The Mindpool Hybrid: Theorising a New Angle on EBS and Suggestion Systems

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Abstract

Traditional suggestion systems, despite their shortcomings, have been used to promote creativity in industry for over a century. As a parallel track, brainstorming has been applied for almost fifty years as a method to also increase idea generation. However, the two have never met. In this argumentative paper, it is theorised that by adding computer support and applying lessons from the realm of electronic brainstorming (EBS) to traditional suggestion systems, useful improvements may be achieved. A hybrid intranet prototype mimicing the attributes of an EBS system and at the same time serving as a complement to the suggestion system was therefore devised and evaluated using a theoretical framework. The implications suggest novel ideas for both suggestion systems and EBS research.

1. Corporate creativity

It has always been important for organisations to improve and develop the way they conduct their businesses, although this need has been further accentuated in the post-industrial society. Two important vehicles for organisational creativity that both have been used in industry for many decades are suggestion systems and brainstorming.

1.1 Traditional suggestion systems

The first suggestion system recorded in literature was implemented at the Scottish shipbuilder William Denny & Brothers in 1880 [24]. Although more than a century has past, many of today's suggestion system still consists of a box on the wall, and submitted proposals are typically handled by local Proposal-Handling Committees (PHCs), where committee members manually review the ideas. Good suggestions are rewarded in some way, while not so good proposals are rejected. However, while studying creativity and the usage and impacts of a large multinational company's suggestion system, a few but serious shortcomings with this traditional way of handling suggestions have been noticed [24, 28].

Firstly, there is a communication problem. Submitted suggestions are seldom communicated sufficiently within the organisation and good ideas may be implemented locally but remain unheard of in other parts of the organisation. Other ideas may be prematurely rejected due to the PHC's limited cognitive capacity, the proposer's poor communication skills, bad timing, or being proposed in the wrong context. These ideas, good *and* bad, could have started other creative ideas elsewhere in the organisation, had they only been made public.

Secondly, many ideas are never proposed at all. One generally acknowledged reason for this is the fear of being made a fool of by one's peers. As we are reluctant to present ideas if we risk losing face in front of our colleagues, we instead keep our potentially revolutionary ideas to ourselves, missing an opportunity for organisational benefit. Another reason for not participating is the threshold an official suggestion system constitutes. We may lack the self-confidence, the ability, or the motivation to write-up our proposal in the form required for a suggestion to be accepted.

1.2 The brainstorming approach

A parallel, but totally separate, approach to creativity is brainstorming [20], which since its introduction in 1953, has been widely used in industry and business as a technique for idea generation and problem solving. The fundamental aspects of brainstorming as posited by Osborn [20] are quantity over quality, elaboration on others' ideas, and absence of criticism. This means that brainstorming, in contrast to the traditional suggestion system described above, presupposes that all ideas are visible to the other participants and thereby function as *stimuli* for their creativity.

However, in contrast to the popularity of brainstorming stands the result of several independent studies

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showing that nominal brainstorming, i.e. the aggregated work of individuals working simultaneously but without contact with each other, outperform group brainstorming. There are three main reasons for this. Firstly, there is *evaluation apprehension*, which refers to a situation when the group members are reluctant to express their perhaps unpopular or politically incorrect suggestions or poorly developed ideas in fear of being judged by others. Secondly, *social loafing* occur when group members intentionally limit their contributions and rely on other group members to do the job. This often happens when the responsibilities are unclear, when individuals do not feel accountable for producing, or when individual believe that their contribution cannot be identified and thus not fully appreciated. Thirdly, and finally, *production blocking* is the result of group members having to wait for others to finish before they can offer their own ideas. While waiting, ideas may become obsolete or forgotten, or, in order not to forget, people concentrate on and rehears their own ideas instead of participating and generating more and new ideas. All these three factors have previously been discussed in numerous works, e.g. [5, 9, 10, 18, 21, 26, and 29].

In an attempt to address these three problems, *electronic* brainstorming (EBS) was introduced. With EBS, the participants initially used a special room equipped with networked computers used to enter and share ideas within the group. Although distributed solutions now exist, especially so in industry, the specially equipped rooms still seem to dominate the research literature.

By allowing anonymous idea entry the evaluation apprehension problem is avoided. At the same time, the logging capability of computer software helps reduce the social loafing, since information on the relative performance of each individual may be made salient. However, caution must be taken here not to upset the balance between the demand for anonymity and the need for social recognition. Finally, since participants are using individual computer terminals, idea entry and sharing may be performed by all users simultaneously, thus eliminating much of the production blocking observed in face-to-face brainstorming.

Though it seems indisputable that EBS outperforms face-to-face group brainstorming, it remains somewhat unclear whether or not EBS is superior to nominal groups. However promising and convincing the theoretical reasoning above may sound, the literature shows mixed results; some claim that EBS performs significantly better than nominal groups [6, 7]; some report weak evidence at best [25]; other still have found EBS to perform worse than nominal groups [21]. It has been debated whether the size of the group has any influence on the expected outcome. Some argue that for groups of more than eight members, EBS outperform nominal groups due to the increased synergy that comes from the larger pool of ideas [8]. Others, however, maintain that this synergy is neutralised by increases also in process losses [22].

