enabler
Robert, Dennis, & Ahuja (2008)	Knowledge Integration	Making reference to other's ideas	Social capital framework

Integrative Complexity

Integrative complexity is defined as a measure of the individual tendency to consider decision-relevant information from more than one dimension (Suedfeld, Tetlock, & Streufert 1992; Gruenfeld & Hollingshead 1993) and within group integration involves generation of new conceptual relations among different perspectives (Gruenfeld & Hollingshead 1993). Integrative complexity has been identified by two phases of differentiation and integration. Differentiation is the perception of different aspects of a subject, and integration is the recognition of connections among those aspects (Suedfeld, Tetlock, & Streufert 1992).

Complexity researchers define integrative complexity as a cognitive or information processing style (Harvey, Hunt, & Shroder 1961). While some have referred to integrative complexity as a trait, many other research studies consider it as having dimensions of both trait and state (Streufert & Swezey, 1986). Some research studies have also referred to integrative complexity as a changeable trait. Trait complexity is the one that is less likely to change while state complexity is prone to environmental mediators (Suedfeld, Tetlock, & Streufert 1992). In general, complex thinking is not simply a matter of ability; it is also a matter of motivation (Thoemmes & Conway 2007). Complexity research proposes that organizational context can foster different levels of complexity. State complexity, for instance, can be modified over the short run by motivation. Situational conditions such as environments rewarding complex or simple behavior will be influencing the level of state complexity (Homan *et al.* 2007; Suedfeld, Tetlock, & Streufert 1992). Personality of the individuals also influences the extent to which they exhibit flexibility in changing their level of complexity. Most of the previous research literature on integrative complexity research has dealt with state complexity (Gruenfeld & Hollingshead 1993); one which changes in a particular situation or context. This research also focuses on state

complexity as it examines features of user interface that influence state complexity through channeling individuals' attention.

Idea integration, in the current study, is defined as an activity that leads to the creation of integratively complex ideas. Idea integration occurs when an individual refers to the ideas proposed by other individuals (Robert, Dennis, & Ahuja 2008) and creates the conceptual connection among those ideas and those of his/her (Gruenfeld & Hollingshead 1993). Reference may be made to an idea as a whole or to some *dimensions* of the ideas. Even though *dimensions* are considered building blocks in the study of integrative complexity (Suedfeld, Tetlock, & Streufert 1992; Gruenfeld & Hollingshead 1993), no previous research study has explicitly defined it. Since in the current study *idea dimensions* are referred to repeatedly, it is defined here as "a unique testable proposition." Therefore, the shared information is called a multi-dimensional idea if it includes more than one unique testable proposition.

While it is not certain whether higher integrative complexity leads to better quality outcomes in a general task (Gruenfeld & Hollingshead 1993), as ideation involves creative thinking, higher integrative complexity will lead to better ideas. Gruenfeld and Hollingshead (1993) have proposed a conjecture on the correlation between integrative complexity and task performance based on the task type in which they suggest that the performance of conceptual tasks and intellective tasks are positively correlated with integrative complexity. The same study suggests that integrative complexity and task performance will be much more highly correlated in a non-decomposable task than in a decomposable one. Other empirical studies (Okhuysen & Eisenhardt 2002; Robert, Dennis & Ahuja 2008) suggest that knowledge integration will improve quality of the outcome at the group level. Since the current paper is concerned with idea

generation as a creative and non-decomposable task, the proposed framework posits that idea integration will contribute to the quality of the idea generation process.et

The new approach for defining knowledge integration based on integrative complexity has some advantages. This new definition allows for flexibility in operationalization of the *knowledge integration* construct at the group level, which is more strongly linked to the creation of knowledge-based capabilities at the firm level (Grant 1996b). To date, the empirical studies have focused mainly on the quantity of integration measured by the number of references made by individuals to ideas of others (Homan et al. 2007; Robert, Dennis, & Ahuja 2008). However, as different combinations of the same factual information (testable propositions) may generate different combinative outcomes (Okhuysen & Eisenhardt 2002) measuring quality of the integration is key to studying the value created by knowledge integration. The degree of knowledge integration at the *group level* influences the value of the knowledge integration at the firm level. The current study's definition of knowledge integration based on integrative complexity allows for differentiating between mere reference to ideas of others and completely integrating others' ideas with those of their own (Baker-Brown *et al.* 1992). This differentiation among levels enables stronger theory development and more precise empirical testing, which then link knowledge integration at the group level to the creation of the firms' knowledge-based capabilities. Based on this new definition of knowledge integration, the next section proceeds to explain the attention-based theoretical framework.

