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Supporting Joint Application Development with Electronic Meeting Systems: A field study

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The University of Arizona, 1991
SUPPORTING JOINT APPLICATION DEVELOPMENT WITH ELECTRONIC MEETING SYSTEMS: A FIELD STUDY.

by

Erran Carmel

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1991
As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Erran Carmel entitled SUPPORTING JOINT APPLICATION DEVELOPMENT WITH ELECTRONIC MEETING SYSTEMS: A FIELD STUDY and recommend that it be accepted as fulfilling the dissertation requirement for the Degree of Doctor of Philosophy.

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

Dissertation Director Joey F. George

7/16/91
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[Signature]
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ABSTRACT

JAD (Joint Application Development) is a meeting-centered methodology used to address the problem of getting users involved in the systems development process. Industry has used the JAD approach to develop systems for over a decade, predominantly for in-house software applications. Electronic Meeting Systems (EMS) are networked software systems that support meetings through a variety of software tools. The combination of the two—JAD and EMS—creates Electronic JAD (E-JAD). A field study was conducted to investigate whether applying EMS to JAD benefits the systems development process. The field study compared five traditional JAD sessions to six E-JAD sessions. All E-JAD sessions made use of the University of Arizona GroupSystems EMS. All sessions involved actual software development efforts conducted in a half dozen organizations and were all held in a face-to-face setting. There was some evidence that the E-JAD approach was beneficial as compared to traditional JAD techniques on the variables of efficiency and equalizing participation and influence. Traditional JAD sessions showed benefits over E-JAD in handling conflicts (particularly in resolving conflicts) and in enforcing a higher degree of structure. Neither of the approaches dominated on all criteria, hence an examination of E-JAD's weaknesses identifies two key areas for improvement: fit of GroupSystems tools to tasks (with discussion of divergence and convergence), and greater involvement of the session facilitator. Other constructs analyzed and discussed are: completeness, creativity, satisfaction, IS-user bonding, user expectations, users' mental models, JAD costs, group size, and planning activities.
CHAPTER 1

INTRODUCTION

You know there are a great many odd styles of architecture about; you don't want to do anything ridiculous; you hear me, among others, as a respectable architectural man-milliner; and you send for me, that I may tell you the leading fashion...


Experts estimate that software expenditures in 1995 will be near a quarter of a trillion dollars in North America alone (Boehm, 1987b). Even a small improvement in software construction methods can save countless millions of dollars. The objective of this study is to investigate one such improvement: automating a technique for building systems called Joint Application Development (JAD).

One of the most important developments in recent years in software construction is the maturation of Computer Assisted Software Engineering (CASE) tools. CASE and other Systems Development Life Cycle (SDLC) tools hold great promise because they automate a process that has been largely manual: the design and construction of Information Systems (IS). Yet, tremendous hype around CASE has created two widely believed myths:

- CASE will solve all problems.
- CASE captures everything.

This study focuses on one area that CASE does not—and to a great extent cannot—
address. The area is referred to as user involvement. The users are the ultimate customers of the IS developed by groups of computer designers. CASE tools do not address the communications link between designer and user. Curtis, et al. (1988) state that the development of large software systems “must be treated, at least in part, as a learning, communication and negotiation process” (p. 1282). Systems development in the large introduces a level of complexity with which our profession is still struggling to deal, and making fairly little progress (Brooks, 1987; Scacchi, 1984). As Brooks succinctly points out: Building software is hard and there is no Silver Bullet. 

The chapter begins by discussing the software development problems for systems in the large. These problems led to the introduction of the JAD techniques which address many facets of these problems. The topic of JAD is introduced in the following section. The last two sections introduce the technology used to automate JAD sessions: electronic meeting systems.

1.1 The Software Development (SD) problems.

Throughout the late 1970s and to some extent until this day, organizations developed software using the waterfall model (Royce, 1970). The waterfall metaphor describes a non-retraceable sequence of tasks. For example, common attributes of the chronological steps implicit in this model are: planning, requirements, specifications, design, implementation, integration, maintenance, and retirement. There are certainly many variations on this sequence. Using the above model, this study will focus on the first four steps of the SDLC, the early stages.

---

1 Any attempt to draw lines between large, medium and small development efforts would be heroic, but it would be safe to state that a large project requires more than 1 person-year and directly affects a user community of more than a dozen people. Most problems, and in particular solutions (e.g., JAD sessions), discussed here are also applicable to medium-size systems.
The SDLC in organizations begins with a set of individuals (e.g., executives, managers) who define exactly what it is they want out of the system. The individuals are called *users* and the system "wants" are called requirements. Articulating one's wants of a system is a tremendously difficult cognitive task at which few users are naturally gifted. Perceptions of information needs are influenced by each user's cognitive makeup, which in turn may bias the user's preferences for information (Nutt, 1986).

Traditionally, systems analysts begin the SDLC by conducting one-on-one interviews with the users about their requirements. This stage culminates in a requirements or specifications document. The users review and sign-off on this document. The IS people then disappear for a long time to design and implement the system. They reappear, perhaps more than a year later, with a finished product (consisting of hardware and software). This process is analogous to the proverbial house story (adapted from Schach, 1990):

The Zacks want to build a house. They hire an architect. He speaks separately to Mr. Zack and to Mrs. Zack about their desires in the new house. Instead of showing them sketches or models of the new house, or taking them to their land and discussing its use, the architect gives them a 30-page document written in technical language, describing the house. The Zacks are asked to sign-off on the document. The architect hires the builder and disappears. A year later the house is ready.

To summarize, there are three problems areas in the Requirements Elicitation (RE) process: the users' failures to articulate their wants; the analysts' failures to analyze the wants correctly (addressed in the systems analysis problem, below); and finally, the requirements communication channel from user to analyst. The failures in RE are saliently captured in Figure 1.1, a cartoon that makes its way around the "IS underground."
Figure 1.1: Humorous look at the user involvement problem
In practice, the RE process creates a variety of problems: misinterpretations, omissions, incomplete requirements, inconsistent requirements, and incorrect requirements. Although researchers have had a sense of this problem for years (Gause and Weinberg, 1989), recognition of the fundamental improvements needed in RE began when Boehm published his work on software engineering economics (Boehm, 1981). In documenting “faults” in projects in several organizations, he found that, once the system is implemented, the cost of repairing a fault stemming from a problem in RE is 100 times the cost of repairing it immediately during the RE phase. Breakdowns in the RE process affect many areas of the SD domain. Five SD problem areas (summarized in Table 1.1) that motivated the introduction of JAD and are therefore of interest to this study need to be discussed in detail.

1. The systems analysis problem If the brunt of making design decisions in the life cycle falls upon systems analysts, then one would expect them to be somewhat like supermen: that they have an excellent understanding of the business, people, politics; that they be able to capture every minute detail as well as every high level concept. In addition, one would expect them to have the perfect tools for their jobs. This, however, is far from reality. Numerous studies document the “human” problems of systems analysis. Davis (1982) presents a set of biases, derived from decision theory, which we all have to some extent. Because of the nature of RE, these are especially acute for systems analysts. One bias is recency, meaning people are influenced more by recent events than by the past. Thus, they give more weight to an information need experienced
recently. Vitalari and Dickson (1983) list the problem-solving characteristics faced by a systems analyst: the analysis problem is ill-defined; solutions to the problem are artificial; solutions are dynamic; the analyst’s knowledge-base constantly changes; the analysis process is primarily a cognitive one that requires the analyst to structure an abstract problem (more on this is found in Appendix H.).

Adding to the natural behavioral and cognitive difficulties, industry norms usually call for the requirements phase to end with a requirements document. In practice, the requirements documents created in many organizations are poorly written, extremely large and verbose, and tedious to read. This causes difficulties for other participants in the life cycle such as designers, programmers, testers and maintenance programmers.

Finally, the system analysis problem culminates with the simple truth that no measurements exist for a good definition/design of a system. One never knows objectively which software artifact is good and which is poor.

2. The user involvement problem  Beginning in the early 1970s, the IS community began to realize another truism: The more users are involved in the entire SDLC, the more successful their resulting system will be (cf. Grudin, 1991). The inverse holds true: fewer users involved in the process implies their system will be less successful. There is no empirical proof of this truism (Ives and Olson, 1984), but it is so intuitively powerful that it is viewed as axiomatic. Indeed, most practitioners recognize it as such. Gould and Lewis (1985), in a survey of IS professionals, found that 62% at least mentioned “early focus on users” as a key step in developing IS.

However, there are two problems in involving the users. The first is that the IS community has been very slow to change its old ways. Gould and Lewis (1985) discuss why the IS community ignored the basic principles of good design. IS professionals have a set of (somewhat mistaken) beliefs about the users and their need to interact with them: IS underestimates user diversity (and therefore it is not worthwhile to talk
3. The need for innovation As information systems progressed from "mundane" labor-replacement systems to sophisticated systems that support decision-making (DSS), systems that integrate all functions of an organization, and systems that help firms compete in the marketplace (strategic information systems), it became evident that the IS community needed to introduce creativity and innovation into the systems it was building. Today, it is widely believed that users are the innovators. Novel solutions and approaches come from users and not from staff people such as IS specialists. Von Hippel (1988) finds that for certain product categories, 70 to 90 percent of innovations—both major and minor—come from users.

It became clear to IS departments that traditional SD methods, which do not rely upon users for innovations, had fallen short as organizations searched for systems to help them increase productivity and enhance customer service.

4. Compressing life cycle time Users frequently wait years for applications necessary to run their organization. As one tongue-in-cheek Law of Project Management states:
<table>
<thead>
<tr>
<th>Type of impact</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
<td>Customers require customized needs. Customers say that needs have changed and demand add-ons. Technology advances require re-thinking. Competitors' products spur tinkering. Regulation by agencies and standards committees lead to changes (particularly in defense projects).</td>
</tr>
<tr>
<td>Company</td>
<td>Approvals are needed from marketing, finance, and legal departments. R&amp;D departments interfere in the process.</td>
</tr>
<tr>
<td>Hidden</td>
<td>“Creeping elegance” and skunkworks (work hidden by managers).</td>
</tr>
</tbody>
</table>

Figure 1.2: Sources of fluctuating and conflicting requirements (from Curtis, et al., 1988).

Projects progress rapidly until they are 90% complete; then they remain at 90% complete forever.

All stages of the life cycle are problematic in this regard.

5. Fluctuating requirements The lengthy life cycle introduces the moving target: requirements change over time. This is inevitable as organizations, technology, the environment and user preferences all change over time. Curtis, et al. (1988) note that “fluctuating and conflicting requirements” (summarized in Figure 1.2) was one of the three most important factors causing problems in systems development.

1.1.1 User involvement techniques

The discussion has focused on a subset of systems development problems that led to the solutions discussed in this dissertation (Table 1.1). Many, although by no means all, of these solutions concern user involvement techniques. In practice, in industry, users are almost always involved at discrete points in the SDLC using a variety of involvement techniques:
• **The Sign-off** is the milestone at which the user representatives review and approve a document or system module. A sign-off can come at the end of the requirements phase.

• **The Walkthrough** is a small meeting typically dealing with the topic of computer code. Yourdon (1989a) predicts that walkthroughs will evolve from their code orientation and become both broader as well as more specialized in the future.

• **The Review** is a meeting at which the IS staff presents a document or system module to the users for approval and feedback (e.g., Parnas and Weiss, 1987). Reviews can be technical or managerial. In practice, *review* is used generically to refer to any sort of meeting.

• **The Steering Committee** is composed of user managers and IS personnel who periodically review development progress, problems and design issues.

• **The User Liaison** is a go-between, usually from the user department rather than the IS department. In some organizations the position of liaison is a full-time position, although this job is falling out of favor because the liaisons tend to lose touch with the users they represent.

• **Prototyping** or by its current name, rapid prototyping, is the process by which users review mock versions of the final system. Prototypes are often presented to users several times before the system is finalized. Prototyping is typically a high user involvement method that spans the spectrum of Figure 1.3 and can be combined with other user involvement methods such as JAD.

• **Participatory Design (PD)** is a socially-oriented and controversial high involvement method which mandates that the workers (clerical, union members) both initiate and design the computer systems they work with on a daily basis (see Appendix C for more on PD).
Figure 1.3: The user involvement spectrum
Figure 1.3 presents these seven techniques (and JAD) on a scale of low to high involvement. Researchers warn that the low involvement techniques commonly used in industry are insufficient (Gould and Lewis, 1985). The failures of some of these techniques led to the user involvement on which this work focuses: JAD.

1.2 Joint Application Development—JAD

JAD is an approach for Information Systems development that has the following six attributes:

1. *Users.* The principal participants are the users.

2. *Meeting.* The JAD approach revolves around one or more meetings/sessions/workshops.

3. *Facilitation.* The meeting is managed by one or more designated leaders.

4. *Agenda/structure/stages.* The meeting is part of a series of well-defined development phases. The meeting itself must have a strictly followed plan of action.

5. *Documentation.* One or more designated people carefully documents everything in the meeting. He is often referred to as a *scribe.* Lists are rigorously maintained.

6. *Group Dynamics.* Group dynamics techniques are used for inspiring creativity (e.g., brainstorming), resolving disagreements (e.g., airing facts, documenting them as "issues," taking notes), handling speaking protocols (e.g., enforcing "one conversation at a time").

JAD is both a technique and a methodology. It is a technique because over the years it has evolved to mean a framework for "how to run a design meeting" as represented in the "typical JAD room" in Figure 1.4. It is a methodology because it is specific to the domain of systems development. When introduced into the SDLC, JAD meetings
<table>
<thead>
<tr>
<th>SD Problem/Issue</th>
<th>JAD solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems analysis</td>
<td>Have the users define the requirements and design details. Synergies of group work. Enforce top-down methodology.</td>
</tr>
<tr>
<td>User involvement</td>
<td>The user meeting. Spirit of cooperation and teamwork.</td>
</tr>
<tr>
<td>Need for innovation</td>
<td>Encourage creativity. Brainstorming. Pool experts together.</td>
</tr>
<tr>
<td>Compress life cycle time</td>
<td>Condense several steps into a structured, facilitated, intensive meeting.</td>
</tr>
<tr>
<td>Fluctuating requirements</td>
<td>Gather all decision-makers and experts in one place— and reach closure. Group Dynamics: build shared goals; build consensus.</td>
</tr>
</tbody>
</table>

Table 1.2: Systems development problems and the JAD solutions

become the core around which all the activities revolve. As Table 1.2 indicates, the JAD approach addresses all five problems areas identified earlier in this chapter: first, through high user involvement; and second, through a variety of techniques used within the meetings to address specific dynamics.