This lack of consensus suggests that perhaps more efforts should be put into trying to find consistent ways to evaluate or measure the effectiveness of brainstorming technology. Another possible implication is that more work has to be done with large groups, and preferably with very large groups. A scenario such as the one depicted in this article, i.e. where the entire organisation can participate, may then prove useful. A third and final interpretation could be that a creative process such as idea generation is too situated and context-specific to be evaluated in general terms.

2. Research rationale

Although suggestion systems and brainstorming are both used in industry and both used to promote creativity, they have been treated separately. This paper describes a novel attempt to combine these two parallel tracks. By bringing lessons learned from the large body of research done within the EBS community in to the realm of suggestion system, the author hope to be able to address the shortcomings of traditional suggestion systems identified earlier. The objectives with this project are to increase visibility in a suggestion system by posting all submissions on the web, and to engage a larger part of the organisation in the creative process. The latter is obtained by distributing a brainstorming application to *all* organisational members and simplifying submission by allowing free-text emails.

Although this work relates closely to the large body of existing research on EBS, the approach described herein differs in several aspects from the ones normally seen, and may therefore provide useful new ideas also for EBS researchers. Most fundamentally, the proposed method deviates from the predominant problem-oriented view that has dominated EBS research and tries to address creativity more broadly. As pointed out by Bostrom and Nagasundaram [4], most EBS research does not explicitly discuss creativity *per se*. The prototype presented here attempts to provide a bridge between suggestion systems and EBS systems and offers novel ideas to both these communities.

The author has not only the desire to observe and understand but also to intervene in and change the process under study. Such an approach can be referred to as *action case* research [30]. Action case should thus be seen as a mix of both understanding and change, designed to balance the trade-offs between being either an observer capable of making interpretations or a researcher involved in creating change in practice. The case described here will

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thus be conducted live in a real industry setting instead of being artificially tested in a laboratory setting. Although a live study means less control, the unpredictability instead increases the chance of breakdowns leading to new and unanticipated findings. To provoke such interruptions, the Mindpool hybrid application was implemented at the intranet of a large Swedish corporate group.

3. The Mindpool prototype

The Mindpool prototype uses the corporate intranet to utilise the new forms of group interactions that was previously suggested at HICSS-31 [4]. The strength of such tools is that they are less resource intensive than the same-time-same-place labs that has dominated much of the EBS research. EBS is tacitly understood as being designed to support rather small groups. Although research has indicated that EBS might work better in larger groups [11, 6, 8], facilities to handle groups larger than 30 members are rarely seen [31]. Further, despite the fact that it has been shown that diverse stimuli have a positive affect on creativity [16, 1, 2] and that groups are better equipped to provide the cross-boundary kaleidoscopic thinking [14] that can boost creativity, not much EBS technology has been designed for very large groups. Knowing that the combinatorial effects of cross-fertilisation increase exponentially with group size calls for more research in this direction. The prototype advocated here, which attempts to engage the entire organisation, is a response to this call.

3.1 Design principles

Most EBS systems are designed to help solve a problem or reach a decision. This means that there is a pronounced purpose of which all attendants are aware. Further, there is also only a limited number of attendees and a limited amount of time available. Consequently, EBS sessions focus on producing as many relevant ideas as possible within the specified timeframe. The objectives and the conditions of a traditional suggestion system are however very different. Firstly, there is no specific problem to be solved or topic to focus on. Any suggestion that in some way improves the current practice is welcomed. Secondly, the improvement process is a continuous event without any start or stop time. Thirdly, any member of the organisation is welcome to contribute. In those aspects, the two processes are quite different. However, the hypothesis posited in this article is that Osborn's [20] fundamental aspects around which all brainstorm activities are built would add valuable features to the suggestion system and help eliminate the shortcomings discussed in the introduction.

When conducting a face-to-face brainstorm session, ideas are typically written down on a flip chart or a white board for all participants to see. The ideas are often recorded in the order they emerge, i.e. chronologically, without any links or other visible connections to the previous idea(s) that might have stimulated them. Mindpool is an intranet application that copies this concept and mimics the creative atmosphere often found in brainstorm sessions with the addition of using the intranet instead of a flip chart. The main ideas are easy entry and company-wide exposure of ideas. Unlike most EBS systems, Mindpool supports *asynchronous* brainstorming, allowing ideas to develop long after the point of introduction. The system further allows the proposer to be anonymous while yet providing a mechanism for letting people contact them. Mindpool is different from most other EBS systems in four ways:

