

The Effects of Perceived Visual Aesthetics on Process Satisfaction in GSS Use

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Abstract

Although group support systems (GSS) can potentially have tremendous impacts in helping to solve the challenges faced by organizations and societies today, research to date has primarily focused on direct outcomes, with less research focusing on factors contributing to use and continuing use of GSS. Integrating hedonic elements into the human computer interface of GSS is one way to potentially enhance users' satisfaction with the meeting process, which in turn can influence usage intentions. Hence, this study explores the effects of perceived visual aesthetics on satisfaction with the meeting process using a free simulation study with twenty ad-hoc teams performing an idea generation and evaluation task. The results show a significant role of perceived visual aesthetics in predicting satisfaction with the meeting process.

1. Introduction

Increasing globalization has brought about tremendous challenges and opportunities for business organizations [1]; consequently, virtual teamwork is being increasingly used to deal with these challenges or harness the opportunities [2]. Technologies such as group support systems (GSS) have been shown to effectively bridge time and space, and assist teams with generating more creative ideas and making better decisions. Nevertheless, most teams still rely on email and instant messaging for most of their remote collaboration [3], and the adoption of GSS for virtual teamwork has been sluggish [4].

In order to reap the greatest benefits from GSS, it is therefore important to motivate people to *use* such tools. In a variety of contexts, ranging from online banking [5] to GSS [4,6], a key factor underlying low intentions to use or continue to use a system is low satisfaction with using a system. In face-to-face meetings, verbal brainstorming sessions are often perceived as one of the more enjoyable of work activities [7], serving as a type of 'status auction'

among different participants. In contrast, distributed settings lack the social cues inherent in face-to-face interactions, potentially leading to lower participant satisfaction. The design of the human-computer interface (HCI) can help to substitute for some of these cues and can play a key role in enhancing satisfaction with the meeting process. GSS have so far been characterized as being "unimaginative and awkward" [8, p. 141], as little effort has been invested in developing HCIs geared at increasing the users' satisfaction with using such systems.

Thus, the overarching research question guiding our study is: What influence does the design of the HCI of a GSS have on process satisfaction? In order to shed light on this question, we draw on literature from the areas of social psychology, system design, and information visualization, to hypothesize the effects of interface design on process satisfaction. We then report on the findings from our empirical study examining the influence of perceived interface design aesthetics and perceived ease of use on GSS process satisfaction, and conclude our paper by highlighting our contributions and providing avenues for future research.

2. Background

2.1. Idea generation

The challenges faced by organizations and societies increase the need for continuous innovation [9]; generating quality ideas and deciding on the best alternatives can therefore be crucial to survival and success. Traditionally, variants of Osborn's [10] brainstorming technique have been used for idea generation tasks. This technique attempts to amplify the creativity of individuals by enabling joint idea generation sessions guided by four procedural rules: i) do not criticize other people's ideas; ii) be open to wild or unusual ideas; iii) generate as many ideas as you can; and iv) build and expand on others' ideas. However, constraints inherent in face-to-face brainstorming (such as production blocking and

evaluation apprehension) limit its potential as a group ideation method [11,12]. Computer-mediated idea generation technologies, allowing for e.g., parallel and anonymous input, have attempted to overcome some of these limitation. However, with few exceptions [e.g., 1,13], little work has examined the influence of the interface, and research on process satisfaction in this context has been particularly sparse. Furthermore, the HCIs of computer-mediated idea generation systems available on the market or tested in labs as prototypes tend to be very utilitarian. Nearly all HCIs from GSS studies merely feature a chat window (where a large part of the interface is usually dedicated to displaying the entire list of ideas, with a text box to type new ideas); some may support video [8]. Such systems essentially circulate individual ideas around computer workstations, where each participant expands on someone else's idea, argues with it, or generates a completely new idea [12].

2.2. Group support systems

Group support systems typically encompass more than just computer-mediated idea generation. In general, GSS are information and communication technologies that support people engaged in a common task by providing an interface to a shared environment [14]. In the context of the current study, we are interested in GSS that go beyond communication and coordination: namely, systems that purposely alter interaction processes within groups to optimize problem formulation, idea generation and evaluation, decision-making, and consensus building [15]. Although GSS are sometimes classified based on the tasks they support (e.g., computer-mediated idea generation systems vs. decision support systems), what such systems have in common is their support of relatively *short-term* problem-solving teamwork [11], often in distributed settings [3]. Hence our interest in virtual teams, or self-managed groups of dispersed knowledge workers, formed ad-hoc to perform an information-processing task.