JAD emphasizes structure and agenda. This is evident in the JAD literature which is somewhat analogous to cookbooks (JAD, 1986; Guide, 1986; Wood and Silver, 1989; August, 1991). Everything is explained in great detail: "to do" lists are included, as are copies of forms that can be used. The generic approach is a top-down structured process that supports the planning, requirements and design phases of the systems life cycle (FASC, 1990). Wood and Silver describe a five phase approach in which JAD sessions themselves are grouped together over consecutive days.
Figure 1.4: The typical JAD room (from Wood and Silver, 1989)
Generically, JAD sessions are of two kinds, requirements and design. In traditional IBM JAD parlance, these are called JAD/PLAN and JAD/DESIGN initially. JAD sessions early in the SDLC deal with higher level issues: defining objectives, decomposing the domain into smaller functions, defining boundaries and scope, deciding what should and should not be included. In these sessions, participants also begin to compile a list of assumptions, constraints and open issues; specific people and organizations are targeted for tasks; and timelines are constructed. In the latter JAD sessions—in the design phase—the users are asked to provide ever increasing detail. These sessions are often longer in duration—perhaps 3-5 days.

JAD techniques are fairly strict about assigning roles to the various players in the sessions. For example, the roles in the IBM JAD approach are (for more detail on these roles see Appendix E):

- **Users.** Users are at the heart of the entire approach. They are the ultimate owners of the systems; the people who will use it on a day-to-day basis. The users most knowledgeable about the use of the system should be present at the session(s).

- **Executive Sponsor.** The (user) sponsor defines the overall project purpose and direction.

- **IS Project Team.** The IS staff includes analysts, project managers, database personnel, and technical experts. Some—though not all—professionals in the field suggest they not be involved in the session per se, for they might intimidate the users and shoot down good ideas.

- **Facilitator/Session Leader.** The session is led by a neutral facilitator (a member of neither the IS team nor the user group) who is specifically trained in leading such meetings. The facilitator should have training in group dynamics (or an instinctive flair), and in systems development methodologies. S/he is responsible

---

2The latter term is redundant, leading IBM to introduce two new terms a few years ago: JAR (Joint Application Requirements) and JAD (Joint Application Design).
for all activities: the agenda, the discussion, and documentation of the session results.

- Scribe. The scribe captures the proceedings of the session: charts, flows, lists and definitions. S/he maintains the "group memory" of the meeting.

1.2.1 JAD in the marketplace

JAD originated at IBM in the late 1970s. In the mid 1980s, JAD gained recognition in the IS community as an effective method to manage requirements and design of the systems life cycle. During that time, JAD received coverage in many of the IS trade journals (Kull, 1985; Rush, 1985; EDP Analyzer, 1986; Gill, 1987). The well-respected IS association Guide International, which publishes surveys on topics of interest to the IS community, published its first "Guides" to JAD in this period (Guide, 1986). The first definitive book about JAD, aptly named Joint Application Design: How to design quality systems in 40% less time by Wood and Silver, was published by a major publishing house (Wiley) in 1989. By 1991– and the writing of this manuscript– JAD has become fairly well known in the IS community and continues to receive attention in the trade press (Martin, 1990e; Martin, 1990f; Martin, 1991; Andrews, 1991; Crawford, 1991; Hill, 1991).

Today, IBM has a very large program for supporting JAD. The computer company
conducts numerous JAD sessions for internal development. IBM Corporate Information Systems and Administration Standard 204A mandates some form of JAD in the development process. In parallel, IBM treats JAD as a service product— it trains customers in JAD methods and conducts JAD sessions for its customers on a consulting basis. As a result of IBM’s pioneer work in JAD, other organizations and individuals have embraced the basic concept and modified it to their needs and philosophy. Hence JAD— as defined by IBM— is considered to be a subset of a more holistic approach that is part of an overall methodology for structured and facilitated user meetings. Many firms now have their own flavors of JAD techniques. Appendix D describes some of these firms’ JAD service products. These summaries demonstrate that there is no “right” methodology for conducting JAD sessions. Many of the consultants in the field emphasize the behavioral aspects of the session and preach keeping sessions simple and non-threatening (Crawford, 1991; Hill, 1991). The use of creative visual aids is broadly recognized as beneficial to assist users, who are IS novices, in visualizing the software, which is an abstract artifact. For this purpose, for example, M.G. Rush, as a part of the company’s week-long facilitator training program, offers a $400 suitcase of custom-designed magnetic color-coded symbols that the facilitator can use during a session, on a whiteboard, for presentation purposes.

The marketplace has also created a plethora of names to describe JAD-like processes which suggest subtle differences between them. (Table 1.3). This manuscript uses the term JAD in the sense of Joint Application Development, not Design. Such a definition seems the closest to a truly generic name.

As JAD has matured it has become part of industry’s new thinking about Systems Development methodologies, or as McDonnell Douglas Information Systems puts it: JAD is a component of Best Current Practice (McDonnell, 1991). The “new” thinking is a common-sense amalgamation of the most successful concepts present in Systems Development today: JAD, small teams, rapid prototyping, CASE (see Appendix D, JAD
and CASE), and rigid time limits (revolving around the “timebox” concept; Martin, 1990h). Use of these methodologies is said to lead to increased quality, reduced cost, and life cycle time reduction. Often, the new approaches are given energetic names: Fusion Centers (Andrews, 1991); Tiger teams (PRI, 1990); RAD (Rapid Application Development) and SWAT teams (Martin, 1990g; Martin, 1991).

The increased recognition of JAD suggests that this is, in a sense, its coming of age. But JAD is still, by and large, a low-tech approach: Can automation serve to improve it in some way?

### 1.3 Electronic Meeting Systems

JAD is fundamentally a meeting technique and as such can be supported by a new type of software environment: Electronic Meeting Systems (EMS). The term EMS was coined in Dennis, et al. (1988) to describe Information Technology that supports the meeting process. EMS combines technology, procedures and facilitation to make meetings more effective. One of the significant research efforts in this field, and one on which much of the rest of this study is based, is the *University of Arizona GroupSystems*, referred to from hereon in as GroupSystems (Dennis, et al., 1988; Dennis, et al., 1990b; Nunamaker, et
GroupSystems evolved from Plexsys, one of the first major life cycle automation efforts (Konsynski, et al., 1984; see Appendix B for a history of Plexsys). The Plexsys researchers recognized the need for more efforts in the upstream part of the life cycle. As a result, beginning in 1984, researchers at the University of Arizona developed a networked system intended for use in a meeting room, to support the requirements elicitation phase in the SDLC. This was the first electronic meeting room at the University of Arizona (see Figure 1.5). The researchers quickly realized that such a system, now classified as an EMS, can support much more than merely requirements elicitation. For a number of years, efforts with GroupSystems have been devoted to planning, idea generation, communication, problem-solving and negotiation sessions (Nunamaker, et al., 1991b). Life cycle automation, the original motivation for GroupSystems, was de-emphasized for several years. The subject of this dissertation, automation of JAD, is essentially “closing the circle” on systems development and the original ideas of Plexsys.
In 1987, provided with funding from IBM, a second facility opened at the University of Arizona with 24 workstations (see Figure 1.6). In the meantime an electronic meeting room was set up at an IBM manufacturing plant in Owego, NY, using the Plexsys software. Within three years IBM had 35 electronic meeting rooms using Plexsys software (the system is called TeamFocus at IBM). In 1989, Nunamaker started a spin-off firm in Tucson called Ventana Corporation which markets group support software.

GroupSystems' approach is to provide a wide variety of flexible software tools— a "toolbox"— that are carefully orchestrated by a facilitator. The facilitator is active in meeting planning, and supervises the meeting process. The toolbox approach gives the facilitator a great deal of flexibility. Currently, the toolbox has over a dozen tools. Typically, during the pre-meeting planning activities, the facilitator decides on the tools she will use and the order in which she will use them. The tools support different task types and can be run in any order. A complete list of the tools in GroupSystems and their functions is presented in Appendix B.
1.4 Electronic JAD: The automation of JAD

With the proliferation of EMS in many locations and the obvious overlap between EMS and JAD, it was not long before essentially "automated JAD sessions" began taking place. IBM personnel reported conducting several such sessions in some of their electronic meeting rooms as early as 1989. Some JAD-like sessions were conducted on an experimental basis at Arizona (Ram, et al., 1989; Daniels, et al., 1990). In 1989, the term Electronic-JAD (E-JAD) was coined at the University of Arizona to describe EMS support for the JAD process. More precisely, E-JAD is defined in this manuscript as:

The use of electronic meeting systems to support JAD meetings in two ways: first, by automating current JAD practices; second, by introducing new computer-mediated group processes which have not traditionally been used in JAD sessions.

Familiarity with both EMS and JAD suggests that integrating the two approaches can potentially address/solve the Software Development problem areas delineated in Table 1.1. Table 1.4 describes the mapping of GroupSystems tools to the needs of Systems Development and JAD. For example, the critical need for creativity in JAD sessions can potentially be supported by the GroupSystems tool Electronic Brainstorming (EBS), which allows participants in a meeting cooperatively and anonymously to generate a list of ideas about a certain topic. Another need in the Systems Development process is to compress the SDLC; this can potentially be addressed by the parallel processing capabilities of a group of E-JAD participants—each working individually on the same problems.
Table 1.4: E-JAD: tasks and GroupSystems tools

<table>
<thead>
<tr>
<th>JAD Task/Issue</th>
<th>GroupSystems tool/concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity/idea generation</td>
<td>EBS</td>
</tr>
<tr>
<td>Discover all requirements</td>
<td>EBS, TC, GO</td>
</tr>
<tr>
<td>Resolve conflicts</td>
<td>VO, GM</td>
</tr>
<tr>
<td>Compress process</td>
<td>parallel processing</td>
</tr>
<tr>
<td>Scope and boundary definitions</td>
<td>VO</td>
</tr>
<tr>
<td>Agenda setting</td>
<td>the entire toolbox</td>
</tr>
<tr>
<td>Documentation/design rationale</td>
<td>GW, TC, GO</td>
</tr>
<tr>
<td>Organizing ideas/items</td>
<td>IO</td>
</tr>
<tr>
<td>Prioritize requirements</td>
<td>VO</td>
</tr>
<tr>
<td>Maintaining notes</td>
<td>FR</td>
</tr>
<tr>
<td>Define relationships</td>
<td>GM</td>
</tr>
<tr>
<td>Maintain lists</td>
<td>IO, FR</td>
</tr>
</tbody>
</table>

1.5 Summary

The stage has been now been set: We have examined the frustrating and expensive problems of SD that led to the development of JAD techniques. JAD is inherently a "meeting solution." EMS is a meeting solution that potentially supports JAD by adding useful tools to automate an otherwise manual process. The combination of the two is described as "Electronic JAD," or E-JAD.

Thus, the next question that arises is whether E-JAD fulfills its promise of high functionality. This question that will be investigated rigorously in this study: is E-JAD worthwhile? Clearly the opportunities are promising, but does automation enhance the traditional JAD techniques and methods? Perhaps the overall picture is mixed: perhaps in some respects E-JAD improves the process, and in other respects it detracts. If so, what are the tasks and techniques that work?

Therefore, this study is a comparative study: of E-JAD versus traditional JAD meetings. It is a comparison of two fuzzy domains since there is no generic JAD and there is no generic E-JAD. The implicit assumption guiding this entire study is that
there is a generic set of norms and techniques for JAD which are an amalgamation of the popular JAD literature and practice. Furthermore, E-JAD is assumed here to be a JAD-like session conducted with the help of the electronic meeting system developed at the University of Arizona called GroupSystems. This system as it exists in the 1990-91 period (with a few prototype tools in a few cases) is the point of comparison.

This dissertation begins with a literature review of some of the concepts introduced in this chapter. Next, in Chapter 3, the approach and constructs are discussed in detail. Chapter 4 describes the methodology. Chapter 5 presents the research findings, which are then discussed in Chapter 6. Finally, Chapter 7 explores the broader implications of this research.
Chapter One defined the area of study as the intersection of a Software Development (SD) technique called JAD and a means of conducting meetings called Electronic Meeting Systems. At this point we delve into the context and research background of the disciplines, and problems associated with both the referent fields and their intersection.

The chapter begins with a discussion of user involvement in the SD process. Next, it places the domain of the dissertation in perspective with regards to Software Engineering and JAD. The chapter then moves to a broad discussion of frameworks and research in group work: in meetings, design meetings, and finally in user design meetings. Lastly, it reviews the topic of meeting automation.

2.1 User involvement in SD

The two most important frameworks of user involvement in SD were proposed by authors with a strong bias towards very high levels of user involvement. Mumford (1981) presents a model of three types of user involvement which has been embraced by many MIS researchers:

- *Consultative design.* IS makes the decisions. Users are simply sources of information with little to no influence or control.
• **Representative design.** Some user representatives, who are either elected or appointed, have influence and affect decisions. This is fairly descriptive of the JAD approach.

• **Consensus design.** Users actively decide and have total responsibility for the system. This mode of involvement requires a wholly different interaction between the users and the IS staff and it representative of Participatory Design (PD) (See Appendix C).

The Mumford model represents a continuum ranging from little involvement to total involvement. Indeed, this model can be overlaid on top of the spectrum presented in Figure 1.3 which presents industry techniques in user involvement.

Grudin (1991) presents the second important framework of user involvement. He introduces three dominant development contexts: In-house development (the "classic" involvement context); contract management (where requirements are handed over to contractors); and product development (e.g., micro computer software development, where there is no real identifiable user community). Grudin's contribution is in highlighting how little user participation there is in the contract and product contexts. In-house development has the most user involvement. Grudin refers only superficially to operationalization of user involvement.

These two frameworks are useful, but do not take into account the activist role of users in JAD sessions. They also do not consider the possibility that the user himself may develop software using today's higher level languages.