ATTENTION-BASED VIEW AND KNOWLEDGE INTEGRATION

As discussed in the previous section, idea integration requires recognition of different perspectives and then making conceptual connections among them (Gruenfeld & Hollingshead 1993). Assuming that individuals are motivated to do so, discovering different perspectives

requires attending to ideas proposed by others. As individuals attend to ideas shared by others, they are likely to discover new dimensions. Thus, for ideas to be integrated, they have to be exposed to brainstormers' attention. However, similar to what happens in many Web 2.0 knowledge-sharing applications (e.g., Yahoo Answers and Mail.ru) the abundance of information diverts individual's scarce resource of attention (Simon, 1976). One method for overcoming the information overload is to use information technology interface to direct individuals' attention to a few selected ideas.

Taking insights from prior empirical studies of knowledge integration that use interventions for directing and switching individuals' attention (Okhuysen & Eisenhardt 2002), the current developed framework suggests that *visibility of the ideas* and *idea prioritization* are two methods for channeling brainstormers' attentions (Figure 2). Since individuals can focus only on a limited number of ideas at any given time, in an ideation setting, ideas compete with each other to receive the attention of the brainstormers and visibility based on chronological order or the collective prioritization of the ideas are two commonly used methods for distributing attention among the ideas (e.g., in face-to-face brain-storming). The definition of idea visibility is consistent with that of availability and saliency of issues and answers in the *attention-based view of the firm* (Ocasio 1997). As individuals are selective in the issues they attend to and the actions they perform --- generation, sharing and integration of ideas --- depend on how their attention is channeled, this dissertation proposes that visibility of the ideas and prioritization are key drivers of the integrative behavior of the brainstormers in virtual teams (Hollinghead 1996; Ocasio 1997); this framework suggests that visibility and prioritization are interventions that are easily manipulated via IS user interface and can potentially enhance integrative complexity of the ideas generated in electronic groups.