Most group tasks can be characterized according to McGrath's [16] taxonomy, which classifies tasks into eight types according to several dimensions. In this study we focus on creativity and decision-making tasks, i.e., tasks that involve idea generation and selection. Such tasks abound in knowledge-based organizations like management consultancies, product design firms, and advertising agencies [17].

In knowledge-based organizations, however, large numbers of ideas is rarely the ultimate goal of a brainstorming session [17]. Although in general, 'quantity breeds quality', studies have shown that high productivity in brainstorming is not sufficient to lead to

better solutions [18]. Rather, for creativity to become innovation, and be usable in organizational settings, divergent idea *generation* must be followed by convergent idea *selection* [17]. Whereas divergent thinking promotes the generation and sharing of as many different ideas and options as possible, convergent thinking funnels down and selects among the available options, distinguishing between relevant and irrelevant ideas.

2.3. Prior studies of GSS interfaces

Empirical studies of GSS meeting satisfaction have so far by and large neglected the influence of the human-computer interface (HCI). For divergent tasks (such as idea generation), few experiments have examined the effects of different interfaces on collaboration outcomes *other* than performance. Whereas Connolly, Jessup, and Valacich [11] examined the influence of evaluative tone on performance and satisfaction, most studies examining the effects of manipulating the interface focused on performance only. For example, Jung, Schneider, and Valacich [1] and Shepherd et al. [13] manipulated the interface by providing performance feedback to examine the effects on productivity. Similarly Dennis et al. [12] compared the effects of using a basic single window dialogue structure versus a multiple dialogues interface on performance.

A paucity of research also exists on convergent, or decision-making tasks supported by GSS [19,14]. Notably, Dufner et al. [20] found that groups using a simple feature for visualizing group convergence perceived the medium as richer and less ambiguous than did control groups. Without this lightweight HCI enhancement, these groups had to "comb through many comments without seeing at a glance the extent to which consensus had been reached" [20, p. 240].

Overall, the impacts from GSS use on process satisfaction are unclear. A meta-analysis by Shaw [6] revealed that only in field studies of idea-generation tasks has GSS use led to higher process satisfaction in comparison to unsupported, face-to-face (FTF) groups. More recently, Kerr and Murthy [17] examined GSS satisfaction with a realistic business-consulting task that required both idea generation and evaluation, and found participants in the GSS groups to be generally less satisfied with their team experience than participants in FTF groups.

3. Theory

3.1. Satisfaction with process (SP)

In computer-supported teamwork, objects of satisfaction may be the outcomes, process, group, or technology. In the context of GSS, satisfaction with the technology has been found to impact satisfaction with the entire process, which in turn has been found to influence satisfaction with the meeting outcomes [21]. In this study, we chose to focus on satisfaction with process (SP) over other user satisfaction conceptualizations, as the former accounts for group and social factors, while the others are more technology-oriented. Further, we focus on SP rather than satisfaction with the outcome (SO), since the latter is to a large extent a function of the output as it emerges, rather than a controlled structure. Put another way, it is the meeting *content* that mainly determines SO, while SP should be influenced by characteristics of the group collaboration environment, which is the primary focus of your study. We have adopted the definition of satisfaction with process offered by Briggs, Reinig, and de Vreede [4], who defined SP as “an affective arousal with a positive valence on the part of a participant toward the tools and procedures used in the meeting”. The emphasis on affect, rather than judgment, stems from observations of many instances where users judged the deployed GSS to be useful and easy to use, but with which they nonetheless felt dissatisfied [4]. Rather than asking for a judgment of specific technology attributes, SP taps directly into one’s evaluative affect with respect to the process, which is inclusive of both tools and procedures.

3.2. Effects of visual aesthetics

One interface characteristic likely to influence users’ satisfaction is the system’s visual attractiveness [22,23]. In particular, the choice of colours, shapes, typography, and layout [24] influence the degree to which an interface is considered pleasing to the eye; hence, we refer to the emotional appeal of the graphical user interface of an IS as perceived visual aesthetics (PVA) [22]. More specifically, we define PVA as the elements of visual design that deal with balance, emotional appeal, aesthetics, and uniformity of the Web interface and its overall graphical look.