User involvement intrigues researchers in the MIS field since it encompasses a confluence of complex social factors which make it a challenging area. Henderson (1987) studied design teams composed of both users and IS staff. The interesting result of this study is that the best performing teams were interactive teams—those in which there was a balance of leadership between users and IS. The IS-driven teams performed the worst,
while the user-driven teams ranked in the middle. Henderson and Lee (1990) studied an aspect of user involvement called boundary management, i.e., how the development team deals with individuals outside the team boundary. King and Rodriguez (1981) examined involvement in an experimental setting and found some support for the "participative design theory" (not to be confused with PD), which seems to be a higher form of user involvement than was the norm for the late 1970s. Users' inputs were actually used and user perception of system worth was higher.

2.2 Software Engineering and JAD

For some time, the domain of building software systems has been moving into the realm of a science, hence we see the development of a field called software engineering (SE). A NATO study group coined the term in 1967 to encourage building software using methods like other engineering tasks. Today, we find numerous software sub-disciplines with the term engineering: requirements engineering, reverse engineering, information engineering. One of the dominant IS themes of the 1970s was the development of structured systems analysis that tried to "scientize" the process of building systems.

As a derivative of its engineering orientation, the IS community has also forged time and again into automating the SDLC. CASE (Computer Assisted Software Engineering) and more comprehensively, IBM's AD/Cycle, are but the latest incarnations of automation efforts such as NCR's Automated ADS, developed in the 1960s, and PSL/PSA, which was developed during the 1970s.

However, none of these tools addresses the heart of the problems introduced in Chapter One: user involvement. Since user involvement means dealing with non-technically oriented individuals working on unstructured tasks, it has not taken kindly to automation. Solutions to user involvement problems have tended to be managerial, behavioral and group-oriented.
The study of SE has focused—instead—on the next step in the life cycle: on translating a body of requirements into specifications. Numerous articles in the last decade of *IEEE Transactions on Software Engineering*, the prominent journal in the field, have looked at the structured task of taking one syntax and translating it into another. This stage is measurable and contains the challenge of a programmed solution. As Kettelhut (1991) suggests: symptoms of the SE research problem are evidenced in the terms software *validation* and *verification*. These concepts measure correct transformation of input to software outputs, without regard for whether the inputs are correct initially. The SE field shuns organizational/behavioral research, as reflected in its journals. Scacchi (1984) preached for “a social analysis” of SE, arguing that a variety of social arrangements intimately shape both the cause and outcome of SE activities. He advocated more attention be focused on the “complex web of social arrangements that shapes the production of software.” What are the most severe problems in large scale systems development? In a large scale field study conducted by Curtis, et al. (1988), the three most salient features of the development problems were: the thin spread of application domain knowledge, fluctuating and conflicting requirements, and communications and coordination breakdowns. Note that none of these is an inherently technical problem and that all of these “features” overlap to a great extent with three of the five problems presented in Table 1.1, particularly: systems analysis, user involvement, and fluctuating requirements.

In spite of its engineering orientation, SE recognizes the failures of the rigid waterfall method. Consequently, new approaches toward the software development process have been introduced that fall under the rubric of the “spiral model” (Boehm, 1988): prototyping, refined waterfall techniques, incremental systems development, and others. The spiral model is based on frequent feedback and re-evaluation of development efforts. Simplified, it means prototyping requirements, prototyping design and prototyping code. The model implies that a strictly deterministic view of SD is insufficient.
Thus, we come to SE and JAD. JAD is a practitioner's tool; there has been no academic research on it. Some industry research has been done, as witnessed by the statistics in Table 2.1. The methodologies used for all of the findings in the data are not available and could not be verified. Many seem to be post-hoc estimates by advocates of the method. Nevertheless, the numbers, even if acknowledged as exaggerated, paint a positive picture of the benefits offered by JAD sessions.

Articles on JAD tend to emphasize aspects of practice. For example, Andrews (1991) lists six reasons for failures of JAD implementations in organizations: 1) the endless session syndrome; 2) users playing musical chairs; 3) wondering workshops (where a deliverable is not clearly defined and participants wonder what to do); 4) reliance on a magician facilitator; 5) an anyone-can-run a session mentality (similar to Hill, 1991, who states that in-house or untrained facilitators can do more harm than good); 6) and a lack of accountability for documentation delivery. The striking impression derived from this and other similar practical articles is how little any of the recommendations have to do with SE, technology, or systems analysis methodologies. Rather, emphasis is placed on the behavioral, managerial and organizational issues.

Why has there been little research in this field? Two referent fields are clear candidates for performing JAD research: Software Engineering and MIS. SE almost always falls under the aegis of Computer Science. However, Computer Science departments do not generally study organizational issues. On the other hand, as MIS almost always comes under the auspices of schools of management, behavioral research is accepted. However, the MIS community has traditionally focused on the more amorphous construct of "user involvement." Research has all but ignored the differences in form and substance of user involvement techniques such as JAD.
<table>
<thead>
<tr>
<th>Time savings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 30-40% in design and 20-30% in implementation (FASC, 1990)</td>
</tr>
<tr>
<td>• 15% cycle reduction (Guide, 1986)</td>
</tr>
<tr>
<td>• 80% time savings (Boeing Computer Services, 1990)</td>
</tr>
<tr>
<td>• 8 hrs/Function Point for traditional method vs. 2.5 hrs/Function point for JAD (EDP Analyzer, 1986)</td>
</tr>
<tr>
<td>• A project at Western-Southern Life: 4 to 6 weeks (Wood and Silver, 1989)</td>
</tr>
<tr>
<td>• A project at Texas Instruments: 6 project months (Wood and Silver, 1989)</td>
</tr>
<tr>
<td>• 40% less time (Wood and Silver, 1989)</td>
</tr>
<tr>
<td>Cost:</td>
</tr>
<tr>
<td>• 50% cost reduction (Boeing Computer Services, 1990)</td>
</tr>
<tr>
<td>• A project at Texas Instruments: cost avoidance of $0.5 million (Wood and Silver, 1989)</td>
</tr>
<tr>
<td>Completeness:</td>
</tr>
<tr>
<td>• Less than 10% of functional requirements are missed with JAD as opposed to up to 35% without JAD.</td>
</tr>
<tr>
<td>The requirements that are missed add up to nearly 50% more code (PRI, 1990b)</td>
</tr>
<tr>
<td>• A project at CNA: 25% increase in number of Function Points (Guide, 1986)</td>
</tr>
<tr>
<td>Subjective Evaluation:</td>
</tr>
<tr>
<td>• 99% of users would participate in JAD sessions again (Guide, 1986)</td>
</tr>
<tr>
<td>• 94% of users said that they had a better understanding of the system (Guide, 1986)</td>
</tr>
<tr>
<td>• 100% of the users said that the system would be at least “good” (Guide, 1986)</td>
</tr>
</tbody>
</table>

Table 2.1: Some benefits associated with JAD-like techniques
2.3 The study of groups, meetings, and design teams

Group work is of vital interest to organizations; in business we hear more and more of 

*business teams* (Drucker, 1988; Johansen, 1990; IFTF, 1990). One finds work groups in 
a variety of fields ranging from auto manufacturing and quality control circles to system 
development project structures (DeMarco and Lister, 1987). A work group is defined 
by its common goal or product-- much like that of JAD.

In the social sciences the midpoint between the study of organizations and the study 
of individuals is the study of groups (Forsyth, 1983; McGrath, 1984). The study of 
groups evolved from social psychology work in the early part of this century. In the 
1930s, the Group Dynamics (GD) movement began under the leadership of Kurt Lewin. 
The GD movement takes a holistic approach to the concept of the group, i.e., it maintains 
that the group is greater than the sum of its parts. The GD discipline is not a collection of 
maxims about how to run a meeting, as commonly used in practice, but rather a discipline 
which encompasses many referent fields: psychology, sociology, anthropology, political 
science, speech and communications, business, social work, education, counseling, crim­
inal justice, and sports. The lessons from group and GD research have permeated many 
aspects of organizational life. Certainly JAD techniques have assimilated the lessons 
and techniques developed by researchers over the years. GD perspectives also shed light 
on other aspects of SD involving team, project or group work (Kettelhut, 1991).

There are several helpful frameworks and models in the study of groups which will 
be referred to throughout the manuscript. The first is the typology of groups as presented 
in McGrath (1984). Groups are classified along two main dimensions (see Table 2.2): 
term of involvement and spectrum of activities. Hence, a family is very high on both 
dimensions, while an ad hoc group organized for an experiment is very low on both. 
JAD meetings are also "low" on both dimensions.

The second McGrath model is his synthesis of the group tasks. He lists four generic
Table 2.2: Group typology, McGrath (1984)

<table>
<thead>
<tr>
<th>Long Term</th>
<th>Limited Activity Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded systems</td>
<td>Standing crews</td>
</tr>
<tr>
<td>(families)</td>
<td>(work teams)</td>
</tr>
<tr>
<td></td>
<td>(SD project teams)</td>
</tr>
<tr>
<td>Short Term</td>
<td>Task Forces</td>
</tr>
<tr>
<td>Expeditions</td>
<td>(study commission)</td>
</tr>
<tr>
<td>(space crews)</td>
<td>(JAD sessions)</td>
</tr>
</tbody>
</table>

types of tasks that groups perform—roughly in the order in which they are usually done:

1. Generate. Planning and creative tasks.
2. Choose. Intellective tasks, decision-making tasks, tasks for which experts define the correct answers.
3. Negotiate. Resolving conflicts of viewpoint and/or conflicts of interest.
4. Execute. The task in which "contests" and performance are crucial.

JAD activities overlap the first three of McGrath's task types quite a bit (to varying degrees over the SDLC), but the fourth one very little.

2.3.1 The meeting

A meeting is simply a subset of group work as defined in McGrath's group typology. It can be defined as a situation in which a number of people who have both a limited timeframe and scope of activities gather around a meeting table in order to address a task. Since JAD is fundamentally a meeting process, the study of meetings is of great interest to this research.

Considerable attention has been paid to the fact that the meeting is an essential but oft mismanaged process in organizations (e.g., Mintzberg, 1979; or from a practical
perspective—Doyle and Strauss, 1976). The problem areas we speak of in the area of meetings are numerous: coordination costs, poor team work, wasted time, groupthink, and difficult personalities, to name a few.

Meetings vary on many dimensions: size, ad-hoc versus formal, subject domain, degree of structure, and goals. Groups go through phases in meetings—from orientation and trust-building to implementation and performance, and hence different meeting forms are applicable in different stages (Johansen, 1988). In early phases of work, face-to-face meetings are essential to convey the richness of information required. In later phases of work, distributed meetings (such as conference calls) may be sufficient.

Process leadership, or facilitation, is the cornerstone of well managed meetings: from legislative meetings (e.g., the U.S. Congress) to generic business meetings (Doyle and Strauss, 1976), JAD (Wood and Silver, 1989), and EMS (Iacono, et al., 1990). The philosophy of leading electronic meetings at the University of Arizona began with a very cautious approach to facilitator involvement. Experience brought increased appreciation of the facilitator's role and— to some extent— discovery of technology's limitations. Some anecdotal evidence has emerged from the experiences of IBM and the University of Arizona that suggest meeting facilitation is at least as important as meeting computer support (McGoff, et al., 1990; Iacono, et al., 1990).

2.3.2 Design teams

Within the context of group work and meetings there is a domain-specific type of group structure involving, what is generically referred to here as, the design team. Design teams are not unique to IS, of course. An assortment of fields utilizes design team concepts. For example, concurrent engineering (Business Week, 1990) is a concept found in manufacturing. In addition, a design team concept called programming, oddly enough, which has a striking resemblance to JAD has emerged in the field of architecture
Architectural programming is a structured process that brings in the “users.” The information is synthesized into forms much like those of JAD.

IS teams need to be composed of carefully selected participants who complement and augment each other. Kettelhut (1991) lists four reasons for using teams in the systems development context: 1) information collection (any one participant may not have all the required knowledge); 2) the problem area has alternative solutions that have different impacts on the group; 3) conflicts may arise over the goals set; and 4) implementation has a higher probability of success when there is group participation.

In the classic Systems Development waterfall model, there are many teams responsible for a software product (Pfleeger, 1991): the analysts working with designers; later, the designers working with programmers; and still later, teams for trainers and testers and maintenance stages. Bendifallah and Scacchi (1989) found that there are only two team authority structures in the literature of SE: chief programmer and egoless programmer. The chief programmer concept (Schach, 1990) uses the analogy of the medical surgeon. The chief programmer, a highly qualified professional, is surrounded by a team of five assistants who revolve around him. This approach was made famous by the New York Times project in 1971 which produced astonishing productivity for its time. The second authority structure for IS teams is the egoless programmer (or democratic team) which restructures the social environment in order to develop a team ethos. However, both the classic SD teams of Pfleeger and the two authority structures identified by Bendifallah and Scacchi have flaws, one of the foremost of which is the absence of the user in the process.

Yet recently, there has been more recognition of the need to involve users in design teams. Bendifallah and Scacchi (1989) conducted a quasi-experiment to examine patterns of work structure and found that integrative teams (those that have a balance between

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1 The organization of IS teams follows the metaphor of the pregnant woman giving birth to a child after nine months—nine women cannot possibly produce the same baby in one month. Similarly for software—adding personnel to a project does not necessarily make it faster, nor better.
users and IS staff) were the least efficient, but produced the highest quality results. The wave of the future, if one follows James Martin, is the notion of SWAT Teams—small (three-four programmers) teams of highly experienced members equipped with the latest workstations and development tools (Martin, 1990g). Martin proposes having SWAT teams communicate with users through JAD and rapid prototyping.

The design meeting is a subset of the domain of the design team. Little attention has been paid to the design meeting until recently. One recent approach presented by Retting (1990) proposes adding some JAD-like principles of facilitation and scribes to programming teams meetings. Three institutions currently research the area of design meetings: Xerox PARC, Microelectronics and Computer Technology Corporation (MCC), and the University of Michigan's Machine Intelligence Center. The goal of these three efforts, like that of this dissertation, is to gain a deeper understanding of the design activity in order to introduce technology to support the design process. Research at Xerox (Tang and Leifer, 1988) and at MCC (Ellis, et al., 1991; Cook, et al., 1987) has focused on shared workspaces. Attention at Michigan (Olson and Olson, 1991) has centered on distributed cognition within a meeting and on understanding streams of activity during meetings. Olson and Olson observed that technology can address limitations of traditional artifacts: current artifacts (such as lists and whiteboards) are not easily edited; idea generation sometimes stops when the whiteboard ends; not everyone can see the whiteboard; when more than one person takes notes, interpretations of decisions are different.