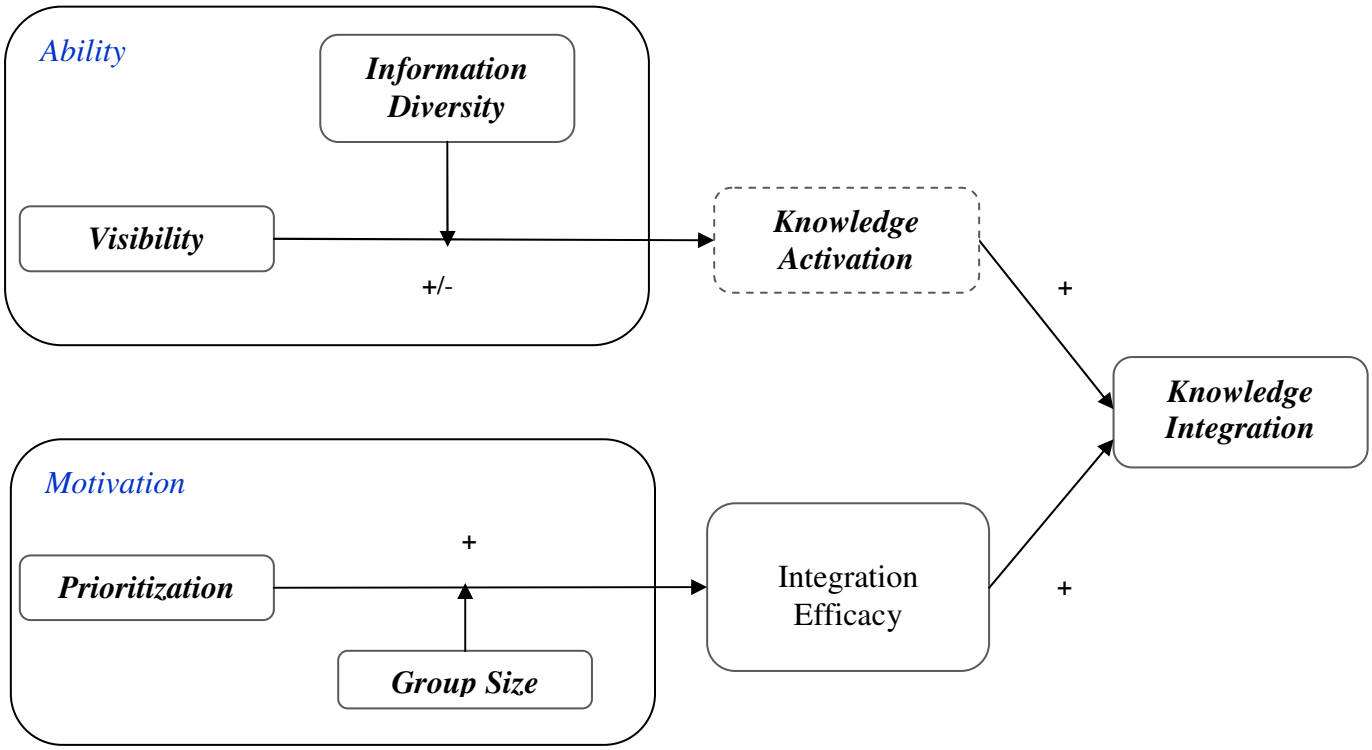

Figure 2: Research framework

In electronic groups, individuals are able to integrate ideas that they already have in mind with those of others that are visible via user interface. The integration process requires search in memory for possible links among the perceived concepts and associative thinking empowers that (Osborn 1953; Potter & Balthazard 2004).

VISIBILITY

For idea integration, individuals must attend to the ideas posted by others so as to discover new perspectives. For directing an individual's attention in the group context, relative visibility or salience of ideas becomes important (Dennis 1996). Visibility of the ideas on user interface facilitates members' exposure to the different dimensions and is a predictor of the idea being used in an integration activity when ideation is taking place. With the shift from information scarcity to information richness in modern organizations, visibility of the ideas becomes

even more important (Hansen & Haas 2001). Idea visibility identifies the extent to which ideas proposed by members of the group are visible to other members of the group.

The construct of *idea visibility,* in the current framework, is studied in the context of user interface design but is independent of a particular technology. Idea visibility is defined by the portion of the idea pool that is visible without significant effort (clicking or scrolling) and it is posited that visibility plunges as the effort for viewing the ideas increases. In other words, *idea visibility* is the number of ideas that are placed on the screen and are visible without scrolling or changing pages. This construct can be manipulated by changing the size of the idea pool presented to the individuals via the user interface. As ideas created during the ideation process compete for getting on the screen, individuals' attention is channeled through the user interface where ideas are presented to the viewers. The extent to which the ideas are exposed to the viewers depends on their position on the screen. The visibility of the idea affects the focus of attention, which in turn influences the extent to which relevant concepts are activated in associative memory. The activation of relevant concepts in associative memory based on the stimuli available in the salient ideas is discussed next.

Knowledge Activation and Search in Associative Memory

For idea integration, individuals must perceive different perspectives on the issue and then must recognize the connection among them. To create the conceptual connection among the differentiated perspectives, individuals must search their memory for the relevant concepts (Potter & Balthazard 2004). Models of memory suggest that for information to become available to the working memory they should be activated by probing the memory with cues. For instance, the two theories of Adaptive Control of Thought (ACT) and Search of Associative Memory (SAM) (Anderson 1983, 2005; Anderson & Lebiere 1998, Raaijmakers & Shiffrin 1981) state

that memory traces become more or less active as a function of cues in the context and they become more active when associated concepts are presented. Focusing attention, therefore, helps individuals get cues and helps probe memory with those cues. When individuals search memory with the cues from ideas, related concepts will be activated and through spreading activation finding the connection among concepts becomes possible (Anderson 2005). As a result when certain ideas are attended to, memory is probed using the cues made available by those ideas and the connections among them are more likely to be discovered. Given that the environment is encouraging complex behavior, it then becomes likely that those connections are articulated as combinative ideas by individuals in an ideation process.