1. Mindpool is an intranet application designed to be run from the organisational members' *ordinary* places of work; e.g., there is no need for a specially equipped room. This offers three advantages; i) the absence of physical space barriers eliminates the need to restrict the number of participants, ii) large organisations often have geographically distributed employees, who otherwise might be unable to participate, and iii) being in close vicinity to their ordinary work tasks inspires creative that is more beneficial for the organisation [24].
2. EBS is typically performed by *groups* of people. In Mindpool, there is no group concept whatsoever. Some argue that even ordinary EBS groups that are assembled together in a room are not groups in any traditional sense, but rather a collection of individual that interact with each other's ideas [16]. In Mindpool, where participants are distributed in both time and space, this reasoning is taken to its extreme.
3. Mindpool has no time constraints. The idea generation process is not limited to x-hour sessions or any other particular timeslot but should instead be seen as a continuous activity that the organisational members attend to from time to time. This absence of time pressure has important implications.
4. When there is no time restriction, there is also no need to limit oneself to any one topic. Mindpool is thus not problem-oriented in the sense that it does not restrict the ideas to any particular problem to solve nor to any specific topic to be exploited. Instead, new possibilities may be addressed and pursued in parallel.

3.2 A Mindpool scenario

To give an understanding of how Mindpool is intended to work, a possible scenario is described and explained below. The numbers in the text refer to the number in figure 1.

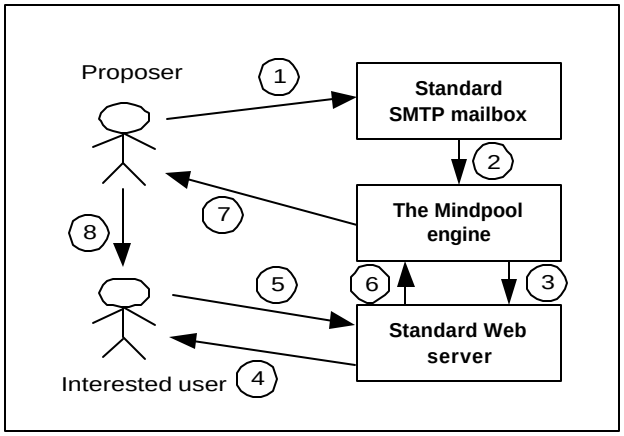

Figure 1. Mindpool workflow and the interactions between Proposer, Mindpool, and other users.

1. *Doris has been at a meeting and is irritated that the flipcharts in the meeting room were – again – out of paper. When returning to her desk she writes a short note about this problem in her email system and sends it off to Mindpool*.

Suggestions, ideas, or simply comments are submitted as emails to Mindpool to be displayed on an intranet web page. These tools – email and web – were chosen because they are widely used amongst most office workers [3].

2. *Mindpool checks the email inbox every sixth minute, downloading any new email, and storing it in its own database*.

When Mindpool receives the email it assigns it a unique ID number and stores it in the Oracle database together with the date, time, and proposer's name and email address. The proprietary email system used at the test site automatically inserts the sender's full name and return address, which might otherwise have been left blank if a web-based form had been used.

3. *When the web page is requested, i.e. when a user accesses the Mindpool server, the web page is dynamically build from the content of the database*.

On the dynamically built web page, all ideas from the current month are retrieved and displayed The web is used because it is easily accessible from all computer platforms. A web page also adds asynchronicity to the sharing process and users do not have to be active simultaneously, which removes the temporal restriction present in e.g. chat forums. The persistent nature of the web page also allows the idea to linger long enough for it to be found by many different people in different locations and contexts.

4. *The re-constructed web page is sent back to the user, in this case Michael, who is displaying it in his favourite web browser*.

The web page displays the date and time of the suggestions, the subject titles, the suggestions themselves, and the unique idea ids (see figure 2). The name of the proposer is kept hidden for two reasons; firstly, it eliminates evaluation apprehension and enables users to submit proposals without risking making fools of themselves, and secondly, not revealing the contributors' identity contributes to a more task-oriented and objective evaluation [13], especially so when power differences exist among the participants [17].

5. *Michael casually browses through the suggestions and happens to notice the note sent by Doris. He decides to contact Doris but since he does not know who sent the suggestion he clicks on idea ID and the associated hypertext link brings up a form allowing Michael to enter a comment, leaving a phone number, email address, or whatever*.

The purpose is not to facilitate a discussion but to provide a *pool of stimuli*. When Michael browses through the submitted ideas he receives various input for his own thinking process, which supposedly takes place off-line. Ideas are not primarily there to be commented on but to serve as stimuli. The possibility to add comments directly to a proposal, as is the case in threaded discussion lists, is intentionally absent in Mindpool. Not providing this opportunity to provide public comments helps shielding new ideas from public negative critique. Such a filter is important since negative socio-emotional communication has a negative effect on agreement [13].

6. *The entered message is then returned to the Mindpool engine, which uses the unique suggestion ID to resolve the email address associated with the suggestion*.

The web form feature is implemented to allow interested readers to request more information without forcing the system to reveal the identity of the proposer. Michael may, for example, contact Doris to hint about the whiteboards that he heard about, that can be connected to a PC and thereby saving the work to a hard disk.