2.4 Automating the meeting

The desire to support and automate meetings came from frustration with groups, meetings and collaborative work as they have been conducted. Hence several similar types of software have emerged: Groupware, Group Decision Support Systems (GDSS), Computer
Supported Collaborative Work (CSCW) and Electronic Meeting Systems (EMS).  

The section begins with a variety of typologies. Huber (1984) may very well have been the first to attempt taxonomies for GDSS by introducing "modes of GDSS delivery," but in this rapidly developing field they are already outdated. DeSanctis and Gallupe (1987) divide GDSS into three levels: Level-1 systems provide communications support. Level-2 systems include decision-modelling and support. Level-3 systems are characterized by machine-induced group communications. Most GDSS/EMS are still at the Level-1 stage today.

Johansen (1988) presents the time-space model. Meetings can take place along two dimensions: time (all participants meet at the same time versus meeting asynchronously, as in electronic mail); and place (all participants in one room versus all participants distributed). The time-space model has great potential for JAD and E-JAD, since it implies that such sessions do not have to be limited by distance and may be run in a distributed fashion. Finally, and more recently, Ellis, et al., (1991) introduce a taxonomy of groupware having six types; message systems, multi-user editors, GDSS and EMS, computer conferencing, intelligent agents and coordination systems.

2.4.1 Examples of CSCW and EMS

The first electronic meeting room was built in 1980 by Execucom, a Texas firm (Gibson and Ludl, 1988). Over the last 11 years, most of the significant efforts have come from academia, the dominant one being the University of Arizona's GroupSystems EMS now installed in a dozen universities in the United States. GroupSystems, the basis for this dissertation, is described in greater detail in Appendix B. A few similar efforts that also

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2 It would be heroic to step into the political minefield that delineates the differences between the four terms. Nevertheless... Groupware is the broadest of the four and encompasses all the others. As applicability of the terms EMS and CSCW increases, usage of the term GDSS is beginning to fade. CSCW suggests support for groups that are working together on an on-going basis, while, of course, EMS stresses the act of the meeting, and not what takes place outside the meeting.
fall under the rubric of groupware are described briefly in this section.

COLAB at Xerox PARC (Stefik and Brown, 1989), was designed to accommodate the informal types of meetings common in organizational settings. The COLAB has a "liveboard" in the front of the room with a touch sensitive screen. Each workstation has an interface so that all screens display the same information. Each person has a personalized telepointer. Collectively, the software tools are called Cognoter and include: brainstorming, grouping, and ordering. Ordering, for example, is achieved by pointing to a symbol on the screen and dragging the symbol into group buckets. Mermaid, at NEC Japan (Watabe, et al., 1990), is a distributed multiparty desktop conferencing system that allows real-time conferencing from the user's desk and includes voice, video, and multimedia documents. Capture Lab at the Center for Machine Intelligence in Michigan (Mantei, 1988) enables participants to gain access to a publicly shared screen by pressing a key on a workstation. SAMM (Software Aided Meeting Management) at the University of Minnesota (Zigurs, et al., 1988) is a menu-driven recording and problem-evaluation system. Although somewhat similar to GroupSystems, unlike GroupSystems, it operates without a facilitator.

2.4.2 Automating the design meeting

Broadly speaking, EMS addresses the generic business meeting. The problem area— the application— has received only cursory interest. A subset of computerized meeting support is systems geared towards supporting a particular task: the design task, particularly IS design. For this task, the system would need most, if not all, of the tools of a generic meeting plus specific tools to support design.

On one hand, the outlook for automating the design process is discouraging. Much research in the SE area points to the importance of behavioral issues and the small effect of tools and methods on the process (Walston and Felix, 1977; Boehm, 1981, 1987b).
Card, et al. (1987) stated that a collection of SE tools used in actual projects improved reliability by 30% and productivity by zero percent.

On the other hand, the IS community strives to automate itself and is generally optimistic about the results of its investment; witness the tremendous interest and investments in CASE. In what situations, then, do generic design meeting activities need computer support? Several research efforts have examined this question.

Perhaps the best known effort in automating design meetings is work within the Software Technology Program at MCC. MCC set up electronic meeting rooms with electronic blackboards and networked workstations. Ellis, et al. (1988) describes an experiment that compares experimental design meetings in the MCC electronic meeting rooms using a variety of treatments. The results showed that: gains were made in meeting effectiveness and quality, messaging capabilities increased equality, and the electronic blackboard helped the group to focus on completing the task at hand. More recent efforts at MCC are described in Ellis, et al. (1991). The Grove system focuses on a distributed (i.e., participants are not face-to-face) work environment with shared and private editors, and shared context presentation in a windowed environment. Usage issues and ergonomics are strongly tied into the architecture. For example, GROVE uses the cloudburst metaphor where all text is "aged" so that new text appears in bright blue and then gradually changes to black.

Though not strictly an approach to support the design meeting, work at the University of Oregon (Fickas, et. al. 1990) addresses a key design meeting problem: design meetings involve a great deal of conflict. Using the computer to resolve conflicts between planners, designers and negotiators is an area that has intrigued researchers for some time (cf. Sycara, 1988). Fickas and colleagues created a system for dialogue between the designer and the user which resolves conflicts through one of several means: dissolution (getting rid of the obstacle); compensation (the unsatisfied user); and case-based reasoning (looking up a similar case to find out what was decided). In reality, this
kind of prototype system, even using any of the resolution schemes mentioned, is still far from the robustness needed to resolve group conflicts within a typical JAD session because it lacks domain knowledge.

2.4.3 Automating the user design meeting--Electronic JAD

Although there are many common areas, JAD differs from the stereotypical or "classic" design meeting, such as the one studied at MCC, in several ways:

1. JAD introduces the special problem of bringing in non-designers (i.e., users) into the design process. This is the core of the systems analysis problem presented in Figure 1.1. This also introduces cognitive problems for untrained participants (see Appendix H).

2. Whereas the classic design meeting is democratic, JAD is a facilitated process, and not democratic.

3. The JAD methodology revolves around intensive meetings buffered by long periods of (user) inactivity.

4. The JAD structured meeting techniques tend to be specialized and regimented. Classic design meetings have no such techniques.

5. JAD meetings are often larger than the classic design meeting of three to five participants--frequently bringing together 10 to 15 users.

Automating JAD (i.e., E-JAD) is a very new field in which there has been no substantive research. Several concept papers have appeared recently: Nunamaker, et al. (1989a); Vogel and George (1991); Carmel and George (1991). The pilot study described in Appendix E is perhaps the first empirical research of JAD in an electronic environment.
2.5 Summary

Since E-JAD is a new idea, it is therefore not particularly surprising that there has been no research directly concerning it. However, there has been virtually no research on the topic of JAD. The referent fields have stayed in their respective corners: user involvement and software engineering. On the other hand, the study of meetings presents a stronger theoretical basis from which to proceed. The next chapter will examine some of the concepts needed to research automating the user design meeting, or E-JAD.
CHAPTER 3

FROM THEORY TO RESEARCH

This chapter takes up the methodological approaches to the research. It begins with a thorough discourse of the case/field study methodology used in this dissertation. It follows with a discussion of methodologies and measures in two referent fields: software engineering and meetings/electronic meetings. The chapter ends with the ten propositions to be investigated in this study.

3.1 The case study methodology

In order to answer the research question, several methodologies were considered and dismissed:

- An experimental approach was considered but suffered from ecological validity. Two issues were of concern: the experimental task, and creation of ad hoc groups of subjects playing the role of users. Some pilot experiments explored this approach and are described in Appendix E (note that Sections 3.2 and 3.3 discuss experimental work in the two referent fields: SE/SD and EMS).

- A quasi-experimental approach could have offered the benefit of control without compromising realism. IBM, a sponsor of this study, was approached with a plan for a quasi-experiment. The cornerstone of the approach was to replicate the early stages of the SDLC using three treatments: E-JAD, traditional JAD, and the traditional method of systems analysis (one-on-one interviews). In a large
organization with a large user base of fairly equal expertise, this proposal is doable, though expensive. The proposal was not accepted.

- A survey was rejected early in the process because the subject of interest—E-JAD—is new and largely unknown by a wide audience.

This dissertation uses a cross-section embedded field study methodology. Generically, this is referred to as a case study. JAD sessions are thought to be effective for systems and organizations in the large where large complex webs of issues and items exist that are represented by the people and the entities involved. The context and complexity are the core problems that JAD addresses and these factors need to be preserved in the research setting. The field study offers realism in context.

The case/field methodology deserves a careful overview of its history, advantages and disadvantages. The methodology must be discussed because the accepted model for conducting research in management is the natural science model (Lee, 1989). Natural science is an ideal on which social science (of which the study of management is a subset) is modeled. The basis of the natural science model, or the positivist research orientation, is the quantitative (and not qualitative) method. The case/field study methodology (the approach used in this dissertation) is qualitative and inductive in nature. The objection to qualitative research is that controlled observations cannot be made because numerous confounding influences exist that cannot be removed. In quantitative research, statistical controls are introduced in order to make controlled observations: to prove, or disprove a hypothesis.

In this context, the case study approach taken in this dissertation is explained below by: a) stating what it is not meant to accomplish, b) stating how it overcomes some methodological issues, and c) pointing to support for this methodology within the referent fields in question.
This study is a comparative field study: it does not set as a goal to build theory from qualitative research (Glaser and Strauss, 1967); nor does it attempt to consider a particular theory or set of theories as Lee (1989) posits for MIS case research (cf. Markus, 1983); nor is it intended primarily for exploratory research (although it does have exploratory purposes as a secondary objective).

Lee (1989) states four methodological problems with case studies and shows how Markus (1983) overcomes them. This is a useful framework for explaining how this dissertation overcomes these problems. The first has to do with making controlled observations: Lee suggests using natural controls. In this dissertation there are 11 cases of which five- or half- are essentially control cases—several more than Markus’ (although not of the same quality). The second problem has to do with making controlled deductions: Markus deduces several different predictions from three stated theories. In this dissertation, 10 propositions/predictions are developed from applicable theories. Third, is replicability. Markus’ study cannot be replicated. This dissertation has implicit replicability by “treatment” (the independent variable). Finally, a study must allow for generalizability. As Lee states, generalizability is no more or no less a problem in a lab experiment than in a case study.

The last part of the discussion of the case study examines the referent fields and finds fairly broad support for case/field studies. In both major referent domains, Software Engineering/Software Development (SE/SD) and EMS, the case methodology is becoming increasingly prevalent— as is evident by the survey of Sections 3.2 and 3.3. In parallel, a methodological discussion in other social science fields points to increased interest and acceptability: Bonoma (1985) in marketing, Jick (1974) in administrative sciences, Mintzberg (1979) in management, Yin (1989) in social sciences, and Miller and Freisen (1982) in management science. In the MIS area, besides Lee (1989) mentioned above, several articles about qualitative research received attention in the literature in recent years and these are reviewed in the following paragraphs.
1. Phenomenon is examined in a natural setting.
2. Data are collected by multiple means.
3. One or few entities (person, group, organization) are examined.
4. The complexity of the unit is studied intensively.
5. More suitable for exploration, classification, and hypothesis development stages of knowledge building. The investigator should have a receptive attitude towards exploration.
6. No experimental controls or manipulation are involved.
7. The investigator may not specify the set of independent and dependent variables in advance.
8. The results derived depend heavily on the integrative powers of the investigator.
9. Changes in site selection and data collection methods could take place as the investigator develops new hypotheses.
10. Useful for the study of how and why questions because these deal with operational links traced over time rather than with frequency.
11. The focus is on contemporary events.

Table 3.1: Key characteristics of case studies (from Benbasat, et al., 1987)

Benbasat et al. (1987) advocate use of case research for those areas in which theory and research are in their early formative stages, and for “sticky” practice-based problems where the experience of actors are important and context of action is critical. The article lists three reasons why case study research is viable for IS: 1) the researcher can study IS in a natural setting; 2) the researcher can ask “how” and “why” questions; 3) where there is little previous research. The paper summarizes a list of 11 characteristics of case studies presented in Table 3.1.

Swanson and Beath (1988) advocate use of the case study methodology in software management research. They emphasize that some software issues cannot be addressed in experimentation, e.g., the importance of collaboration among individuals in software development. They describe the methodology which they used (in their study of 12 organizations) in detail.

Kaplan and Duchon (1988) conducted a case study of IS implementation at a large hospital and describe their methodology—of combining qualitative and quantitative data—
in great detail. The data collection methods are similar to the one in this dissertation: a combination of quantitative (questionnaire) and qualitative (observations and interviews). The authors go through a very frank description of how the quantitative data served to explain the quantitative data and vice-versa.

Smith (1990) wrote the most outspoken of all of these articles in support of the case study in the IS field. He attacks excessive focus on positivist studies in management which have little to no external validity. He demands that case studies be used for more than just exploration research— for their validity depends, not on the presence of controls, but on how they are used and the logic of analysis.

3.1.1 When to measure?

Once the methodology is determined— here a field study— then the issue of length of study follows. By and large the length of study reduces to an issue of time and money constraints. As a rule of thumb in IS, the longer that the object is studied the better the understanding of its success/failure. Ideally, JAD should be studied in its natural setting, from the first initiation of the project, through development and well into operation. Measurements of various kinds should be taken throughout the SDLC in question. The JAD literature points out that JAD benefits manifest themselves well after the system is in place, when improvements are easier to make and the system is generally more responsive to the business needs. However, in practice, such a study is extremely costly in time and effort.

The JAD literature, with its practitioner orientation, does not deal with the question of length of study, with the exception of Guide (1986), which suggests two measurement milestones: immediately following the JAD session, and once the project has entered into the implementation phase of the SDLC. In the field of SE, longitudinal studies are treated with a great deal of respect— because of their rarity— and have a profound impact
on our knowledge of the entire field (e.g., Boehm, 1981; Basili and Weiss, 1984; and more recently Chmura, et al., 1990). Similarly, longitudinal studies have contributed to our understanding of SD (Franz and Robey, 1984; Markus, 1983). However, these studies were conducted in order to investigate theoretical perspectives, and not practical implementation issues— as this dissertation does.