Visibility of the ideas directs individuals' attention by facilitating members' exposure to the different dimensions of the proposed ideas. Each idea that an individual attends to provides a potential set of cues that can be used for the individual's memory search process (Potter & Balthazard 2004), the number of potential cues increases as the number of visible ideas increases. As visible ideas are attended to and the attended information resides in an intermediate short-term memory that has limited capacity, only a few ideas can be active in memory at the same time. In other words, short-term memory has room for a limited number of elements that is referred to as memory span. Memory span is defined by the number of elements that one can immediately repeat back and the general view is that memory has room for about seven elements (Anderson 2005). An increased number of cues facilitate retrieval of more information from memory, which increases the possibility of the members realizing connections among different ideas' dimensions (Figure 2). However, as the number of visible ideas increases, cognitive overload will decrease the extent to which individuals attend to the visible ideas. Considering memory span and cognitive overload, it is proposed that:

Proposition 1: Idea integration is curvilinearly associated with idea visibility through the mediating effect of knowledge activation; that is idea integration will occur more at moderate levels of visibility and occur less at both low and high levels of visibility.

Also, as pieces of information in visible ideas are more likely to be used as cues to probe individual's memory, the memory search process is likely to return results that are connected to these ides; and therefore the visible ideas are more likely to be referred to in the integration process. As such, the framework proposes that the overall visibility of the items influence the level of activation of the relevant concepts (Grownski & Bodenhausen 2005).

INFORMATION DIVERSITY

As ideas that are attended to become more diverse, the potential for integration increases because information diversity will by itself stimulate information integration (van Knippenberg, De Dreu, & Homan 2004). If knowledge that resides within individuals is homogenous or identical, there will be no gain from integration (Grant 1996b). As integration occurs when different perspectives are combined, *ceteris paribus*, a highly diverse set of visible ideas is more likely to stimulate generation of integrative ideas than a less diverse set of visible ideas. Diversity of the ideas leads to increased diversity of cues, which in turn, facilitates knowledge activation and retrieval of more information from memory. Diversity of ideas, therefore, increases the extent to which visibility influences knowledge activation and knowledge integration. Thus the gains from controlled visibility should increase with the diversity of the idea pool. The current framework proposes that diversity moderates the relationship between visibility and knowledge integration through its effect on knowledge activation (Figure 2).

Proposition 2: Diversity of the ideas moderates the relationship between visibility and idea integration through the mediating effect of knowledge activation. The higher the levels of diversity, the higher the extent to which idea integration occurs in the group.

Visibility helps with directing individuals' attention, and facilitates activation of the relevant knowledge. Diversity of the ideas also helps with activation. The more diverse the salient ideas, the more stimuli will be available for probing memory and the more likely relevant concepts are activated and knowledge is integrated. Diverse information stimulates original ideas but empirical research studies indicate that the mere presence of diverse information may not provide any benefits for generation, sharing or integration of ideas (Philips *et al.* 2004; *Wooley et al.* 2008). Since the current's study's proposed framework is concerned with knowledge integration, the following section will focus on prioritization as a method to increase motivation for knowledge integration.

PRIORITIZATION

Integration, which requires creating connections among different dimensions, is also referred to as association (Osborn 1953). Association can be enhanced by selective attention (Osborn 1953). As only a limited number of ideas can be attended to, criteria are required for choosing the ideas for display on the screen. In the current framework, the criterion is the collective evaluation by the group, which is the most commonly used prioritization criterion in face-to-face brainstorming groups. Prioritization based on the collective evaluation of the group is the most efficient method of prioritization as at the time of idea generation, actual evaluation of the ideas based on organizational goals (Litchfield 2008) cannot be easily achieved. Alternatively, ideas can be displayed on the screen based on the chronological order.