7. *Michael's message is then forwarded to Doris, the original proposer, who remains unknown to all but Mindpool. The comment is not displayed on the web site*.

Since each contributor, i.e. those sending suggestions or ideas to Mindpool, are registered, the aggregated result of each contributor may be made salient once a month or one a year and recognised by corporate officials as a useful contribution to the company's development.

8. *When Doris receives Michael's comment, she may now decide to give up her anonymity and contact Michael for a direct discussion.*

Apart from being viewed by ordinary corporate employees, Mindpool should be regularly monitored by the PHC members, who would treat any useful idea as had it been submitted via the traditional channels.

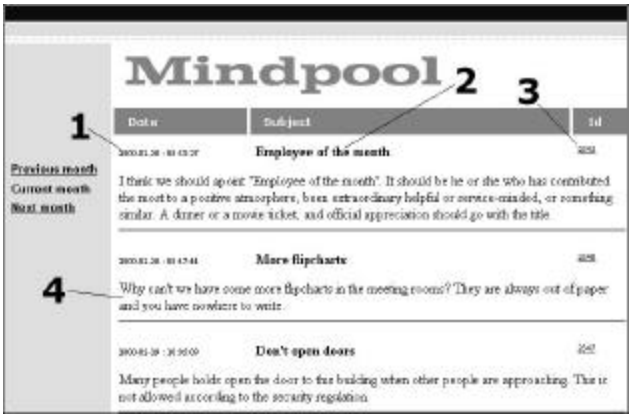

Figure 2. A screen dump showing Submission date (1), Subject title (2), Submission ID (which also holds the link to the comments form) (3), and the actual suggestion or idea text (4).

4. A theoretical evaluation

Pinsonneault *et al*. provide us with a schema for assessing the performance of any given brainstorming technology by suggesting that the performance should be calculated as the net sum of the process gains and the process losses [21]. Although such a schema is somewhat problematic, implying that qualitative aspects can easily be transformed to quantitative measures, it offers a method to compare the relative strengths of different approaches. Measuring the suggested factors for four different brainstorming technologies; Verbal, Nominal, Anonymous EBS, and Non-anonymous EBS groups respectively, Pinsonneault and colleagues conclude that there is no significant difference between EBS and nominal groups, and that they both outscore verbal brainstorming.

In addition, they identify what they claim to be five previously undetected process losses that EBS seems to introduce. These have been added to table 1 and marked with *i*. Adding also Mindpool (column 5) and examined how it measures, we find that it seems to preserve many of the process gains while being able to eliminate most of the losses. Pinsonneault *et al.* carefully stress that the result of such an assessment must not be seen as a scientific fact but rather as a crude but hopefully useful estimate of the different techniques' relative capacity. With this in mind, we can see from table 1 that Mindpool comes down to a total of +3, thereby outscoring the other four forms of brainstorming. The factors evaluated in the Table 1 are briefly explained in the following sections. For a more detailed discussion, please refer to [21].

Table 1: Comparing process gains and process losses for five brainstorming methods as suggested by Pinsonneault *et al*. [21].

Process gains	**Verbal**	**Nominal**	**Anonymous EBS**	**Non-anonymous EBS**	**Mindpool**
Separation of task		+	+	+	+
Cognitive stimulation	+		+	+	+
Observational learning	+			+	
Social recognition	+			+	+
Task orientation		+	+	+	+
Motivational	+	+	+	+	+
Total process gains	*4*	*3*	*4*	*6*	*5*
Process Losses					
Production blocking	-				
Effort redundancy		-			-
Cognitive interference	-		-	-	
Cognitive inertia		-			
Evaluation apprehension	-			-	
Productivity matching	-		-	-	
Cognitive conformity	-			-	
Personalisation of issues	-			-	
Social influence	-			-	
Social loafing	-		-		
Distraction[i)]			-	-	
Attentional blocking[i)]			-	-	
Striving for originality[i)]			-	-	
Cognitive complexity[i)]			-	-	-
Cognitive dispersion[i)]			-	-	
Total process losses	*8*	*2*	*8*	*11*	*2*
Net score (gains - losses)	*-4*	*+1*	*-4*	*-5*	*+3*

4.1 Process gains

Separation of task processes and the decomposition of tasks into subtasks have been found to increase productivity. Mindpool addresses no problem in particular and participants may break up their tasks as they see fit.

Cognitive stimulation/synergy by receiving verbal or textual cues from peers may elicit new ideas. Mindpool

opens the brainstorm context to the entire organisation, leveraging this potential.

Observational learning suggests that members can imitate and learn from the best performers and thus increase productivity. The anonymity of Mindpool does not allow this.

Social recognition means that individuals want their contributions to be recognised by others. Though Mindpool facilitates anonymous submission, it also provides a mechanism for contacting the submitter. This means that the author of a good ideas or suggestions can be contacted and receive appreciation. The numbers of contributions per individual are also accumulated and frequent submitters may thus periodically receive recognition.