Since longitudinal observations and long term data collection were deemed prohibitive, a way to partially overcome this problem is take “snapshots” of a number of projects. Since these “snapshots” have a random component, they cover the spectrum of time that could not be studied from beginning to end. This field study takes a slice of the SDLC on a cross-section of projects and examines the JAD session in-depth at that one narrow slice of time. The measures are collected immediately before (pre-session interviews), during (observations), and immediately after (interviews, questionnaire) JAD sessions, and lagged data were collected in follow-up conversations. This is discussed in greater detail in Chapter 4.

The chapter now moves to each of the two referent fields: SE/SD and EMS. Two methodological issues are dealt with in each of these sections: measurement approaches and establishment of case/field studies as accepted approaches.

3.2 Methodological issues in Software Engineering and Systems Development research

By and large Software Engineering/Systems Development (SE/SD) is still a field with a fairly small body of theory. As Bradley (1986) points out: the body of software engineering literature is almost totally descriptive, and “in at least 95% of experimental SE literature there is no stated theory.”

As a result of the absence of theory, research in SE/SD usually begins by positing
a question about what software related task is of interest. After all, this is a field with a strong application orientation. Researchers in the field are interested in prediction and causality, e.g., what technique can improve software? Improvement in software is usually measured as a reduction of errors. This leads to the issue of measures.

The problems in SE measurement are widely acknowledged. Most SE metrics measure source code attributes. While the domain of this dissertation is in measuring front-end processes, the focus of much of SE research has been on the latter stages of the SDLC: in design, programming, and maintenance. For example, Curtis (1980) discusses software complexity as the suggested focus for measurement and research. But such a research agenda focuses on the program itself and not on the process of defining it. The problem of lack of design measures was more recently encountered by Ramback (1990) who created his own set of measures for design processes that fit his needs for his research projects. He stresses that these measurements are architectural (and not algorithmic), but he concedes that "the creative natures of the design process means that many aspects cannot be formalized and consequently measured."

How does one measure or prove a good system? This is a question that the IS community has been struggling with for years. There has been some, mostly theoretical work, done on proving. In order to measure success of a particular methodology, one would have to see it through the entire life cycle or a good part of it to see if certain treatments that were done at the beginning of the life cycle, affect the latter stages. This, of course, is prohibitively expensive. It is also difficult to attribute causality. Boehm, et al. (1987) looked at an entire life cycle in their study of prototyping (1984), though the study was a semester-long controlled experiment with students subjects.

These factors have driven researchers in SE/SD to measure process factors and other items as surrogates for a successful system. Many studies have looked at self-reported measures of user satisfaction, administered through questionnaires. Other studies have measured productivity: how fast can the software be produced? Boehm (1987) wrote
that the best definition of productivity of a software development process is simply the total outputs produced in the development process divided by the inputs required to produce the output. He concedes that the major problem in using this simple formula is in defining outputs. Most often it is in lines of code (LOC). LOC, as a metric, has many problems (Boehm, 1981). More to the point from the perspective of this study, LOC cannot be used to measure output from JAD sessions in any reliable manner. In conclusion, SE/SD does not offer a well-beaten path to follow for studying JAD methodologies.

3.2.1 Field studies in SE/SD: methodology and measures

Surprisingly, very few studies have attempted to do any comparisons in vivo–in the field–without any controls. Considering the importance of the development process to the IS field this would seem perplexing. For years the literature–both trade and academic–have lamented about the SDLC problems. Then why are there not more studies? There are two reasons: First, that field studies (or even case studies) are extremely difficult and time consuming to do. Second, the methodological problem of measurement crops up (which was discussed above), namely, what is the dependent variable in such a study? There are no good measures for success. Table 3.2 summarizes major works in SE/SD case/field studies.

Several conclusions can be drawn from the data in the table. First, that there is no dominant approach within the case/field study methodology. Second, approaches tend to be domain- and problem-specific (meeting plots, analyzing defect sheets). This suggests that in SE/SD each problem area be examined in a fresh light.

A popular subset of field research in SE/SD is the single case study, typically examining one case in which the action research methodology (Mansell, 1991) is used. Two cases in areas similar to this dissertation are: Blomberg and Henderson (1990) and
<table>
<thead>
<tr>
<th>Study</th>
<th>Goal of study</th>
<th>Methodology &amp; data collection</th>
<th>Primary presentation of findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basili and Weiss (1981)</td>
<td>Evaluate new SE technologies and techniques</td>
<td>CRF analysis of requirements document</td>
<td>Histograms by various categories</td>
</tr>
<tr>
<td>Basili and Weiss (1984)</td>
<td>Evaluate new SE technologies and techniques</td>
<td>Analysis of CRF and interviews</td>
<td>Histograms by various categories</td>
</tr>
<tr>
<td>Franz and Robey (1984)</td>
<td>Test social theory of SD implementation</td>
<td>Longitudinal and ethnographic. Questionnaires, interviews and observations</td>
<td>Qualitative assessments</td>
</tr>
<tr>
<td>Hirschheim (1985)</td>
<td>Assess user involvement in SD.</td>
<td>Structured interviews</td>
<td>Qualitative assessments</td>
</tr>
<tr>
<td>Henderson (1987)</td>
<td>Assess cooperation in software design teams</td>
<td>Questionnaires; structured modeling methodology</td>
<td>Statistical analysis of questionnaire</td>
</tr>
<tr>
<td>Curtis, Krasner &amp; Iscoe (1988)</td>
<td>Behavioral issues in SD</td>
<td>Structured interviews</td>
<td>Qualitative assessments</td>
</tr>
<tr>
<td>Chmura, Norcio &amp; Wicinski (1990)</td>
<td>Understand system dynamics</td>
<td>Analysis of CRF and personnel data</td>
<td>Ratio data over the time axis</td>
</tr>
<tr>
<td>Olson and Olson (1990)</td>
<td>Investigate design meetings for support with IT</td>
<td>Analysis of meeting video tapes</td>
<td>Meeting plots</td>
</tr>
</tbody>
</table>

Table 3.2: Field studies in SE/SD. Note: CRF= Change Request Form
Daniels, et al. (1990). Each describe a case with which the authors were intimately involved and attempted to impose a new user-centered methodology. In both cases, the work is descriptive and no stated methodology was used.

3.2.2 Experimentation in SE/SD: methodology and measures

With all the practical difficulties in SE/SD field studies, why not address the issues with experiments? There are many problems with experimentation in SE/SD and particularly large scale systems development, the most important of which is external validity. Experimental subjects are often college sophomores and not professional programmers and designers (Schach, 1989). Additionally, there are external validity problems of generalizing from programming and design projects “in the small” to the real thorny problems of projects “in the large.” As Swanson and Beath (1988) point out, there are issues which lend themselves to classical experimental methodology, such as individual problem-solving. But (this author’s comment—) team development efforts generally do not.

Probably one of the most influential SE experiments— the Boehm, et al. (1984) study of prototyping versus specifications— had an average team effort of 2.7 person-months; this is hardly the size of a project that runs into snags as compared to efforts measured in hundreds or thousands of person-months. Schach (1989) suggests alternatives to controlled experiments. One of his suggestions is to collect field data on code rather than on human begins (e.g., Baily and Basili, 1981).

As with the topic of case/field studies, the SE/SD experimental research is surveyed here to highlight its characteristics and limitations. Experimental research in SE is reviewed in two important works: Curtis (1980), and (separately) Basili, et al. (1986). In Curtis the focus is on programming. Of the studies reviewed, seven looked at the domain of conditional statements and program comprehensions while four of them looked
at the domain of control flow of programs. In the survey of Basili, et al. (1986), a wider range of topics were reviewed: testing, debugging, program comprehension, maintenance, design techniques, software development approaches, and errors. This survey also classifies studies as being either single project, replicated project, multi-project variation or blocked subject project. Of the project-oriented studies intended to understand the software development methodologies— the topic of this dissertation— one was the Boehm, et al. study described above, and the other two were conducted by Basili and his colleagues with teams of three people each.

Experimental research in SD within the MIS field has not been summarized comprehensively. Some works which have appeared in major journals in the last few years are: Boland (1978) on the systems analyst interview style; Vitalari and Dickson (1983) on problem-solving abilities of good and bad analysts; De Brabander and Thiers (1984) on IS-user relations; Nosek and Schwartz (1988) on the relative success of several diagram methods; and Teng and Sethi (1990) on requirements elicitation.

In summary, there are three dominant paradigms in experiments in SE/SD. The first is the study of individual problem-solving skills— that of the person versus the problem. The second is the dyadic approach of one user versus one analyst (with the exception of De Brabander and Thiers, who used a graduate student to play the role of facilitator). Third, very few look at group or teamwork; the only such study mentioned has teams of three.

3.3 Methodological issues in meeting and electronic meeting research

While SE/SD is a field with a small body of theory, EMS benefits from utilizing a solid body of social science theory in the areas of group work, group dynamics and meetings. Researchers can begin their study with a theoretical question or with a practical question and be able to refer to a number of research frameworks such as McGrath (1984), Dennis,
et al. (1988), or more recently, Nunamaker, et al. (1991b); or Cook, et al. (1987), which is specific to collaborative work.

McGrath (1984), perhaps the definitive source on group research, lists the important questions in group research: problem-solving, developing consensus, resolving conflicts of viewpoint, resolving conflicts of interest, performance of tasks requiring generation of ideas, communication processes with the group, acquaintance processes, social interaction, intimacy, influence, and role patterns.

Meeting research is a subset of group research. In meeting research the questions have more of a practical flavor. In (business) meeting research one must first deal with the question of what to measure?; what is a successful meeting?; is it one that is short?; that meets all its objectives?; that creates "good" feelings among the members?; that nullifies the need for further meetings? Unfortunately, there are no definite answers to these questions.

A considerable body of work has been done in recent years in the area of studying electronic meetings in a variety of settings: both in the field and in controlled settings.

3.3.1 Field studies in electronic meetings: methodology and measures

Recent years have seen a marked increase in EMS field studies, most from researchers at the University of Arizona conducted on GroupSystems. At the time of this writing, several thousand GroupSystems sessions have been run at the University of Arizona, IBM and a few other sites— all providing a fertile ground for the study of this new technology and its efforts on a multitude of meeting types.

Some major recent studies include: The Burr Brown study (Dennis, et al., 1990a), which was a case of action research; the IBM study (Nunamaker, et al., 1989) which was an embedded case study examining 29 sessions, with different work groups; and
Carmel, et al. (1990) which was action research examining the particular domain of negotiations. A summary of 17 case studies conducted at the University of Arizona is presented in Dennis, et al. (1990b).

Dennis, et al. (1988) and Dennis, et al. (1990b) report two significant differences between experimental and field studies: The participants’ level of satisfaction was high in field studies with “real-world” supported groups, while participants’ level of satisfaction was not different in controlled settings of supported and non-supported groups. The users in field settings all rated EMS high in effectiveness as compared to the way things are usually done, while—again—the users’ assessment was not different in controlled settings of supported and non-supported groups. These strong differences are attributed to group size, task complexity, and motivation differences between in vitro and in vivo studies.

EMS case/field research has suffered from several methodological problems: in many cases the researchers are also involved in the process (action research); the researchers are advocates of the technology; finally, the instruments and measures vary from site to site and make comparisons difficult at best.

3.3.2 Experimentation in electronic meetings: methodology and measures

A comprehensive survey of experimental research in EMS can be found in Dennis, et al. (1988) and George, et al. (1990). Much of the EMS research has been experimental, although this has changed in the last few years. Generally, experiments have measured the following dependent variables: number of solutions, solution quality, decision speed, satisfaction, degree of consensus, participation, and non-task behaviors (such as inhibition and tension). Less frequently measured dependent variables are idea generation, number of comments/items generated in textual form, number of messages sent, and amount of verbal discussion. Most studies have compared variables in an EMS
environment to a control setup without an EMS.

In summary, because of measurement considerations, EMS experiments measure success of the meeting through partial operationalizations (e.g., number of alternatives advanced) or through the surrogates of process measures (e.g., equality of participation).

3.4 Constructs and their use

Once the methodological approach is determined—a cross-section field study—the issue of measurement comes up next. This section synthesizes research experience measures from a number of fields and a number of research methodologies.

The measurement approach in the domain of EMS was covered in Section 3.3. Research in EMS has been influenced by behavioral research methods in group work with a heavy emphasis on process measures. SE, on the other hand, is concerned with measure of product and efficiency (Riddle, 1984). The efficiency and product measures in this study derive largely from the SE approach. Combining the approaches of EMS and SE/SD yields the three variable groupings that will be used in this manuscript:

```
| Efficiency | Product | Process |
```

There are ten process constructs discussed in this section (see Figure 3.3). The EMS research constructs have been a dominant influence on determination of constructs and measures in this dissertation. Indeed, five of the process measures in this study stem directly or indirectly from past EMS research. Three other constructs are derived from issues that frequently appear in the JAD literature. The last two constructs have to do

1Efficiency can be viewed as a process measure but it is one with direct economic and not behavioral implications and will thus be grouped separately.
<table>
<thead>
<tr>
<th>Process construct</th>
<th>Primary influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity</td>
<td>•</td>
</tr>
<tr>
<td>Equality</td>
<td>•</td>
</tr>
<tr>
<td>Conflict</td>
<td>•</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>•</td>
</tr>
<tr>
<td>Bonding</td>
<td>•</td>
</tr>
<tr>
<td>Expectations</td>
<td>•</td>
</tr>
<tr>
<td>Structure</td>
<td>•</td>
</tr>
<tr>
<td>Mental model</td>
<td>•</td>
</tr>
<tr>
<td>Fit</td>
<td>•</td>
</tr>
<tr>
<td>Group size</td>
<td>•</td>
</tr>
</tbody>
</table>

Table 3.3: Theoretical influence of process constructs

with topics investigated in SE/SD in the context of user involvement in the development and design process.

The constructs are summarized and mapped back to the originally-stated SD problems in Table 3.4.