Although in general, GSS can be considered utilitarian systems that provide instrumental value to the user, hedonic features such as a visually appealing layout or more engaging information graphics can help to influence technology acceptance and prolonged system use [25]. Features designed to increase users’ intrinsic motivation and tendency to pursue sensory-derived stimulation [26] are likely to arouse positive affective reactions to the tools used, thus contributing

to satisfaction with process. When technology engages our innate pleasure-seeking need, we enjoy the process, and “thus want more”, notes Zhang [26, p. 145].

Such reasoning is consistent with findings from empirical studies of the effects of PVA on determining attitude toward systems that may be considered both utilitarian and hedonic. Cyr and colleagues have ascertained PVA’s role in influencing the likelihood that customers will revisit a website [27] or use a mobile browsing interface [24]. Similarly, in another study on wireless technology, Sarker and Wells [28] examined how interface characteristics affect the implementation and acceptance of mobile phones, and concluded that although users were “quite forgiving of physical limitations of the device due to technological constraints, they were bothered by flaws in the interface of the devices”.

Based on the above argumentation and evidence, we hypothesize the following:

Hypothesis 1. Perceived visual aesthetics will positively influence satisfaction with process.

In addition to its effects on satisfaction with process, PVA is likely to influence beliefs about the system as well. A long line of research in psychology has argued that perceptions of beauty can have spillover effects (for example, on desirable personality characteristics [29]); relatedly, research in marketing has demonstrated that the attractiveness of products can influence affective responses, which influence purchasing behaviour [30]. Following this line of argument, van der Heijden [31] and Tractinsky et al. [32] demonstrated that perceptions of aesthetics can indeed influence perceptions of a system’s ease of use (EOU), through spillover effects. Indeed, it seems intuitive to expect that when users are intrinsically motivated to use a system, they will find the interaction more free of effort. Thus, given the argument for PVA’s role in facilitating intrinsic motivation, we further argue that:

Hypothesis 2. Perceived visual aesthetics will positively influence perceived ease of use.

3.3. Effects of ease of use

EOU has been found to be critical in user acceptance of both utilitarian and hedonic systems [25,33,34]. In prior studies of system quality perceptions, EOU directly influenced beliefs about the usefulness of the system, thus indirectly contributing to ultimate attitude formation toward the system as a whole [24,35]. As indicated earlier, SP relates to the effectiveness of the tools and procedures used in the meeting. Although participants may not consciously

relate EOU to procedures, it stands to reason that easy to use *tools* should contribute to satisfaction with the process:

Hypothesis 3. Perceived ease of use will positively influence satisfaction with process.

4. Methods

To test the hypotheses, we conducted a free simulation of GSS sessions consisting of idea generation and decision-making (voting) phases. A benefit of free simulations is that the endogenous variables can vary freely over the naturally occurring range, allowing for a closer examination of the relationships between exogenous and endogenous variables [36]. Further, the sessions were minimally-facilitated in order to gain rich insights from the interaction between team members. The unit of analysis in this study was the individual.

4.1. Participants

Participants were recruited from a large undergraduate Business class (250 students) at a North American university. Minor class credit was given as compensation for participation. Additionally, a prize of \$30 per member was awarded to the two teams that proposed the most creative yet workable ideas.

In total, 126 participants successfully completed their GSS sessions. Ages ranged from 19 to 23. Fifty-eight percent were male.

4.2. Procedures

The participants were randomly assigned to groups to create ad-hoc teams without any prior group history. It was deemed that seven was the ideal group size for a virtual team, but groups were ‘over-recruited’ with one member to compensate for volunteers failing to actually participate [37]. No session started unless at least six participants had joined. A total of 20 groups participated, with final group sizes ranging from six to eight, with a mean of 7.3.

During the GSS sessions, participants interacted remotely from their own homes via high speed Internet connections using our experimental web-based collaboration environment. Teams worked on a 20-minute idea generation and evaluation task. In order to balance image management and identifiability concerns, the system allowed participants to type in a username of their choice. Those who desired ‘visibility’ could type in their own names; those who preferred a ‘low profile’ could use fictitious names.

4.3. Task

The task for this study was devised to cover both idea generation and decision-making (voting) categories as per McGrath’s taxonomy [16]. The task involved creating a simple message for an outdoor ad to market the University’s Bachelor of Business program to high school graduates. The participants could thus draw on their own knowledge as university students. Pilot testing confirmed that this task was perceived as relevant and challenging. The task instructions were as follows:

Imagine that [our] University’s Bachelor of Business program is losing applications to the [competing] program. Your team should brainstorm ideas for advertising our program in the mass transit. Do not aim for a polished ad, but roughly describe ideas for an appealing message. The 20 minute online session using a group support system will consist of three phases: brainstorming possible directions for the ad, then distilling the ideas into a headline or visual description, and finally, voting for your team’s three best ideas.