Task orientation rather than author orientation and socialisation improves productivity. Being an anonymous on-line application Mindpool is strictly task oriented.

Motivational/arousal aspects come from groups stimulating individuals to perform better. Mindpool is not a group in the true sense, but by providing a forum in the super-group that the company constitutes that shows how other organisational members submit ideas, it should work in a similar way.

4.2 Process losses

Production blocking means being unable to express ideas as they occur due to social norms. As all other forms of EBS systems, Mindpool should escape this trap.

Effort redundancy results from many contributors working on the same or similar ideas. Mindpool publishes all ideas to avoid this. However, the free-text format and the potentially large amount of ideas that may accumulate over time can make it difficult to get an overview of what has previously been suggested.

Cognitive interference occurs when others people's ideas interfere with ones own idea generation process. Being entranced by another group member's idea may have a negative effect on one's own ability to generate ideas. However, such concerns stem from the time limitation and since Mindpool usage is not limited to a specific timeslot, this should not be an issue.

Cognitive inertia means being too focused or trapped in a single train of thoughts. This is not expected to happen with EBS systems, nor with Mindpool.

Evaluation apprehension is when people hesitate to express ideas in fear of what others may think. Being anonymous to the crowd, Mindpool eliminates this risk.

Negative productivity matching occurs when group members adjust individual productivity to a (lower) base-line level. Since Mindpool sessions are not performed in a closed group or even with simultaneous users, this risk is small.

Pressure for cognitive conformity/uniformity may cause members to remain within certain group norms or values. Mindpool avoids this as do all anonymous EBS system.

Personalisation of issues happens when individuals associate the discussed ideas to personal matters. As with other anonymous EBS systems Mindpool should not suffer from this.

Social influence from dominant group members can be a problem in non-anonymous settings, but since Mindpool offers anonymity and treats all suggestions equally no individual dominate.

Social loafing means deliberately limiting ones efforts, counting on the others to solve the problem, while still sharing the credit. This cannot occur in Mindpool since you either contribute by submitting ideas, and then you are participating, or you do not submit anything and then your do not receive any credit.

Distraction refers to when people become overly engaged in reading other's suggestions instead of generating own ideas. When time is limited, spending too much of it on reading could cause problems. However, from the viewpoint of receiving new stimuli you are supposed to read as many ideas as possible. Mindpool allows such "distraction" by providing an unlimited amount of time.

Attentional production blocking may occur in synchronous idea generation groups when members formulating their own ideas are prevented from paying attention to the ideas of others. However, attentional production blocking can only occur when the brain-storming session is limited in time. In contrast, Mindpool is an asynchronous and continuous event where you are supposed to pay intention to others ideas, and where your own idea generation takes place off-line.

Striving for originality may cause EBS members to try too hard not to replicate ideas already entered, which hinder them from coming up with original ideas of their own. Eventually, such production blocking will let go and in Mindpool, where there is not time restriction, this should not be an issue.

Cognitive complexity is higher in EBS than in nominal brainstorming due to the need to simultaneously read, understand, and interpret other's ideas. Since Mindpool expects its user to read previously entered ideas it can be said to be a more complex environment than a nominal brainstorming session. However, it not required nor intended that all users should read all comments. Users are suppose to browse through the diverse set of stimuli for as long as they like, and the added complexity should be compensated for by the unlimited amount of time given to the users. This, however, has not been tested.

Cognitive dispersion is characterised by group members being exposed to ideas along different lines of thoughts, of which some may deviate from the intended topic. This can make it more difficult to successfully elaborate on each individual thread. It should not be a problem in Mindpool, however, since such elaboration may be done off-line.

5. Discussion

Judging from the result in table 1, it appears that the benefits of Mindpool are not so much additional process gain as the elimination of process losses. However, one must also ask whether the schema proposed in table 1 is at all applicable to Mindpool, since Mindpool is a hybrid and not an EBS system in the strict sense. It is more of an electronic bulletin board or public forum, intended to increase the organisational members' attention to new stimuli, alternative ideas, and diverse viewpoints. However, as a complement to a traditional suggestion system, the Mindpool prototype presents possibilities as well as limitations that might be of interest for both organisations, trying to improve their suggestion systems, and EBS researchers.

5.1 Major differences

It is clear that the hybrid aspects of Mindpool make it difficult to evaluate it using EBS-specific norms, since the context differs from that of a typical EBS setting.

The fact that a suggestion system, unlike an ordinary brainstorm session, has a continuous timeframe has certain implication on the process loss factors. *Cognitive inference* and the closely related *Distraction* both affect group brainstorming negatively since they since they slow down the ideas per minute rate. However, when time is not an issue it seems unmotivated to speak of other's ideas in terms of distractions when the very heart of brainstorming is to elaborate on other people's ideas. Also *Attentional production blocking* and Co*gnitive complexity* are consequences of a limited amount of time and do not quite apply in the scenario where Mindpool would be used.