In the current study's framework ideas are prioritized if the criterion used for displaying them is based on the collective evaluation of the individuals. In other words, prioritization is defined as using the limited number of visible spots for exposing individuals to a particular set of ideas that are collectively ranked high and shielding individuals' from other ideas (Simon 1947).

Since the number of visible ideas on the screen is limited and lower-ranked ideas will be placed down the list, the probability of the idea being exposed to individuals' attention becomes less for the lower-ranked ideas.

For knowledge integration to occur, it is necessary that individuals in the groups positively evaluate the ideas posted by others (Borgatti & Cross 2003). Also, social exchange theory maintains that individuals engage in social interaction based on expectation of some type of rewards. Individuals should perceive value in integration so that they process ideas and then engage in integrating them with their own ideas (Blau 1964). Perceived integration efficacy, in the current framework, is defined to encompass individuals' evaluation of others' ideas (perceived value of information) and perception of the gains from knowledge integration (perceived value of integration), which are proposed to influence individuals' knowledge integration behavior in an ideation group.

The criterion for display influences individual's perception of the value of the ideas and consequently of the value of knowledge integration. If the ideas are selected for display based on the collective evaluation, individuals attribute more value to the ideas being displayed. Prioritization based on collective evaluation therefore reduces the uncertainty involved in individual's decision to integrate ideas with those of others. It is thus proposed that individual's perception of the integration efficacy is at higher level when ideas are prioritized based on the collective evaluation by the team, and are presented through user interface based on that rank order (Figure 2). This logic leads then to the following proposition.

> *Proposition 3: Prioritization or visibility based on collective evaluation will lead to the formation of higher perceived integration efficacy.*

Perceived Integration Efficacy

Perceived integration efficacy is defined by perception of the individuals on how integration contributes to the quality of the outcome, that is, the quality of the ideas generated by the group. This constructs is defined by two sub-constructs, individuals' belief on the value of the ideas chosen for integration, *perceived value of information,* which is similar to, but more general, than *perceived information credibility* used in prior research studies (Dennis 1996) of information use. And *perceived value of integration,* which is individuals' belief on the extent to which integration adds value to the ideas generated by the individual: perceived value of knowledge integration mediates the effect of prioritization on knowledge integration.

Since individuals' actions are based upon their beliefs of the consequences of those actions (Simon 1947), the current framework proposes that individuals are more likely to integrate ideas when they perceive that integration efficacy is high (Figure 2).

> *Proposition 4: Formation of higher perceived integration efficacy leads to more idea integration.*

Group Size

Like in most of the theoretical and empirical studies of electronic brainstorming (Dennis & Valacich 1999; Dennis & Wixom 2001), size of the group is an important moderator of the relationships proposed in the current study. In the current framework, the size of the group is posited to moderate the influence of prioritization on perceived integration efficacy. Prioritization works as a selection mechanism for choosing a few ideas for display among competing ideas. In larger groups, more people are available for evaluating or criticizing an idea (Gallupe *et al.* 1992) therefore prioritization based on the collective evaluation of the idea will be more credible in larger groups than it is in smaller groups. As such, there will be more gain in terms of the perceived integration efficacy.

Prioritization is also less salient when information is not abundantly available and, in the current study, when the pool of ideas is small. Prioritization, however, is more salient when the pool of ideas is large. Consequently, the size of the group, which presumably influences the size of the idea pool, is an important moderator in the model (Figure 2).