Participants first generated ideas in a chat dialog for ten minutes (Phase 1); then, each team member was given the opportunity to develop his or her own proposal (Phase 2). This convergent and evaluation phase took another ten minutes during which teams could still use the dialog window for discussion. Phase 3 employed preference-ranking to reduce the number of individual ideas within the group (by default, equivalent to group size) to the top-three ranked proposals. (Participants could vote for their own ideas.) Figure 1 summarizes the task structure.

Phase 1: Idea generation Free-form brainstorming discussion in ‘chat’ window	Phase 2: Idea development Each team member further develops and promotes one idea in their own text box.	Phase 3: Idea selection Each individual proposal is ranked by team members.
User D ...	A’s proposal:	¶¶
User C ...	B’s proposal:	¶
User B ...	C’s proposal:	¶¶¶
User F ...	D’s proposal:	¶
User E ...	E’s proposal:	
User B ...	F’s proposal:	¶¶
...	G’s proposal:	¶

Figure 1. Schematic of task structure

Participants were clearly instructed that only the three top-ranking individual proposals as voted within the group would be counted and judged against the competing final sets from the other groups. Each team’s top-three ranked proposals were later rated by

two independent judges, who were creative directors from local advertising agencies. This semi-competitive structure aimed to simulate a realistic marketing or advertising agency scenario [38], where not all individual proposals make up the team's final product. After completion of the task, the participants were asked to complete a brief survey.

4.4. Interface design

The interface design of the GSS used in this study, as shown in Figure 2, drew on principles of social translucence [39]. In socially translucent group environments, participants share an understanding of how the spatial nature of the setting enables a process of social computation. Translucent systems, such as IBM's in-house prototype named *Babble*, make use of minimalist graphics [39]. In that particular interface, participants are represented by social proxies in the form of colored dots positioned within a circle. Minimalist graphics were also employed in the current prototype. To represent individual participants, we used social proxies in the form of dice. These were used as identifiers in Phase 1's idea generation discussion (within the chat window), but also as prominent labels adjacent to individual contributions in Phase 2. The main content in Phase 2 was submitted in text boxes, or *Ideacells*; each Ideacell was assigned to a participant, allowing to further refine an idea. These ideas were then evaluated in Phase 3's voting. Voting, i.e., the group's preference ranking, was implemented in the form of *Rankplots*: five-by-five square grids that displayed votes as they were cast in real-time. Final results were clearly visible by the size

of the darkened portion in each Rankplot. This voting visualization aimed to not only enhance the interface aesthetics, but facilitate social comparison and ease of use by adding an at-a-glance visual representation to what would otherwise be a text-based tabular display.

Ranking results basically corresponded to the size of the darkened areas. We implemented a voting system of average rating. Each team member selected their top, second-best, and third-best choices among all individual proposals in the Ideacells, and had a fixed amount of scores (a total of six) to be assigned to alternatives (3, 2, and 1, respectively).

The overall structure of the interface thus presented individual contributions horizontally, via user ID, Ideacell, and Rankplot, whereas *comparison* of contribution could be made vertically, between Ideacells and their respective Rankplots. Such spatial persistence is important not only for purposes of cognitive amplification and facilitating group memory (creative output has been shown to be a function of the extent participants pay attention to each others' ideas [40]) but also in facilitating the emergence of social comparison (which has been shown to increase productivity [1]). Diagrams such as two-dimensional plots and small multiples [41] can reduce the effort for information searching and pattern detection by portraying a large amount of data aggregated in a small space.