Striving for originality is not really time related but still difficult to correctly position within Mindpool. No-one is expected to read *all* suggestions entered in Mindpool and a certain level of redundancy may therefore be expected. However, even if people would spend time trying to avoid replicating proposals already submitted, they would eventually contribute and thereby adding to the pool of ideas.

Social loafing or free-riding is another troublesome aspect to discuss in a Mindpool scenario. In an organisational context, anyone discussing the latest football result during office hours could be said to be free-riding since they are not contributing to the firm's progress and yet being paid. However, this is not what is usually meant with social loafing in an EBS context. Instead, it denotes a situation where someone gets credit for an achievement to which he or she has not actively contributed. In Mindpool, it is okay to only browse through the suggestions looking for inspiration. If the user gets inspired, fine. If not, it is fine, too. Since only those actually submitting are part of the "group", only those can receive any credit.

Mindpool provides the organisational members with a pool of ideas that may be used to stimulate creativity. However, unlike in brainstorming the idea generation process does not necessarily take place while using the tool but may be performed later. The problem of *cognitive dispersion* should therefore only be present *while browsing through* and reading the suggestions posted in Mindpool. In the thinking process, which presumably occurs off-line where people work individually and independently as in nominal brainstorming, the users are free to uninterruptedly pursuit any particular line of thoughts.

5.2 Contributions

Two distinct contributions with the suggested Mindpool approach can be identified. Firstly, there is the novel blurring of boundaries between EBS and nominal groups – people are exposed to each others' ideas (as in an EBS session) but remain distributed and without physical contacts (as in nominal brainstorming). Although many good ideas occur when doing things totally unrelated to work task, such as shaving or driving to work [16], it has been claimed that people are most creative when conducting their ordinary work [24]. If this is the case, forcing them to leave their workplaces and gather in a predefined and specially equipped room may thus in itself be counter-productive. Since it in addition cannot be decided in advance, who would be creative or when creativity would strike, it seems that selecting whom to invite to a brainstorming session must be an unsolvable problem. Mindpool evades this dilemma by making its environment accessible from the employees' office desks.

Secondly, Mindpool allows continuous company-wide brainstorming. Facilities sufficiently large to host all employees of even a rather small company are difficult to find for ordinary EBS sessions, and should the number of employees exceed, say, a couple of hundred, they are probably impossible to find. Having observed this limitation, de Vreede *et al*. propose a Relay-mode of EBS where the company is divided into sub-groups, each performing sequentially and handing over to the next sub-

group like runners in a relay race [31]. However, though circumventing the problem of hosting very large groups, their approach still suffers from having to relocate people and limit the session duration.

It has been suggested that EBS has more process gain than have nominal groups. The schema compiled by Pinsonneault *et al*. [21] (and re-constructed here as table 1) shows that it also has more process losses. What is interesting about the Mindpool approach is that while maintaining the process gains traditionally associated with EBS, Mindpool also seems to eliminate many of the process losses. By offering anonymity and at the same time allowing for people to contact (and for the administrator to identify) the proposer, Mindpool avoid several usually seen problems. By also providing asynchronisity, Mindpool offers the participants an unlimited amount of time. It has been argued that the uninterrupted time participants have *prior* to a group discussion enables them to process and integrate information, but that this is not possible *during* the brainstorming, at least not at the pace required [12]. Since Mindpool is a continuous and asynchronous environment without time constrains, organisational members have this opportunity for information integration also *after* receiving the stimuli.

Computer networks allow geographically distributed people to conceivably work together as a group *electronically* without ever interacting physically. This stretches the definition of what constitutes a group far enough for us to ask if it at all is feasible to speak of groups in the traditional sense. Nagasundaram and Dennis [16] have suggested that group idea generation is fundamentally a cognitive and not a social phenomenon, and that an EBS "group" is therefore not to be seen as a group in the first place. Instead, EBS participants are just a bunch of individuals interacting with an evolving set of ideas. This means that it should be possible to extend the EBS concept to include an entire organisation without the having to worry about the loss of group identity otherwise afflicted with such scaling-up [15].

5.3 Limitations

A limitation with the approach proposed in this paper is the assumption that every employee has access to computer in close proximity to his or her workplace. Obviously, this is not true for many categories of workers. Mindpool is thus aimed at supporting creativity in an *office setting*.

Practical experiences and empirical evaluations of Mindpool are thus far limited. However, the preliminary results available are consistent with the findings from the previous prototype [27], and some indications that have been noticed shall therefore be discussed. Early comments from the organisational members indicate a concern for not being appreciated for their contributions if using Mindpool. This concern can be attributed to the use of a suggestion system based on extrinsic motivation [28]. Convincing evidence exists showing that the reliance on extrinsic motivation in suggestion systems limits participation to typically 10-15 percent of the employees, as opposed to 70-80 percent when no reward systems is used, or when recognition is kept to a symbolic level [24]. Statistics from the suggestion system in use comply with these earlier findings. This suggests that the employees keep their ideas to themselves rather than sharing them with their organisation, and that motivational aspects as outlined by Amabile [1, 2] need to be more thoroughly understood, although being largely ignored in the EBS literature.

