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THE ROLE OF GSS IN REQUIREMENTS SPECIFICATION: A CASE STUDY

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Abstract
The aim of this paper is to describe the results of an experiment into the use of GSS during the requirements definition stage of an information systems development project. The experiment focuses on providing support for the process of consensus formation among potential system users, prior to the construction of a formal requirements specification. The experiment was based around the determination of user requirements for a bibliographic information system, to be used within a university department. The participants were academic staff of the department with a variety of expectations for the system. Techniques associated with GSS were used to support the group interaction and consensus formation. The paper discusses the key stages in this process and describes the appropriateness of the techniques used. The results are significant in that they identify techniques appropriate to supporting user groups in the clarification of system requirements before the involvement of development personnel.

1. Introduction

"You can never inspect quality into products. You can only build it into them" (Tsurumi, 1981, p.8).

It has long been recognised that the specification of requirements plays a crucial role in ensuring the usability of the resultant system. It is insufficient to build a system with inadequate definition, in the hope that it will meet the customers' needs. The necessity of defining systems correctly before building them can perhaps best be illustrated with reference to Boehm's (1976) observation that mistakes not discovered until a system is operational cost one hundred times more to correct than would have been the case had the problems been noticed in the design phase.

Many people need to be involved in the development of systems simply because no one person possesses all the knowledge and information required for the task. Thus, the requirements specification phase should be a joint, collaborative process that involves managers, systems analysts and, perhaps most importantly, users. Eason (1988) suggests three options for systems specification and design:

- Technical Centred Design - customers commission and later accept the system. They are informed and consulted throughout the design process;
- Joint Customer-Specialist Design - user representatives are involved in all stages of the design process;
- User-Centred Design - technical experts provide a technical service to the users and all users contribute to the design (cited in Macaulay, 1992).

All three options have advantages and disadvantages and Eason does not consider there to be a single "best" solution. Traditionally, systems analysts have followed the Technical Centred Design approach, gathering data from users through interviews, often on a one-to-one basis. This process is fraught with difficulties not least because there will be as many definitions, opinions, approaches and concepts of a system as there are interviewees. There may need to be several cycles of interviews so as to clarify issues with all users concerned before the requirements elicitation process can be considered complete. Even then, it is difficult to integrate all the ideas and views into a meaningful set of system requirements, particularly one that is going to result in a system acceptable to and usable by all users. The Joint Customer-Specialist Design approach represents an improvement in the approach, but since representatives are used, it does mean that some users will not have their opinions heard. In the third option, all users can be satisfied, but this is seen as resource inefficient and commissioning organisations typically do not like this approach (Macaulay, 1992).

In this case study, we have adopted the third approach - User Centred Design. However, as our users are in fact experts themselves, we expect to be able to minimise resource inefficiencies of use. Furthermore, as the users have commissioned the system, there is little reason to suspect that they will dislike being involved in its design and development. In order to facilitate human communication, interaction and decision making in a collaborative environment, we decided to use the GSS software GroupSystems for Windows™.

2. GSS - A Facilitating Technology for Requirements Specification

Group Support Systems (GSS) is, as Jessup and Valacich (1993) make clear, a nebulous concept, with substantial variations between different GSSs. It is safer, therefore, to use their broad definition: “computer-based information systems used to support intellectual collaborative work” (ibid., p.5). GSS technology is primarily directed at meetings (hence the term Electronic Meeting Systems, Dennis et al., 1988) and aims to make those meetings more productive by structuring and supporting the communication and collaboration functions that take place. Thus a number of meeting process features are supported, such as: more structured group interaction processes (Pinsonneault and Kraemer, 1989) and immediate information exchange. Specific tools used in GSS include: electronic brainstorming, topic commenting, stakeholder identification, evaluation (voting, ranking, scaling), etc. (Ventana Corp, 1994).

Research studies that have used GSS to facilitate meetings have found that GSS use increases: the task-oriented nature of communications (Gallupe and Dickson, 1988); decision quality, and participant satisfaction (Dennis et al., 1990). While much previous GSS research has been conducted with student subjects (e.g. Jarvenpaa et al., 1988; Sambamurthy and Poole, 1992; Lewis and Keleman, 1989; Miranda and Bostrom, 1993; Huang et al., 1993), a limited amount has been undertaken with a variety of business and other “real-world” groups (e.g. Dennis et al., 1990, 1991; Heminger, 1989; Lyytinen et al., 1993; Martz, 1989; Nunamaker et al., 1989). These have proved the viability of using GSS in non-student environments and illustrated how best we can adapt a GSS to real-world problems.

3. Designing a Bibliographic Software Package Using GSS

We now proceed to describe how we have used two forms of GSS - electronic mail and GroupSystems for Windows - to enable a substantial number of users to collaborate on a project to develop a software package.