3.4.1 The efficiency construct

Some efficiency claims for JAD were shown in Table 2.1. However these are methodologically questionable and could not be verified. There are basically two measures of efficiency of interest in JAD sessions: efficient sessions in-and-of-themselves, and the effect of the JAD methodology on compressing the SOLC. The latter is—from an economic perspective—more important. Compressing the SDLC can be measured in two ways: in a controlled setting (an experiment such as Boehm, et al., 1984); or by comparing estimates to actuals. Both are problematic and will not be treated here further. Another way is to take an approach such as that of Card, et al. (1987) in which technology (including techniques and methodologies) is one of several dependent variables in a regression model of numerous projects.
Table 3.4: The SD problems and the related constructs in this study

<table>
<thead>
<tr>
<th>SD problem</th>
<th>Construct measured in this study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems analysis</td>
<td>mental model</td>
</tr>
<tr>
<td></td>
<td>completeness</td>
</tr>
<tr>
<td></td>
<td>conflict and conflict resolution</td>
</tr>
<tr>
<td>User Involvement</td>
<td>mental model</td>
</tr>
<tr>
<td></td>
<td>structure</td>
</tr>
<tr>
<td></td>
<td>expectations</td>
</tr>
<tr>
<td></td>
<td>satisfaction</td>
</tr>
<tr>
<td></td>
<td>IS-user relations</td>
</tr>
<tr>
<td></td>
<td>equality of participation</td>
</tr>
<tr>
<td>Need for innovation</td>
<td>creativity</td>
</tr>
<tr>
<td></td>
<td>equality of participation</td>
</tr>
<tr>
<td>Compressing life cycle time</td>
<td>efficiency</td>
</tr>
<tr>
<td>Fluctuating requirements</td>
<td>structure</td>
</tr>
<tr>
<td></td>
<td>conflict and conflict resolution</td>
</tr>
</tbody>
</table>

One is left with the measure of session efficiency which can make use of Boehm’s generic measure of productivity (the product divided by work effort). Boehm’s concept was used, for example, in Card, et al. (1987), where productivity is equal to thousands of lines of non-comment code divided by hours. When applying these concepts to a session, time and resources expended can be measured and can be compared across sessions. The output of a session is the product of the session: a certain number of requirements, a certain number of pages of descriptions, numbers of files and fields defined. In order to standardize these across applications, one has to use a methodology-free and technical-free measure of output. There is no such unit in IS or SE; the closest we come is a metric called Function Points (Dreger, 1989; Albrecht and Gaffney, 1983). One project compared the output— in Function Points— of an 8 hour day of JAD versus "traditional methods." JAD was found to be three times more efficient (EDP, 1986).

Function Points, though, are time-consuming and difficult to count; quite a bit of training is required to count them for even a simple system. Moreover, the logistical

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2In preparation for this dissertation— with the goal of measuring output— this author spent many hours going through FP exercises, which still leaves one at the novice level.
considerations dominated here: of 10 projects in this study, five were inaccessible or inappropriate (because of content) for FP analysis. Several of the remainder presented serious methodological questions as to the use of FP because the session in question was only a (small) subset of the sessions that would lead to a system. Hence, since none of the projects count FP, the decision was made to rely on self-reported measures of processes (further explained in Chapter 4). Output can be operationalized as business processes. One such effort, that measured output in these terms, is documented in Bates (1990), an internal IBM document that describes the efforts of one group to conduct JAD sessions integrated with the Knowledgeware CASE tool.

The other economic efficiency construct is that of the costs, both direct and indirect associated with the JAD session.

3.4.2 The product construct

The JAD literature claims that the end product of the JAD methodology is better—the resulting system is of higher quality. Guide (1986) lists several other tangible and intangible product benefits from JAD, e.g., there will be less system re-work and fewer changes after installation. As discussed above, product variables are difficult to implement for two reasons—the length of study and the causality— is it JAD or other factors which lead to a good or poor system? The product construct is measured here by completeness—the absence of omissions that lead to expensive rework and expensive errors. With JAD, the quality of the system is said to improve because the “synergism” of the group fosters completeness. Closely related, the group in the session is more likely to uncover redundancies and overlapping procedures. Completeness is one of C.F. Martin’s (1988) three components of good requirements (together with clarity and agreement). For requirements to be complete they must include everything: functional requirements, database requirements, performance requirements (e.g., responsiveness), hardware requirements, and much more.
There are numerous studies showing that it costs much less to derive the most complete and thorough requirements up front (cf. Boehm, 1981). Hence, some studies have examined the construct of completeness. Mantha (1987) examines, in a quasi-experimental setting, the nature of differences between two groups of professional systems analysts using two modeling techniques (data structure and data flow). His dependent variable was completeness. He compared the results of the two groups to a comprehensive model prepared by an expert. The designs were scored for attributes, and entity views. Another study was done by this author who conducted several pilot experiments of JAD sessions in the GroupSystems environment (described in detail in Appendix E). The one dependent variable used was completeness. A master list of "system requirements" was compared to that produced by the subject teams. Although this approach is generally objective, some problems with operationalization occurred. Ellis, et al. (1988) used completeness as a part of a quality scoring method in a controlled study, although no details are given.

In summary, short of a rigorous longitudinal study, or a controlled environment, there can be no objective measure of completeness. Hence, a subjective approach was taken from data gathered in the questionnaire, the interviews and observations.

3.4.3 The process constructs

Innovation and creativity

The users— the customers— are those who come up with most of the critical ideas that help the organization succeed. JAD sessions— particularly requirements sessions— are said to foster innovations, creativity and group synergism (Guide, 1986). Contrast JAD with prototyping: Cooprider and Henderson (1990) point out that prototyping is a convergent design method that overlooks important user needs. How does one measure creativity? Vitalari and Dickson (1983) found that the quality of an analyst could be explained by the
number of hypotheses, strategies and heuristics that s/he generated. A similar approach for JAD may be to count the number of issues created as a surrogate for hypothesis generation.

EMS studies have examined this aspect extensively, suggesting that process losses in group work that inhibit creativity (air time, attenuation blocking, concentration blocking, attention blocking, conformance pressure, and evaluation apprehension) may be overcome through use of EMS (cf. Connolly, et al, 1990). Operationalizations include counts of the number of solutions— as a surrogate for creativity— generated by the group (Dennis, et. al, 1988), however this operationalization is useful only for controlled studies. Connolly, et al. (1990) went one step further and operationalized creativity by rarity, quality of the item (assessed by outside experts), as well as number of solutions.

There are some complications in any such measurements in real settings. Are “blue sky” ideas (solutions) to be counted as being creative? Many ideas that are surfaced in JAD sessions are interesting but not doable, or even bizarre. In a controlled experiment these can be ignored. Furthermore, in normal verbal sessions, who is credited with the idea? the “assist”? the solution? It is often impossible to tell.

**Equality of participation, equality of influence**

Closely tied to the construct of creativity is the notion of equality of participation. The JAD group dynamics should foster openness to encourage greater breadth of input. While this is useful in idea-generation phases, such as planning and requirements, it might be counterproductive when detailed knowledge and expertise are needed.

EMS literature has pointed repeatedly to equality of participation as one of the main benefits of electronic meetings (Dennis, et al., 1988; George, et al., 1990)— and measures it often. In EMS this seems to stem from: anonymity, which decreases the threat of critical feedback to ideas (i.e., evaluation apprehension); and from parallel work, which
increases access capabilities (George, et al., 1990)

Closely tied to equality of participation is equality of influence. Franz and Robey found, in a case study of user-led design, that one particular user came to dominate the SD process to the detriment of others. Zigurs, et al. (1988) measured influence in an EMS relative to a non-EMS and found that influence distribution was more even in EMS. Zigurs, et al. operationalized influence by observer rankings and by coding computer and non-computer behavior. Influence was also examined by Henderson (1987) who operationalized influence by questionnaire data in which team members (in actual development teams) were asked to judge one another as to influence on each of five problem-solving stages. Watson, et al. (1988) measured influence in an EMS relative to two non-EMS treatments, and found no difference in influence in the three treatments.

Conflict, conflict resolution and consensus

Although conflict has a negative connotation in Anglo-Saxon culture, for group work this is not necessarily the case. Conflict can be seen as a way to generate stimuli that lead to creativity, which in turn leads to exploring issues in depth. Conflicts are therefore treated as "constructive" if managed properly (clearly, conflicts can also be destructive and disruptive to the process). One of the advantages of the JAD methodology over the traditional method is that the users—the peers—they themselves are said to resolve their differences instead of leaving it to analysts or an executive third party (Guide, 1986). The fundamental JAD techniques are said to be very effective in the conflict process sequence described in Figure 3.1 (the six steps are synthesized from the JAD literature).

Figure 3.1 suggests that JAD techniques support both divergence (i.e inducing conflict) and convergence (i.e., conflict resolution). This is the convergence-divergence dialectic of the meeting. The convergence-divergence dialectic is very difficult to manage properly. Robey and Farrow (1982) examined conflict and conflict resolution and
1. Creates an atmosphere that discovers conflicts of viewpoints and conflicts of interest.
2. Identifies the conflicts (or "issues" in JAD parlance).
3. Documents the conflicts.
4. Discusses alternative solutions.
5. Resolves the conflict (through consensus, impasse strategies, executive fiat, or voting).
6. Documents the resolution.

Figure 3.1: How JAD handles conflict

found that conflict may increase over time; as participants become more familiar, they are more likely to make critical comments.

Forsyth (1983) posits the following stages in group conflict: disagreement, confrontation, escalation, de-escalation, and resolution. Typical group research, according to McGrath (1984) looks at: agreement among group members, changes in aspects of members' judgment policies (viewpoint), trust, quality of solution, time to solution, evaluation of participants by their constituents, size of pay-off, number of trials (or moves), content/amount of subject communication, which coalitions form, and what outcomes they agree on.

EMS research has frequently measured consensus as a dependent variable and has shown that consensus is less likely with EMS (George, et al., 1990; Turoff and Hiltz 1982), that there is no difference (Watson, et al., 1988), or that more productive conflict management is achieved (Chidabaram, et al., 1990) A corollary to this question is whether E-JAD creates conflict rather than bringing out conflicts that already exist—which would be detrimental. On the other hand, if EMS merely draws out expressions of conflicts, then consensus should improve as the group recognizes their differences and act to resolve them.

How can conflicts be operationalized in a field setting? One possibility is to use the issues list that is generated in the session as a surrogate for number of conflicts. The
number of issues surfaced, resolved, left open, and the number of minority opinions can all be counted. When EMS are used it becomes more difficult in some ways to find conflicts and to determine who resolved them. EMS allows issues to be voted on and therefore the concordance index can be used to approximate disagreements.

**Satisfaction**

User satisfaction is the most commonly used measure for IS success and effectiveness; it is by far the most problematic methodologically. Melone (1990) discusses the use of satisfaction as a surrogate for effectiveness or success. She states that there is no articulated connection between the two. Melone also points out confounds between attitude and satisfaction.

There are many problems with the user satisfaction construct: is user satisfaction a surrogate for system success, or is it a causal variable analogous to expectations? The level of analysis is problematic— is satisfaction that of the subjective individual queried or of the system as a whole, or is satisfaction the sum of the individual parts? Satisfaction cannot be measured homogeneously across applications: satisfaction with a DSS is different from satisfaction with a transaction-processing system. Finally, and perhaps most important, for purposes of measuring a system under development: is satisfaction with the process a surrogate for future systems success? There are a number of instruments used for measuring system satisfaction (e.g., Bailey and Pearson, 1983; Doll and Torkzadeh, 1988), but all these instruments examine static, existing systems and therefore are not applicable to the examination of JAD sessions, where the systems do not yet exist.

Guide (1986) suggests two scales of satisfaction— that of users and that of management (presumably user management who are not participating in the session). EMS studies almost always include satisfaction as a dependent variable. EMS studies tend to
distinguish between satisfaction with the process and satisfaction with outcome (Dennis, et al., 1988).

IS-user relations and bonding

Traditionally, IS-user relations have been poor. The JAD literature claims that involvement improves relations between the users and IS. Rapport, or bonding is composed of several dimensions: trust, closeness, friendliness, and a mutual understanding of each side's culture and language. Bonding is thought to foster better productivity in teams.

The study of groups has advanced the construct of cohesiveness which refers to morale, or "spirit." The cohesiveness theory (cf. Back, 1951) has to led to the derivation that the greater the cohesiveness of the group, the greater the power of the group to influence its members. Two EMS experiments examined this construct: Galegher and Kraut (1990) found that non-computer mediated groups had more social interaction than those that were computer-mediated; and Chidabaram, et al., (1990) found that groups using EMS displayed greater inter-group cohesion. It should be noted, however, that both studies did not examine camps or coalitions within the group.

Expectations

The introduction of JAD, or any new technology/technique, could lead to increased user expectations of systems success. Implementation studies suggest that implementation failure is most likely when users hold unrealistic expectations about the system (Ginzberg, 1981). Ginzberg’s study found that users who hold realistic expectations prior to implementation are more satisfied with the system. One could postulate the converse: if user expectations are too low, cooperation and motivation level may be adversely affected. Hence, a balancing act is required in any JAD.
Structure, agenda, and discipline

JAD is a technique that emphasizes structure; it is a *structured* meeting with an agenda, objectives, rules and regulations. In the JAD literature, the adjective *structured* frequently qualifies the words methodology and session. The JAD literature points to this factor as one of the most important in bringing about a successful JAD session. As Doyle and Straus write about making an effective meeting, "clearly a good meeting needs structure and leadership." So, we proceed from this point, accepting the notion that the greater the structure, the better the meeting and the resultant system.

Watson, et al. (1988) find that the structure provided by either an EMS or a manual structured process enables the groups to find their initial level of agreement and build upon it to create post-meeting consensus. Hence it was the introduction of structure—and not EMS—that affected the consensus process. Watson, et al. indicate that there are no differences in outcomes between structured EMS and manual structured meetings. Therefore there is nothing to indicate whether one structured JAD approach is better than another structured approach. This is a key factor for JAD/E-JAD comparisons since both are *structured* techniques.

In practice, structure is not a binary variable, but a continuous one. Furthermore, there is no theory on how to operationalize the construct of structure. The operationalizations for structure used in this study are derived from the synonyms of structure in the JAD literature: agenda, documentation, procedures, set of steps, sequence, forms, documents, organized, rational process, top-down analysis, not as loose as participative design (Wood and Silver; August).