It is assumed that the organisational members have unlimited amount of time at their disposal and a positive attitude towards sharing. Obviously, this need not be true. Just because the tool itself does not imply any temporal restrictions, it does not follow that the users will have time to engage in speculative brainstorming. Nor is it guaranteed that the organisational culture promotes sharing. It remains to be seen to what extent the current implementation will actually be used.

Finally, there is a problem with exposure. Being available on the intranet does not guarantee that the ideas are noticed. Organisational members would have to actively surf through the content to get inspired. It can be questioned whether such a scenario is plausible, since it requires more effort on the participants part [12]. In addition to the web page, we are considering projecting the ideas on hallway walls, e.g. outside the cafeteria, for a more unobtrusive exposure, as previously done successfully in other experiments, e.g. [3] and [23].

5.4 Remaining uncertainties

Orlikowski's work has taught us that both structural elements such as work policies and reward systems, and cognitive aspects such as mental models about the technology and its use, have significant implications for the adoption and early use of new technology [19]. Currently, we remain ignorant of what mental frameworks the organisational members hold.

Tentative empirical results however indicate potential problems when extrinsic motivation in form of the reward system is in place, which makes people focus on the financial compensation rather than on being truly creative, and it also make people more reluctant to share ideas or seeds for ideas with others. It may prove difficult for Mindpool to gain acceptance in such an environment.

Other structural elements such as how the intranet is used and what the daily routines are, have also yet to been analysed.

Using the evaluation framework introduced by Pinsonneault *et al*. [21], we see that Mindpool scores fairly well. However, it can be argued that an evaluation free of context is useless, and the suggested framework is not very helpful when trying to determine how useful any one approach is in a particular setting. We may find that idea generation is too context dependent to be measured in advanced. A later user evaluation will show whether Pinsonneault *et al*.'s assessment schema is a good estimate of how Mindpool would perform in our office setting.

5.5 Future work

An empirical evaluation of the system in use would obviously provide valuable data to support or refute the scenario suggested here. The prototype has in fact been implemented, but since the data collecting and analysis phases had not been concluded in time for this article, empirical findings will be presented in forthcoming papers.

6. Summary

Traditional suggestion systems have a number of drawbacks limiting their effectiveness. One problem is that suggestions are not displayed to the organisation as a whole. Another problem is that many ideas never get into the systems at all. In this paper, it has been argued that by building a hybrid system that borrows features from electronic brainstorming (EBS) these shortcomings might be circumvented, and Mindpool, an intranet prototype of such a system, is introduced.

However, also EBS systems have their particular sets of problem. The relative performance of brainstorm methods has been calculated as the sum of the process gains and the process losses, and while EBS systems score well on process gain they also account for many process losses. This may explain why EBS groups fail to outperform nominal groups despite the obvious benefits noted in the literature.

The work described here brings together the lessons from EBS research with that of creativity studies and offers a somewhat different perspective. By cross-fertilising an EBS application with a traditional suggestion system, we are able to combine the strengths of EBS (the process gains) with the strengths of nominal groups (the lack of process losses). This article has shown that Mindpool scores well in a theoretical evaluation but also that there are many uncertain aspects yet to be evaluated empirically.

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8. References

[1] Amabile, T. M., *The Psychology of Creativity*, Springer-Verlag: New York, 1983

[2] Amabile, T. M., Collins, M. A., Conti, R., Phillips, E., Picariello, M., Ruscio, J. and Whitney, D., *Creativity in Context: Update to The Psychology of Creativity*, Westview Press, Boulder, CO., 1996.

[3] Bellamy, R., Genevro, E., Houde, S., Leahy, L., and Young, G., "Developing a Community Intranet: Social Practices and Technology Interventions", In *Proceedings of CHI '98*, ACM Press, 1998, pp. 193-194.

[4] Bostrom, R. P. and Nagasundaram, M., "Research in Creativity and GSS", In *Proceedings of HICSS-31*, IEEE Press, Hawaii, 1998.

[5] Brown, V., Tumeo, M., Larey, T. S., and Paulus, P. B., "Modeling Cognitive Interactions During Group Brainstorming", *Small Group Research*, Vol. 29, Issue 4, 1998, pp. 495-526.

[6] Dennis, A. R. and Valacich, J. S., "Computer Brainstorms: More Heads are Better than One", *Journal of Applied Psychology*, 78, 1993, pp. 531-537.

[7] Dennis, A. R., Valacich, J. S., Connolly, T., and Wynne, B. E., "Process Structuring in Electronic Brainstorming", *Information Systems Research*, Vol. 7, No. 2, 1996, pp.268-277.

[8] Dennis, A. R. and Valacich, J. S., "Electronic Brainstorming: Illusions and Patterns of Productivity", *Information Systems Research*, Vol. 10, No. 4, 1999, pp. 375-377.