3.1 Background and Initial Requirements Elicitation

The City University of Hong Kong is a ten-year old tertiary education institution in Hong Kong, offering certificate, diploma, undergraduate and post-graduate degree courses in a variety of subject areas. The Department of Information Systems, where the research was carried out is an Academic Department with 23 full-time academic staff, as well as 20 research and teaching support staff, and postgraduate students.

The researcher and a colleague initiated a project to develop, in-house, a bibliographic software package. This was a real project, in that management support was given for the design and development, and it was expected that the completed system would have substantial benefits for most staff in the department. In the first stage of the project, the aims and objectives of the software package were explained to all staff in the department by email[1]. Email has been used for a number of years as a medium for communication of ideas, directives and policies to members of the university staff. Interested parties were invited to make comments on the proposal, also by email. These comments, together with material from the original email proposal were collected and an 18-item questionnaire was drawn up to reflect the issues raised. These covered issues such as: what platform should the system run under; how updates should be made and who should be responsible for them; what response time could be expected from queries to the database; what output format could be generated by the software; how entries should be indexed; who should be able to access the system running the software, etc.

The questionnaire was emailed to all 43 staff in the department mentioned above with the request that individuals return the questionnaire by email to the researcher, indicating on a 1-5 Semantic Differential scale of Strongly Agree through Strongly Disagree how they felt with regard to each questionnaire item. Two days later, a reminder email was sent to encourage replies and two days later again a final request for replies to the questionnaire was made. This final request also attempted to clarify why staff/students had not previously replied to the email. The most common responses were that they were either uninterested in the system development, did not think that the system would be any use to them, or did not have the time to reply.

3.2 Analysis of Questionnaire Data

Analysis of the data obtained from the questionnaire survey shows that of the 18 respondents, 75% agreed about 50% of the design issues. These include items such as: the system should be Windows based; the system should provide hypertext links to related articles; the system should permit each bibliographic entry to have an attached description/abstract of the article, etc. The most contentious issues, where similar numbers of respondents had positive and negative views included: should the author of an entry (not the author of the article itself) have the right to restrict its availability to all staff (no restrictions), some staff (perhaps a

[1] In this case, we used the Windows compatible package Microsoft Mail™.

focused research group), and to no staff except him/her-self (i.e. a personal bibliographic system).

3.3 Detailed Requirements Elicitation

Having used electronic mail to generate initial ideas (individual brainstorming) on possible system functionality and subsequently to elicit views on questionnaire items, we decided to use the GSS to support detailed **topic commenting** and subsequent **evaluation** on the more contentious issues.

Participation in this stage of the process was not so substantial as had been the case in the electronic mail phases. We will discuss possible reasons for this below. All 18 respondents to the electronic questionnaire were emailed an invitation to participate in a face-to-face GSS-supported meeting at a time when no teaching classes were scheduled. Follow up telephone calls to individuals were used to try to ensure a high turnout. In the event, only 6 of the 18 staff turned up for the first GSS session.

Although only one of the participants had previously used the GSS software, participants were quick to learn how to use the software and this did not pose significant interaction problems. Of these 6 participants, 5 were members of the academic staff, while the 6th was a research student. All were familiar with the process of requirements elicitation. Discussion in this session was serious, but interspersed with some jovial bantering. 54 comments on 7 topics were generated in a 20 minute period. Voting was conducted at the end of this session, but this proved divisive. The only issue which the participants could agree upon was that the system should produce output in formats other than Windows applications, primarily Word for Macintosh and WordPerfect for DOS.

At a subsequent session, the researcher decided to provide greater focus to the discussion by limiting the number of topics to just two. It was felt that a major problem with the first session had been a lack of discussion direction. This was partly due to insufficient numbers of participants. Furthermore, rather than merely generating ideas (brainstorming), participants had to analyse issues, make persuasive arguments and try to convince their fellow participants (who they knew would very likely have dissenting views to their own). Attempting to undertake these various activities across seven related, but not identical, topics was likely to blur any focus that existed.

At the second GSS supported requirements elicitation meeting, 6 academic staff members participated. They were all briefed on the results of the previous meeting and informed that it was necessary to focus more deeply on the two issues involved. To strengthen the focus, we first used the brainstorming tool to generate ideas on the advantages and disadvantages of restricting the access of the system. This proved useful, but participants had the tendency of allowing the discussion to veer off the main issue. After 15 minutes, 21 ideas had been generated.