A useful theoretical model for examining the structure in meetings is introduced by Nunamaker, et al. (1991b). The Process-Task model is divided into task structure and process structure. The model appears in Table 3.5 with this author's additions of JAD examples. The model is made up of four components: process support is the use of
technology to support communication among group members; process structure is the use of process rules that systematically direct the pattern of discussion; task support is the provision and use of information or computation support; task structure is the use of a model, or a framework, to analyze a task.

Mental model

Do the users have a good mental model of the system which they have defined? Do they have a good feel for what the system will end up looking like? Jeffries, et al. (1980) describe studies in which the initial pass (the first cut) resulted in a representation of a simplified "solution model." Does an analogous process occur in JAD sessions? Do successive passes of discussion and decomposition refine the solution model—the system?

GroupSystems tools fit with task

Any technology that supports an SD, or organizational, process needs to be concerned with the match between technology and process—technology is the moderator between process and performance. Drazan and Ven de Ven (1985) state that researchers need to understand which patterns of process-technology linkages are internally consistent and effective.

In practice, traditional design artifacts are very flexible and, at the same time, limited in the tasks that they can support. The whiteboard, for example, makes it difficult to organize and edit information. Olson and Olson (1991) have observed that lists tend to end when the board runs out. By the same token, any computerized design tool has limitations and advantages.

Most studies to date have looked at EMS as a unitary, static piece of technology—all of which is quite far from the truth (the exception to the statement is the Easton
<table>
<thead>
<tr>
<th>General Examples</th>
<th>GroupSystems solution</th>
<th>JAD solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process support</strong></td>
<td>E-mail, Bulletin Boards communications, group memory, anonymity, parallel communications lists</td>
<td>most GrpSys. tools, EBS tool, most GrpSys. tools</td>
</tr>
<tr>
<td><strong>Process structure</strong></td>
<td>agenda, Nom. Grp. Tech. brainstorming, take turns, facilitator</td>
<td>tools sequence, EBS tool, facilitator</td>
</tr>
<tr>
<td><strong>Task support</strong></td>
<td>use of information documents on-line, keyword search, calculators, spreadsheets</td>
<td>FR tool</td>
</tr>
<tr>
<td><strong>Task structure</strong></td>
<td>classic DSS framework, math model, method of analysis, decision analysis, multi-criteria decision-making, SA methodology, cognitive mapping</td>
<td>GM tool, SA tool, AE tool, EA tool</td>
</tr>
</tbody>
</table>

et al. study discussed below). EMS are made up of a suite of tools which are used in different tasks—much like using a spreadsheet for the dissimilar tasks of creating a financial model, or for generating a mailing list. These are two very different tasks requiring two very different sets of features within the tool. Easton, et al. (1990) suggest that some of the findings in experiments in EMS result from a mismatch of the tool and the task. Therefore their experiment had two treatments with two sets of GroupSystems tools for the same task.

Assessing the quality of the task is tricky because it is not enough to ask “did you like using EBS?” Therefore a more appropriate measure of the tool is whether the tool fit the task, as in “did EBS fit the task of idea generation?” But since fit is a theoretical construct, it cannot be asked directly; instead a metaphor was created which is described in Chapter 4.

Group size

Group size is of interest as a blocking variable for two reasons: first, EMS research (Gallupe, et al., 1991, Dennis, et al., 1990c) has shown that larger groups exhibit greater success in EMS as measured by a variety of dependent variables (although—to qualify—these studies were done only for idea generation tasks using EBS). Second, from a practical point of view, if indeed E-JAD is successful for large groups and unsuccessful for small groups, then practitioners should be aware of this.

3.5 Propositions

This chapter has reviewed the overall approach, the field study methodology, and the constructs and variables of interest. It is now time to present the specific ten propositions to be tested in the field. The presentation structure, with its use of propositions, is useful
for focusing on constructs of interest in a field setting where the quantitative measures are not the predominant mode of analysis. The presentation structure and subsequent argument is influenced by the format used in an article on comparative software practices by Cusumano and Kemerer (1990). The authors derived seven propositions from the literature which they set out to “test.” As in this dissertation, such tests are not rigorous statistical tests because the sample size is too small, hence use of the term proposition.

First, a convention is introduced: since this study is fundamentally a comparative study between JAD sessions with and without electronic meeting systems support, then the two conditions are called E-JAD (electronic JAD) and T-JAD (traditional JAD). Therefore, whenever the term JAD appears with no prefix it is in the context of JAD rooms, JAD methodology, JAD techniques, etc., all of which can be used in either E-JAD or T-JAD.

Not all of the constructs are expressed as propositions because not all lend themselves to a meaningful comparison between E-JAD and T-JAD. The constructs not associated with propositions (e.g., the fit of tool to task) are grouped as “other variables” and are not discussed on a purely comparative basis.

The overarching proposition in this study is that E-JAD performs better than T-JAD for all dependent variables. The reasoning is as follows: an E-JAD session offers one more layer of tools without detracting from the existing set of tools, techniques, procedures and norms of T-JAD. The same participants are present, as is the same facilitator. Mathematically this can be represented as:

\[ x + k \geq x \]

where \( x \) is a generic JAD meeting and \( k \) is the addition of EMS tools.

And now to each proposition separately:

*Proposition 1: E-JAD sessions are more efficient than T-JAD sessions.*
Research has demonstrated mixed results in measuring EMS efficiency. Experimental research in EMS has shown that it takes longer to reach decisions with EMS (Steeb and Johnston, 1981; Gallupe, et al., 1988; George, et al., 1990; Gallup and McKeen, 1988; Siegel, et al., 1986). One may argue that the process that JAD participants go through is not the same as the rigid activity of "making a decision." On the other hand, EMS field research has shown increased efficiency in meetings: 51% in Nunamaker, et al. (1989b).

Efficiency is a function of more output per given resources, as was proposed by Boehm (1987). Hence the parallel processing power of E-JAD inherent in GroupSystems allows all participants to be working at the same time, while in a T-JAD session only one person at a time can be speaking while others listen. The parallel processing argument is powerful, and when combined with the field study results, points to advantages of E-JAD; hence the proposition.

*Proposition 2: There is no difference between E-JAD sessions and T-JAD sessions in terms of completeness of the output of the session.*

There are two opposing arguments regarding completeness. The first is that the ability inherent in E-JAD to do both parallel processing and to generate ideas allows a group of users to create a more complete set of requirements and specifications. That EMS work is prolific has been shown in Connolly, et al. (1990), as well as in the pilot study described in Appendix E.

On the other hand, the ability of the group to consolidate information in an electronic session and find the gaps in that body of information is still limited and hence the output may suffer on the dimension of completeness. Since none of these arguments dominate, the proposition is stated as no difference.

*Proposition 3: Innovation and creativity is higher in E-JAD sessions than in T-JAD sessions*
EMS studies have shown repeatedly (Connolly, et al., 1990; Gallupe, et al., 1988; Gallupe, et al., 1991) that in comparisons to traditional meetings, the number of ideas generated in an EMS is higher.

*Proposition 4:* *E-JAD sessions exhibit a higher degree of equality of participation and equality of influence.*

The EMS literature in this area is overwhelming: EMS equalizes participation and influence (Siegel, et al., 1986, Zigurs, et al., 1988, George, et al., 1990, Ellis, et al., 1988)—or at worst there is no difference (e.g., Watson, et al., 1988).

*Proposition 5:* *T-JAD sessions are better at identifying conflicts and resolving conflicts.*

There are some questions about E-JAD support for the various components of Figure 3.1. EMS is effective for divergence tasks (e.g. allowing the participants to explore and generate ideas), and weaker in convergence (i.e., EMS does not have a sure-fire mechanism for bringing everyone together at the end). Some studies have shown that there is less consensus with EMS than in traditional meetings (Turoff and Hiltz, 1982, George, et al., 1990), although Watson, et al. (1988) showed no difference.

E-JAD may dilute the powerful techniques of a JAD session in the area of conflict by losing the conflicts in a mountain of text. Even if the conflicts are all identified then there is no one tool (or set of tools) that can replace the verbal techniques of resolving the conflicts and bringing them to resolution, or “closure.” Therefore, it seems that there are too many question marks about E-JAD as compared to T-JAD.

*Proposition 6:* *User satisfaction is higher for E-JAD than for T-JAD.*

The EMS literature has shown more often than not that participants in electronic meetings exhibit a higher level of satisfaction than in traditional meetings (Steeb and Johnston, 1981; Dennis, et al., 1990a; Nunamaker, et al., 1987; Nunamaker, et al.,
1989b), although there are a few exceptions in experimental findings.

**Proposition 7:** There is no difference between E-JAD and T-JAD in building IS-user relations and bonding.

Many "positive" aspects of bonding, trust and the building of good IS-user relations are done in the casual chatting during breaks, or as a result of verbal rapport established during the session. Hence any reduction in verbal communications may lessen the establishment of bonds. Using EMS may create depersonalization—the separation of people from comments, which promotes deindividuation (Zimbardo, 1969).

On the other hand, EMS serve to deflate conflict in the negative sense. Many participants may be fearful of conflict, especially conflict with technical people. Hence channeling some of the conflicts into electric communications, anonymous or otherwise, may present the two camps in a better light. There have been no studies in the EMS field that examined this construct in any form. In light of insufficient evidence in either direction, the proposition of no difference is submitted.

**Proposition 8:** User expectations of system success are higher in E-JAD than in T-JAD.

The introduction of sophisticated "whiz-bang" implementation technology (EMS) would tend to raise expectations of the resulting system. Hence, it is anticipated that expectations about E-JAD are higher.

**Proposition 9:** There is no difference in degree of structure between T-JAD and E-JAD.

There are no sources—either in JAD or in EMS—that discuss which meeting types have a higher degree of structure.

**Proposition 10:** There is no difference between the mental models of the system that the users form in T-JAD or E-JAD sessions.
As discussed previously, we know little of what happens in this regard in JAD sessions and therefore the proposition of no difference is submitted.
CHAPTER 4

METHODOLOGY

With the theoretical foundations laid out in Chapters One through Three, this chapter presents the approach to the study. First, the eleven sessions in the study are described in order to understand the sample from which conclusions are later drawn. Next, the procedures of data collection are discussed in detail. Then, the measures for each variable are presented, both qualitatively and quantitatively. Finally, the instruments are described.

4.1 The field study

The embedded cross-section field study, or multiple-case study, was chosen as the methodological approach. Chapter Three discussed the reasoning for this choice in detail. Knowledge about the topic of JAD is limited. Therefore the approach needs to be descriptive and based on feedback from those who either practice or are subjected to JAD. Both qualitative and quantitative data were collected and complement each other and serve as a form of triangulation. Analysis of the data has a strong inductive flavor.

The unit of analysis is the session. Eleven sessions were studied in detail: five Traditional JAD (T-JAD) sessions and six Electronic JAD (E-JAD) sessions. The sessions took place at half a dozen organizations. All six E-JAD sessions used GroupSystems, but the specific tools, their order and duration varied from session to session. Facilitation also varied: some sessions had more than one facilitator; some sessions had experienced
facilitators, while others did not. The "subjects" in each of these sessions are the actual participants in the systems development processes that took place: the users, analysts, programmers, facilitators, and managers at each of the sites. The sessions make up a rich set of cases which includes background information about the organization, the project, the methods used, the participants, the task at hand and its significance in the overall SDLC.

4.1.1 The sessions in the sample

All organizations in this study were approached and persuaded to participate in the research effort. They agreed to be observed either because they were interested in the study, wished to get feedback from a neutral outsider, or, in the case of IBM, are involved in the research. With the exception of the IBM and Army sessions, the organizations were sent a two-page letter to explain the requirements for this research. In summary, the sample consists of organizations that had a project in the appropriate time window and chose to cooperate.

The sample is a convenience sample. Arizona sites were chosen for geographic proximity. IBM sites were chosen because of the firm's involvement in this study (although the projects investigated were "real projects" with no research interests per se). Finally, the Army sessions were conducted at the University of Arizona as part of an on-going relationship and the groups cooperated in research as part of the customary quid pro quo for using University facilities.

Diversity is a critical factor for generalizability (i.e., external validity). Although not perfectly representative of all sectors of the economy (as no sample with six organizations can be), the organizations studied were fairly diverse:

- Three are corporations, three are public-sector organizations.
<table>
<thead>
<tr>
<th>Organization</th>
<th>Department</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHX1 †</td>
<td>Municipality. 12000 employees.</td>
<td>End users= 11 currently using an off-the-shelf package</td>
</tr>
<tr>
<td>PHX2</td>
<td>Financing for commercial &amp; real estate development. Sales= $188 million. Subsidiary of Dial Corp, a conglomerate ranked 29th in Fortune-Diversified.</td>
<td>Taxes for loans and leases. Cost of entire new system= $4 million, including overhaul of most internal systems. Current system= 872 programs.</td>
</tr>
<tr>
<td>GFC-TAX †</td>
<td>Top executives. Approx 30 end users.</td>
<td></td>
</tr>
<tr>
<td>TUSD</td>
<td>School district. 7000 employees in 118 locations. Personnel department. End users= 21. Indirect end users= 400</td>
<td>N/A</td>
</tr>
<tr>
<td>MCD</td>
<td>Manufacturing. 25th in Fortune 500. Cost Accounting</td>
<td>Enhancements to existing system</td>
</tr>
<tr>
<td>IBM-DB †</td>
<td>Computer manufacturing and services. 30 end users</td>
<td>Data Administration. New methodology. Cost is less than $100000.</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Financial processing. Effects approximately 40000 user indirectly</td>
<td>Re-engineering of current process which runs on three IBM 3090s</td>
</tr>
<tr>
<td>IBM-MPI</td>
<td>US Marketing and Sales. 2,300 users have clearance to use the system.</td>
<td>Enhancements to existing system which currently has 565 modules.</td>
</tr>
<tr>
<td>ARMY-T †</td>
<td>One million “employees” at 180 sites</td>
<td>Effects 8,100 end users. Current system has 22000 LOC. New system est. 44000 LOC. Est. cost well over $1 million</td>
</tr>
<tr>
<td>ARMY-M</td>
<td></td>
<td>No current system.</td>
</tr>
</tbody>
</table>

Table 4.1: Organization demographics
† Information is consolidated for same organization, department, or project.
Figure 4.1: Timeline of sessions in the SDLC
Table 4.2: Overall session information

- All three corporations are large: either on the lists of Fortune 100-Industry, or Fortune 100-Diversified.
- The sites were in three states: Arizona, Maryland and Texas.