4.5. Measures

All variables were measured using seven point Agree/Disagree Likert-type scale items. The exogenous variable, *perceived visual aesthetics* (PVA),

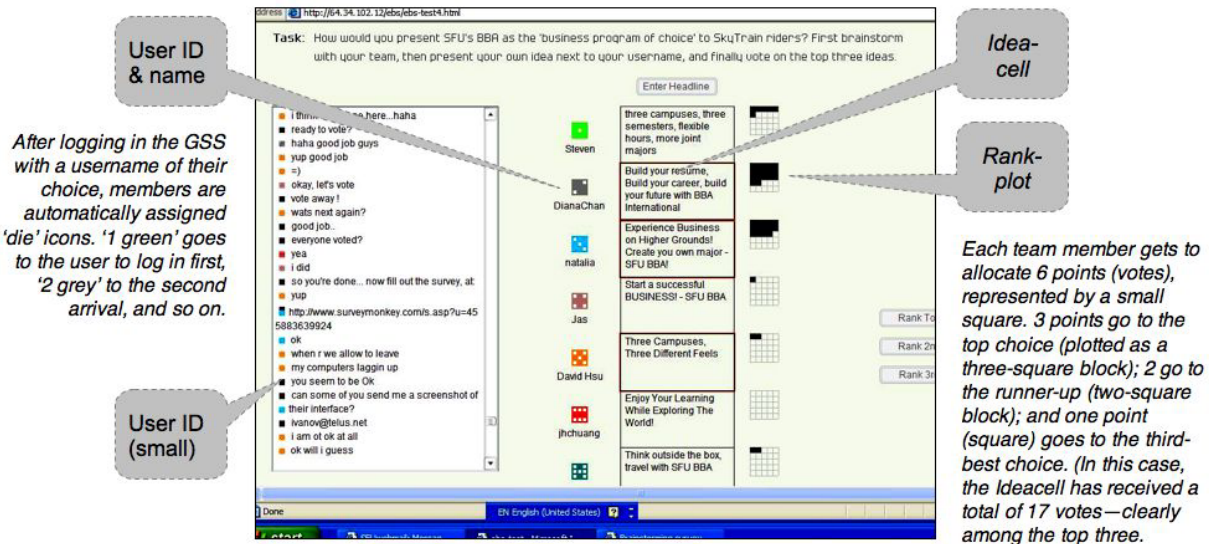


Figure 2. Key features of the experimental GSS

was measured using the following three items [adapted from 22,24]:

1. The GSS interface was attractive.
2. The overall look and feel of the interface was visually appealing.
3. The interface was professionally designed.

The endogenous variables were *satisfaction with process* (SP) and *perceived ease of use* (EOU). Based on [4], SP was measured using the following four items:

1. I feel satisfied with the way in which today's session was conducted.
2. I feel good about today's session process.
3. I feel satisfied with the procedures used in today's session.
4. I feel satisfied about the way we carried out the activities in today's session.

The following three items were used to measure EOU [adapted from 24,33]:

1. The interface was easy to use for the task given.
2. This was a user-friendly interface.
3. My interaction with this interface was clear and understandable.

In order to gain a deeper understanding about the participants' perceptions, we included an open-ended question at the end of the survey, asking participants which part of the system interface they liked most.

In addition, we also noted whether an individual proposal was ranked by team members among the final top three. This measure was therefore dichotomous (i.e., Qualified versus Not-qualified).

5. Results

5.1. Hypothesis testing

We tested the structural model using partial least squares (PLS), which allows for simultaneous modelling of the measurement and structural paths [42]. Specifically, confirmatory factor analysis (CFA) tested the measurement properties of the research model; bootstrapping tested the statistical significance of each path coefficient using t-tests, as per [43].

In the measurement model, all scale items loaded significantly on their hypothesized latent constructs, indicating convergent validity. Discriminant validity was assessed by computing the average variance extracted (AVE) for all scale item loadings. As shown in Table 1, all figures (in bold) exceed the off-diagonal inter-construct correlations.

Table 1. Reliability and interconstruct correlations

	AVE	CR	EOU	PVA	SP
EOU	.867	.951	.931		
PVA	.870	.930	.432	.933	
SP	.824	.950	.455	.399	.908

Note: Square root of the average variance extracted (AVE) shown in bold. CR = composite reliability. EOU: Perceived Ease of Use; PVA: Perceived Visual Aesthetics; SP: Satisfaction with Process.

In the structural model, all three paths were significant, thus supporting Hypotheses 1-3. The variances accounted for (R^2) in EOU was 18%; together, PVA and EOU accounted for 52% of the variance in SP (see Figure 3).