Having more clearly identified the issues at stake, we used the topic commenting tool to discuss issues further. Participants were allowed, initially, to generate one topic each. Later an additional four topics were included to make a total of ten. Over a 35 minute period, 101 comments were generated. As in the first session, we found that participants were unable to focus on the sole issue of how restricted the system should be. While they did discuss this, they also diverged into other areas such as: who will be responsible for entering data; should

we consider developing a CD-ROM based application; are we doing more than developing a glorified library system; and so on. Following this discussion, evaluation was used to see if any consensus existed on the issues discussed. Participants were allowed to submit as many ballot items for evaluation as they wished. In all, fifteen ballot items were submitted. A five point Likert-type scale evaluation method was used with no by-pass permitted. Of the fifteen ballot items, six received ratings of 4 or above (% = Strongly agree; 1 = strongly disagree) and a further six fell in the range 3-3.99. The items that received the highest levels of approval were "Do not develop the system until advantages are more clearly defined" (Mean=4.83) and "Clearly define the requirements before making any decisions of restricted access" (Mean=4.5). Items that received lowest levels of approval were "The system should be available for anyone to read" (Mean=2.83) and "Access to the system should be restricted to staff only" (Mean=2.5).

4. Discussion

We observed that the initial stages of the research seemed to progress quite smoothly. Many members of the Information Systems department expressed an interest in the software design project, as evidenced by the 41.8% return rate of questionnaires. However, the number of people willing to be involved in more detailed face-to-face discussions dropped markedly. It is possible that they were simply not free at the times we chose for discussion, but given the fact that the system would be of use to many of them, we felt that this was a sufficient motivating factor. It is, perhaps, in the nature of academic organisations that members do not always have fixed and rigid timetables that bind them to their departments. The time slot we chose is normally reserved for departmental meetings and in fact such a meeting was held immediately prior to the first GSS session. This in itself ensured that many of the potentially interested parties were available, if they chose to make themselves available. Further hypothesising on the vagaries of attendance may not be useful here, but it is useful to note that commitment by participants is essential not simply to meeting success, but even to meeting existence.

Our email phase of the requirements elicitation process proved most useful in that we were able to identify efficiently and effectively which components of the proposed system were agreed to by a substantial majority of interested parties. With two exceptions, all questionnaires were returned electronically which proves the viability of the email-questionnaire process. Email is extensively used in the organisation as a means of information dissemination, though it is much less used for information gathering in a structured format, such as a questionnaire. Thus, electronic mail proved itself as a good choice of communication medium. We believe that using email as a distribution channel for initial requests for ideas and subsequent questionnaire distribution/return improved our response rates due to the prevailing email culture in the organisation. The purpose of this stage of the project was not to reach any consensus or decision but simply to facilitate the communication of ideas. In this, it succeeded admirably.

Where the use of the GSS GroupSystems for Windows is concerned, we experienced problems of task focus. In the first session, as already described above, there appeared to be a noticeable lack of discussion direction. Although a reasonable number of ideas were generated, some 35% can be considered redundant and/or unoriginal, i.e. they are either irrelevant to the topics ("so let's restrict the system to information theory"), do not add new ideas ("Yes", "No", "I agree") or irreverent ("basically this is a silly idea"). This number is

disturbingly high, though the vast majority of such responses are in the 'not adding new ideas' category.

In the second session, the initial brainstorming allowed participants to get a feel for the ideas of others before committing themselves to more precise statements. The use of the topic commenter tool in the second session was very productive. Ideas were much more focused than previously, in the sense that virtually all ideas were all relevant to the overall topic, yet they were not as restricted to the intended topic (restriction of the system's availability) as had been planned. In the event, we believe that this does not matter. This is a system that is being designed by the users and for the users. They must take as much time as they need to understand the concepts involved and come to consensus. Perhaps it is ironical that the most agreed upon item in the final vote should be: do not develop the system until advantages have been more clearly defined. This is a strong statement in favour of continuing the discussion process.

In later stages of this research, as yet incomplete, we shall undertake further discussion sessions with the GSS tools, particularly the topic commenter which participants found the easiest to use. We shall also involve technical personnel who can be expected to take on a development role in the project when requirements are fully specified.

5. Conclusion

Overall, we found the whole process from initial request for ideas through to final evaluation of the most contentious issues to be a thoroughly worthwhile and educational. We achieved our objective of eliciting system requirements from a number of users, albeit expert users familiar in the art of teaching Systems Analysis and Design, without the aid of any outside systems analysts. We achieved consensus on a range of issues initially, and were able to move towards at least a shred understanding of other issues, even if we were not always able to reach consensus. Clearly, participants were real stakeholders with real objectives. This means that we cannot simply close the discussion at some point, as might be the case with student groups. To do so would be both artificial and misleading as to the intention of the project. This project was not primarily initiated as a data gathering exercise for eventual publication. However, we fell that our experiences are worthwhile recounting and are suitable for publication in a case context. As we have indicated, after a successful start to the project, we shall continue until it is complete and the system is built. We are confident that we shall reach that stage and that we shall have further interesting and useful experiences along the way.

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