> *Proposition 5: Group size will moderate the relationship between prioritization of the ideas and perceived integration efficacy such that prioritization will have more of an effect on perceived integration efficacy in larger groups than in smaller groups.*

SUMMARY AND CONCLUSION

The current paper has developed a framework that links IS user interface design to the creation of firm's knowledge-based capabilities through facilitating knowledge integration at the group level. The framework focuses on user interface attributes that enable and motivate individuals to integrate knowledge at the group level. Integration of individuals' knowledge or combinative capabilities (Kogut & Zander 1992) is indispensable for creating firms' knowledge-based capabilities. As knowledge integration is realized by integrating the knowledge that resides within individuals at the group level (Grant 1996b; Okhuysen & Eisenhardt 2002), the framework is concerned with idea integration within groups. The emphasis on knowledge integration is justified by the assumption that individuals' specialized knowledge will provide no value to the firm unless the knowledge is processed, integrated and used.

Group ideation is considered a communication-intensive mechanism for integrating knowledge in complex tasks (Grant 1996a). Since online collaborative knowledge creation is the prevalent communication platform for group ideation within firms (rise of Enterprise 2.0, McAfee 2006) and as user interface can be instrumental in deploying interventions, which enhances individuals' abilities and motivations for knowledge integration, a systematic study of

user interface effect on knowledge integration is required. Since user interface is the point of contact to the shared knowledge base, its attributes will significantly influence the extent of knowledge integration in groups. Thus the current paper develops a theoretical framework that takes an attention-based view and concerns idea visibility and prioritization to contribute to the knowledge integrating firm. The framework is constructed based on the fundamental logic of Simon (1947) for bounded rationality that stems from individuals' limited capacity for attention.

Building a theory of user interface that considers firms as knowledge integrating institutions, is required to guide further empirical examination of a user interface effect on knowledge integration. To date, the majority of the extant research literature on electronic brainstorming has extensively focused on knowledge generation and sharing within groups and knowledge integration is relatively understudied in the context of IS design. Following, Okhuysen and Eisenhardt (1996) the theoretical framework proposed here distinguishes knowledge integration from knowledge sharing and focuses primarily on knowledge integration.

The framework developed here is currently being examined through a series of laboratory experiments in which attributes of the IS user interface are manipulated for their effect on variations in knowledge integration. As new IS user interfaces are being developed and many are available online, similar examination of the theory developed here may be performed by collection of the data from relevant resources available online (e.g., across different platforms such as Yahoo answers, Facebook discussion forums, twitter or similar applications). With the rise of Enterprise 2.0 (McAfee 2006), and extensive use of collective content creation platforms within firms, empirical studies based on the framework proposed here and its future extensions will likely prove insightful to managerial decision making on the choice of Web 2.0 technologies deployed within such firms.

Although idea generation and idea sharing provide no benefits to the group unless ideas are integrated, and used (Grant 1996b), the first two are necessary for idea integration at the group level. Thus, the focus of the current theoretical framework on knowledge integration poses some limitations on the framework. A more comprehensive theory of user interface design that addresses all of the three processes will be desirable. Previous theoretical and empirical research studies of knowledge generation and sharing and further new theoretical studies of knowledge integration will provide a solid foundation for the study of user interface that facilitates idea sharing, generation and knowledge integration.

Also drawing from the Carnegie School of Simon (1947), the proposed framework of IS interface effect on knowledge integration deals only with bounded rationality and puts aside the motivation problem. It is highly likely that minor forms of opportunism (e.g., free riding, social loafing, and motivation loss) will occur within ideation groups as individuals may not contribute with full effort to generate, share or integrate ideas (Pinsonneault *et al.* 1999; Zhou & Shalley 2007). Future theoretical and empirical studies on how user interface may be instrumental in reducing opportunism and enhancing knowledge generation, sharing and integration within groups will be complementary to the current research.

Developing an attention-based theory of user interface design calls for identification of user interface attributes other than those discussed in this framework and empirical studies of their effect on knowledge integration within groups is highly warranted. Some examples of the attributes commonly used in the design of the state of the art electronic systems and empirical studies that concerns processing of information and its use include structuring presentations of the ideas on the screen (several windows instead of one; e.g., Dennis *et al.* 1996), threading, font size (e.g., digg), or color (McNab 2009). For enabling the firm as a knowledge-integrating institution, IS researchers need to actively pursue theoretical and empirical research that contributes to knowledge integration.

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