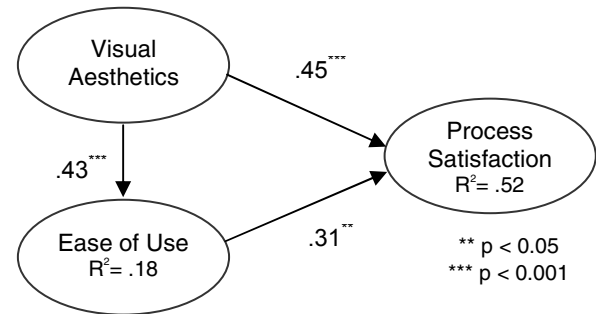


Figure 3. Structural model coefficients

6. Discussion and Implications

Overall, the experimental GSS was a success in terms of usability. No serious typing lags or other delays were encountered in the sessions. The Ideacell and Rankplots features worked as planned.

Consistent with our expectation, the results of the study showed that perceived visual aesthetics can influence both satisfaction with process (Hypothesis 1) and perceived ease of use (Hypothesis 2). The relatively low variance accounted for in EOU is understandable, given that EOU is likely to be primarily determined by strictly usability (utilitarian) characteristics that are separate from the hedonic nature of the PVA construct. Finally, in accordance with Hypothesis 3, perceived ease of use influenced satisfaction with process.

In addition to these quantitative results, qualitative data sheds some light on potential factors contributing to satisfaction with process. About one third of the participants explicitly indicated satisfaction with the process, using words such as *fun*, *great*, *interesting*, or *awesome*. By far the most mentions referred to the

discussion dialog; even some of the more reticent participants mentioned that they liked the discussion.

Other comments clearly related to the overall structure of the process. Specifically, participants appeared to enjoy the voting phase of the experiment, as evidenced by some (typical) comments:

- *Hard to brainstorm without being face-to-face with such a big group. The voting was fun though.*
- *The voting part of the ideas is very exciting. Seeing how much of your idea was accepted.*

While the discussion was generally perceived as the most fun overall experience, the voting process appeared to be the most exciting part of *using* the GSS. This finding is important, considering that almost no studies have been conducted on GSS voting tools [19].

Pertinent to the theoretical focus of our study were indications relating to the main construct, perceived visual aesthetics. Specifically, over one third explicitly mentioned they liked the identifiability in terms of die icons and the voting system:

- *I liked the dice icons, that indicated the presence of a member.*
- *I liked how it was easy to distinguish which users were making each comment.*

These comments lend further support to the hypothesized relationship between perceived visual aesthetics and process satisfaction, as respondents implicitly linked interface design features (such as the die icons) to process, such as when another team member is present or participates in the activity. Less clear is whether those who liked the dice did so because of their identifiability function, the pleasant colours, or by virtue of their association with an activity (i.e. chatting) that most participants enjoyed.

Further, some participants commented on factors relating to both perceived visual aesthetics and ease of use, providing additional support for the argument that there is likely to be a spillover effect of aesthetics on ease of use. Such comments included:

- *Clean appearance and easy to use.*
- *Instant input of headline was easy to see and use.*

Finally, it should be mentioned that one out of every eight participants expressed problems indicative of low satisfaction with process (consistent with the low scores reported by these respective participants in the Likert scales). The majority of these users found the task somewhat hectic due to time pressure or information overload from too much input.

Overall, the results of our study support findings from prior research arguing for the importance of improving the human-computer interface, and not only via enhancing (the traditionally important) ease of use component, but also through hedonic components such as perceived aesthetics. However, whereas most prior research examining effects of aesthetics was primarily concerned with hedonic systems for mostly solitary use, our research demonstrates the importance of aesthetics for systems supporting *group work*, considered traditionally to be a utilitarian activity. A related implication for designers of computer-mediated collaboration systems is to overcome the sole focus on task performance, and incorporate affect into the interface design equation, to move beyond systems that are seen as “unimaginative and awkward” [8, p. 141]. Using lightweight social proxies and basic spatial positioning in the design of GSS interfaces appears to be a practical way of increasing satisfaction with process in virtual meetings.

The current research shows that incorporating convergence tasks such as voting—together with providing the appropriate interface—can also help to increase group members’ satisfaction with the process, which, in turn, can lead to continuing use [5].

6.1. Limitations and future research

As any study, this one is not without limitations. First of all, a potential threat to the validity of statistical results is common method variance. To assess common method variance, we conducted Harman’s single-factor test (one of the most widely used tests to assess common method variance [44]), and found that just over 41% of the variance was due to a single factor, indicating that common methods bias was not a significant issue influencing our findings.