[9] Diehl, M. and Stroebe, W., "Productivity Loss in Brainstorming Groups: Towards the Solution of a Riddle", *Journal of Personality and Social Psychology*, 53, 1987, pp. 497-509.

[10] Diehl, M. and Stroebe, W., "Productivity Loss in Idea-generation Groups: Tracking Down the Blocking Effect",

Journal of Personality and Social Psychology, 61, 1991, pp. 392-403.

[11] Gallupe, R. B., Dennis, A. R., Cooper, W. H., Valacich, J. S., Bastianutti, L. M. and Nunamaker, J. F., Jr., "Electronic Brainstorming and Group Size", *Academy of Management Journal*, 35, 1992, pp. 350-369.

[12] Hilmer, K. M. and Dennis, A. R., "Stimulating Thinking in Group Decision Making", In *Proceedings of HICSS-33*, IEEE Press, 2000.

[13] Kahai, S. S. and Cooper, R. B., "The Effect of Computer-Mediated Communication on Agreement and Acceptance", *Journal of Management Information Systems*, Vol. 16, No. 1, 1999, pp. 165-188.

[14] Kanter, R. M., "When a Thousand Flowers Bloom: Structural, Collective, and Social Conditions for Innovation in Organizations", *Research in Organizational Behavior*, Vol. 10, 1988, pp. 169-211.

[15] McKinlay, A., Procter, R. and Dunnet, A., "An Investigation of Social Loafing and Social Compensation in Computer-Supported Cooperative Work", In *Proceedings of Group '99*, ACM Press, 1999, pp. 249-257.

[16] Nagasundaram, M. and Dennis, A. R., "When a Group is not a Group", *Small Group Research*, Vol. 24, issue 4, 1993, pp. 463-489.

[17] Nunamaker, J. F., Jr., Dennis, A. R., Valacich, J. S. and Vogel, D. R., "Information Technology For Negotiating Groups: Generating Options For Mutual Gain", *Management Science*, Vol. 37, No. 10, 1991, pp. 1325-1346.

[18] Offner, A. K., Kramer, T. J., and Winter, J. P., "The Effects of Facilitation, Recording, and Pausing on Group Brainstorming", *Small Group Research*, Vol. 27, Issue 2, 1996, pp.283-298.

[19] Orlikowski, W. J., "Learning from Notes: Organizational Issues in Groupware Implementation", In *Proceedings of CSCW '92*, ACM Press, 1992, pp. 362-369.

[20] Osborn, A. F., *Applied Imagination*, Scribner's: New York, 1953.

[21] Pinsonneault, A., Barki, H., Gallupe, R. B., and Hoppen, N., "Electronic Brainstorming: The Illusion of Productivity", *Information Systems Research*, Vol. 10, No. 2, 1999, pp. 110-133.

[22] Pinsonneault, A., Barki, H., Gallupe, R. B., and Hoppen, N., "The Illusion of Electronic Brainstorming Productivity: Theoretical and Empirical Issues", *Information Systems Research*, Vol. 10, No. 4, 1999, pp. 378-380.

[23] Redström, J., Ljungstrand, P., and Jaksetic, P., "The Chatterbox: Using Text Manipulation in Entertaining Information Display", In *Proceedings of Graphics Interface 2000*, 2000.

[24] Robinson, A. G and Stern, S., *Corporate Creativity: How Innovation and Improvement Actually Happen*, Berrett-Koehler: San Francisco, 1997.

[25] Roy, M. C., Gauvin, S., and Limayem, M., "Electronic Group Brainstorming, *Small Group Research*, Vol. 27, Issue 2, 1996, pp. 215-247.

[26] Shepherd, M. M., Briggs, R. O., Reinig, B. A., Yen, J., and Nunamaker, J. F., Jr., "Invoking Social Comparison to Improve Electronic Brainstorming: Beyond Anonymity", *Journal of Management Information Systems*, Vol. 12, Issue 3, 1995, pp.155-171.

[27] Stenmark, D., "Asynchronous Brainstorming: A Web Application for Creativity", In *Proceedings of WebNet '99*, AACE Press: Honolulu, HI., 1999.

[28] Stenmark, D., "The Role of Intrinsic Motivation when Managing Creative Work", *Proceedings of ICMIT 2000*, IEEE Press: Singapore, 2000.

[29] Sutton, R. I. and Hargadon, A., "Brainstorming Groups in Context: Effectiveness in a Product Design Firm", *Administrative Science Quarterly*, Vol. 41, 1996, pp.685-718.

[30] Vidgen, R. and Braa, K., "Balancing interpretation and intervention in information systems research: the "action case" approach", In Lee *et al*. (eds.), *Proceedings of IFIP WG8.2*, Philadelphia, USA, 1997.

[31] de Vreede, G.-J., Briggs, R. O., van Duin, R. and Enserink, B., "Athletics in Electronic Brainstorming: Asynchronous Brainstorming in Very Large Groups", In *Proceedings of HICSS-33*, IEEE Press: Maui, HI., 2000.

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