A post-hoc *t*-test showed two significant differences in reported satisfaction with process (SP). For one, females indicated higher SP than males; future research could thus examine gender differences related to process satisfaction. Second, team members whose proposals were ranked among the top-three (i.e. *Qualified*) reported higher SP than members whose proposals were not qualified, indicating that satisfaction with the outcome (i.e., being ranked highly) may have an influence on satisfaction with the process. Future research could try to disentangle these relationships. Moreover, future studies could further examine the effects of anonymity and group history in the different stages. In our study, we allowed the participants to choose a user name, and about a third chose a pseudonym that had no obvious connection with their real names (the others included either their first or last name, or part of their email addresses).

Although the participants may have favoured identified comments over anonymous ones during the idea generation and ranking process (as group members who revealed their identities could be regarded as more serious or credible), we did not find evidence for this. In our analysis of the discourse, we also did not find any references to prior history. An interesting avenue for future research would be to compare ad-hoc versus established groups in the idea generation and ranking process.

Like many studies in IS, this one did not aim to establish causation. The latter requires demonstrating association, temporal precedence, and isolation, whereas regression based techniques like the one used here merely show that correlations are in accordance with the directions assumed by the theory [42]. Second, the current study did not feature an experimental manipulation. However, our intent in using a free simulation was to allow the exogenous variable (perceived visual aesthetics) to vary freely [36]. Nevertheless, future research could experimentally manipulate different interface characteristics in order to evaluate their impact on perceived aesthetics, and consequently, satisfaction. This would complement our current work in providing clear guidelines for designers of group collaboration interfaces.

In terms of generalizability, ad-hoc student groups cannot be expected to have the same vested interests as real employees. The experimental realism consisted of a reward structure, lack of anonymity constraints, and naturally-occurring interaction, but simulating real-world motivation in student labs is a tall order. Another limitation inherent in lab experiments with technology is their inability to accurately identify dynamic issues like learning curves, acculturation, and the novelty factor. Nevertheless, the task we chose was relevant to the participants, as they could draw on personal experiences when generating ideas and voting on the alternatives. In sum, we believe that the results of our study can generalize to ad-hoc groups of involved participants.

One methodological implication from the qualitative comments regarding time pressure and information overload is the recommendation to attempt to minimize process artefacts and cognitive load. One way to achieve this would be to reduce the number of team members to lower than seven, which was the average group size in our study. Another way to reduce cognitive load might be to provide users with more time to complete the tasks, especially given the number of participants that complained about the short time limit. A more interesting approach would be to manipulate the human-computer interface in order to decrease cognitive load or time pressure. For example,

future experimental studies could use a multiple dialogues structure such as the one used by Dennis et al. [12], or artificial intelligence based mechanisms to highlight relevant contributions. Future research could, alternatively, substitute keyboard input with other technologies (such as voice input). This could save time for participants to focus on the tasks, as for many people speaking is faster than typing. Further, the findings from our study could also be tested for different task types. Arguably, following task-technology-fit [45], not only the time limit imposed, but also the task and the technology employed for supporting the task is likely to influence process satisfaction. Thus, an interesting avenue for future research would be to design interfaces that are likely to enhance satisfaction across a variety of different tasks.

Finally, future studies may probe deeper to examine whether social proxies, like the dice IDs used in the current interface, tend to invoke satisfaction with process more by way of sheer aesthetics (pleasant shapes and colours) or by their information presentation value. In this study, user comments from the qualitative section revealed instances where the social proxy and voting system were appreciated in terms of both.

7. Conclusion

Despite the potential of group support systems (GSS) to increase teamwork performance, many organizations continue to rely on email and face-to-face meetings for their collaboration. Such organizations are missing out on the opportunities brought about by other collaboration systems more suited for today's distributed environments. Yet to reap the greatest benefits from GSS, the focus should not only be on performance-based outcome measures, but also on factors contributing to use and continuing use. To facilitate a better understanding of the factors contributing to this, we analyzed the effects of perceived visual aesthetics on process satisfaction. We conducted a free simulation experiment with twenty student teams, who met separately over the Internet for an idea generation and evaluation task. An original GSS was deployed to test both the interface as well as the research model, with data from 126 post-experimental surveys. Results demonstrate the significant role played by perceptions of visual aesthetics in predicting satisfaction with the meeting process. From a managerial and system design perspective, it appeared that infusing more affective social cues into the group collaboration environment could be one practical way of inducing higher satisfaction from virtual meetings, thus leading to better acceptance of group support systems.

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