Background information on demographics is presented in Table 4.1; on each session in Table 4.2; on participant statistics in Table 4.3; on participant averages in Table 4.4; and each session is placed on the SDLC timeline in Figure 4.1.

A description of the pertinent background information and milieu at each session is presented below. A few notes on notation conventions are in order. The abbreviated bold face names are the mnemonics that will be used throughout the rest of this manuscript in tables and text. The order of the eleven sessions is also preserved throughout: beginning with the five T-JAD sessions and proceeding with the six E-JAD sessions.
Traditional JADs

PHX1 T-JAD The city of Phoenix is one of the fastest growing metro areas in the USA. In 1989, the municipality of the City of Phoenix received the proceeds of a voter-approved bond issue to purchase advanced technology for its MIS department. Some of the money went into new workstations and CASE tools. The first "showcase" project in this effort is the "assessment" project, a small low risk application that is geared to be done within less than a year from initiation. Both JAD and CASE are novelties for the MIS Department. Facilitation in the JAD sessions was conducted by an experienced IS staff person who was trained by IBM and James Martin Associates. However, these were his first JAD sessions. In addition, he was "wearing two hats:" he was both a process leader and systems developer. The user department in question is small. Three users came to a series of several dozen JAD sessions stretching from October 1990 through the Spring of 1991. The setting was a conference room of the City of Phoenix MIS Department equipped with several PCs, whiteboards and projectors. The first session observed focused on high-level process descriptions.

PHX2 T-JAD The second City of Phoenix session observed took place two months later, as the design progressed. In this session the focus was on screen design. The participants attending were exactly the same as in the first session.

GFC-TAX T-JAD A mid-size financial institution based in Phoenix, Greyhound Financial Corporation is a subsidiary of Dial Corp, a publicly traded conglomerate that specializes in lending and real estate. GFC is in the process of overhauling its entire IS shop. In order to undertake this large project, GFC hired several consultants from a large accounting firm, bought a new minicomputer system, and new software such as the Synon CASE tool. Eighteen "modules" were targeted for significant re-writes, which together represent a significant portion of the IS portfolio. New tools and techniques
Table 4.3: Participant statistics. Support in the facilitation column denotes someone not from IS whose sole purpose was to support process; Facil in the staff column denotes that the facilitator is from the IS staff; the questionnaire column denotes total surveys completed, and of those, how many were completed by non-users.

were introduced including an informal version of JAD. The tax module was one of the smaller modules and targeted to be the first to reach a sign-off. The session attended was a requirements sign-off which was not— in the end— signed-off. The entire user community of 6 users attended. The facilitator was the lead analyst on the module. The setting was a comfortable executive conference room on one of the top floors of the Greyhound Tower.

**TUSD T-JAD** Tucson Unified School District is the largest school district in the Tucson metro area with 7000 employees in a district that has grown very rapidly in the 1980s. There have been several attempts to improve the Personnel System over the last few years, with mixed results. This time the district turned to IBM, who invited almost the entire Personnel Department to a comfortable conference room at the IBM offices to conduct a week-long JAD for requirements. The facilitator was a trained IBM JAD facilitator.
Table 4.4: Average participant statistics by independent variable

<table>
<thead>
<tr>
<th></th>
<th>T-JAD</th>
<th>E-JAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total participants</td>
<td>8.2</td>
<td>18.0</td>
</tr>
<tr>
<td>Users</td>
<td>4.8</td>
<td>13.6</td>
</tr>
<tr>
<td>Questionnaires completed</td>
<td>4.8</td>
<td>12.7</td>
</tr>
</tbody>
</table>

MCD T-JAD  McDonnell Douglas Helicopter Division in Mesa (Arizona) supports almost all helicopter design and manufacturing personnel. One of the largest headaches for a defense contractor is the cost accounting system. The MAV (Material At Vendor) system was modified several times in the last few years and is now going through a larger scale modification effort to comply with DOD requirements. One of the MIS managers recently began training his people in JAD techniques in an effort to improve the systems development effort. The session observed was one of a number of sessions running from January through May 1991. This session was facilitated by a McDonnell Douglas IS systems analyst. The setting was an MIS conference room with whiteboards. The meeting centered on discussion of two alternatives for a key part of the module.

Electronic JADs

IBM-DB E-JAD  IBM’s internal business systems are constantly undergoing renewal. All three IBM sessions listed here are E-JAD sessions for distinct parts of these efforts, though managed by different people. The first was a gathering of DBAs to develop a new methodology for Data Administration. The facilitator was a very experienced IBM JAD facilitator. The participants in this case were systems people, or what would commonly be referred to as “techies,” not the typical user. The session was partially facilitated by the lead user. The session was held in one of IBM’s most impressive electronic meeting rooms, in Dallas, Texas.
This session was actually a series of E-JAD meetings conducted at IBM's Decision Support Center in Bethesda, Maryland, using GroupSystems. The questionnaire was administered after 10 half-day sessions that took place over the course of 1.5 months.

The meetings dealt with a business re-engineering task. Of IBM's central support functions for its Marketing and Sales group, leasing activities were chosen to be re-engineered with the help of GroupSystems. This was not design of a system per se, but rather of a set of organizational processes. As in the IBM-DB session, this was not a case of "IS versus users." The facilitator was a trained GroupSystems leader who had no experience in JAD-like techniques.

The data for this site consist primarily of the questionnaire, as this was the only site that the author did not observe first-hand. Some interviews were conducted with the facilitator, but no qualitative data are used for analysis. (Note: Many observations made about the 11 cases do not include this site, unless specifically noted.)

The setting for the session was the IBM Decision Support Center in Bethesda, Maryland. The Master Product Inventory System (MPI) is one subsystem in the mammoth IBM internal inventory and marketing system. It is a mature system with many users that is constantly going through update phases. This update is the most extensive in some years. The usability lab at IBM Bethesda was pushing to improve screen design and other human-computer interface aspects of MPI. The JAD session revolved around screen review and discussion. Users came in from all over the country. The facilitator was an experienced IBM-trained GroupSystems meeting leader.

The final (and for many the most interesting) module to define at GFC (see full description above, under GFC-TAX), was the Management Reporting (MR) module. The MR module is to have some features of a typical Executive Information
System. The entire top three levels, including the Chief Executive Officer, came to this E-JAD. The session was held at the Scottsdale (Arizona) electronic meeting room. The GroupSystems process facilitator for this session was a trained UA GroupSystems facilitator. Some of the tasks were introduced by the Director of MIS and one of the project leaders. Neither of the three have had any JAD-like training.

ARMY-TRAVISS E-JAD One of the only non-combat projects to get continued funding during the Gulf War was the US Army's Installation System Management (ISM) project, which is intended to introduce standardization and a high degree of automation to the US Army logistic support. The ISM project is divided up into 18 modules. These are large-scale standard systems that will be installed at every Army installation (i.e., every fort and base). Some work on non-related ISMs had already been done in several JAD-like sessions that were conducted at the University of Arizona's electronic meeting room in the spring and summer of 1990. As in the previous sessions at the UA, users were flown in from a number of installations nationwide. The facilitator was a trained GroupSystems leader, but not one trained in JAD-like techniques. A draft of the requirements document for the TRAVISS module was already prepared and the group was tasked with completing it.

ARMY-MASCHACT E-JAD This session was another one of the Army's “ISMs” (see above), this time, for a smaller scale system: Master Scheduling. This session had two facilitators, a trained JAD facilitator and the trained GroupSystems leader, who cooperatively ran the session together. As in the TRAVISS session, the group was tasked with completing a requirements document. Some of the users in this group had been through a rapid prototyping session for MASCHACT in the week prior to the session.
4.2 The procedures

The procedure described in this section is generic and varied somewhat for individual cases. Material differences are noted here or in the case descriptions.

Coordinating the visit. The process of coordinating the visit was often a lengthy one and careful notes were taken about background information. Early on, a contact person, who was always either a lead analyst or facilitator, or both, established himself. The date of the visit was a subject of negotiation and compromise.

I actively solicited firms to cooperate in this research. This resulted in an estimated 500 phone calls made to organizations in the state of Arizona—to almost every major organization in the state. The GFC, McDonnell Douglas, TUSD and City of Phoenix sites were identified this way. The IBM cases became available through prior research cooperation with IBM. The Army cases resulted from prior relationships with the University. The by-product of the many phone calls is an informal survey into the state of JAD in the state of Arizona, which is summarized in Appendix D.

Once the date for the visit neared, phone interviews were arranged with two key people in the session. Table 4.5 summarizes statistics of all interviews conducted for this study. During the phone interview, careful notes were taken, and then the interview was typed. The interviews were conducted from an “interview schedule” of pre-defined questions (see Appendix G). In general, the pre-session questions were geared towards background information about the project and the people, as well as getting data on some of the dependent measures.

During the visit I would generally sit in the back of the meeting room, take out some papers and a pen, and I would be writing much of the time. I did not feel at any meeting that my presence was changing the behavior of the meeting. In some meetings I was not the only observer. I also collected all documents, handouts and memos that I
I would actively seek conversations with participants of the meeting and use the summaries of these chats as data in my observations. Table 4.5 also indicates a relative scale of these informal sources. In general, the more informal conversations I had, the deeper my understanding of the session was.

At the end of a session a questionnaire was distributed to the participants. This is described in greater detail in the following sections.

Post-session interviews were conducted on site or in a follow-up phone conversation. In on-site interviews I often made use of a pocket audio-recorder for convenience, after asking permission. I had no reason to believe that the recorder inhibited the interviewees in any of the interviews. There was never an instance of someone saying: "please turn off the recorder."

Immediate summaries were made at night after the session. I would write a 3-7 page summary of the session in typed form, while my impressions were still fresh. These summaries were invaluable, when several months later I began writing this dissertation.

Table 4.5: Interviews and other observations

<table>
<thead>
<tr>
<th>Session</th>
<th>Pre-Session</th>
<th>Post-Session</th>
<th>Follow-up</th>
<th>Total</th>
<th>Casual conversations</th>
<th>Observed planning meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHX1 T-JAD</td>
<td>2</td>
<td>2</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHX2 T-JAD</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GFC-TAX T-JAD</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUSD T-JAD</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCD T-JAD</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM-DB E-JAD</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>medium</td>
<td></td>
</tr>
<tr>
<td>IBM-L E-JAD</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM-MPI E-JAD</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>medium</td>
<td></td>
</tr>
<tr>
<td>GFC-MR E-JAD</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>medium</td>
<td></td>
</tr>
<tr>
<td>ARMY-T E-JAD</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>ARMY-M E-JAD</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>high</td>
<td></td>
</tr>
</tbody>
</table>
Follow-up phone conversations were conducted with most sites on an ad-hoc basis. Additionally, one last round of calls was made as this document was nearing completion. These were made to the lead analyst of the project to ask some qualitative questions.

4.3 The variables

The variables are guides to an understanding of the T-JAD and E-JAD process.

4.3.1 Independent variable

The existence, or the absence, of the (GroupSystems) electronic meeting system is the treatment in the field study. The variable is a binary variable. Six of the sessions were conducted in electronic meeting rooms and five were not.

4.3.2 Dependent variables and their operationalization

There are three dependent variable groupings: efficiency, product and process. Each of these is operationalized as described below.

Efficiency is measured by output quantity over time invested. The output figures—measured in processes are taken from either: observations (four cases); follow-up with the lead analyst (two cases); or in the case of GroupSystems sessions, some output measures were taken from the GroupSystems output (two cases). For example, the ARMY-TRAVISS session produced 90 medium- and low-level processes (including the high level processes here would have been double-counting). The times spent on the activities in question were taken from the session notes.
**Product** is operationalized by *completeness* as assessed by three measures: questionnaire item number 7 (Completeness); by post-session questions; and this author’s observations. Several questions in the post-session interview schedule probed at the notion of completeness, including asking the respondent to rate “the completeness of the output” on a scale of one-to-ten.

**Process** was divided up into eight constructs:

*Innovation and creativity.* Qualitatively, this was gathered on both a structured and an opportunistic basis from both interviews and observations. There were a few E-JAD sessions involving idea generation that allowed for some analysis of output. The creativity index, derived from the questionnaire, measures user assessment of this construct.

*Equality of participation and influence.* Qualitatively, this was gathered on both a structured and an opportunistic basis from both interviews and observations. In addition, a “speaking table” was used (see detailed description under “instruments”), which is an empirical tool. Speaking tables were gathered in six sessions. Questions 32 to 34 (INFLUENCE1, INFLUENCE2, INFLUENCE3) dealt with equality of participation and influence.

*Conflict and Conflict Resolution.* Qualitatively, this was gathered on both a structured and an opportunistic basis from both interviews and observations. Conflicts and disagreements are treated synonymously here. In JAD the term *issue* can serve as a surrogate for conflict. An *issue* is a topic that has no resolution for some reason (often because no one in the room knows the answer). Issues lists, as described in Chapter Three, are a major component of the JAD technique. In several sessions, issues lists were either created, maintained, discussed, or resolved (or all of the above) by the group in a formal way. These activities, or sometimes lack thereof, are part of the qualitative study of conflict. In several sessions, issues were tracked by the author in a special table
described further under "instruments." Questions 28 through 32 deal with the topic of conflict and resolution. The first two questions were combined into an index of "contentiousness" while the other two questions are called CONFLICT1 and CONFLICT2.

Satisfaction was measured in Questions 20 through 24. The questions dealt with satisfaction: overall, with GroupSystems, with facilitation, with the product, and with the agenda.

IS-user relations and bonding was measured in Questions 14 through 19. Questions 14 through 17 were combined into the bonding index. Questions 18 and 19 were intended for the IS professionals and were dropped. Additionally, some observational notes were made.

Expectations were measured strictly using Questions 5 and 6, which were combined into the expectations index.

Structure, agenda, discipline and the JAD index. Qualitatively this construct was derived from seven sources: first, the existence of an agenda and adherence to it (although changing the agenda is not apriori an indication of failure); second, post-session interviews in which the interviewees had to assess structure both qualitatively and quantitatively (on a three-point scale); third, documentation discipline, which included observations about what was being captured and what lists were being maintained; fourth, meeting time utilization, which was an empirical aggregation of actual work time (meeting time utilization was composed of categorizations of meeting tasks. Overhead activities, as in Olson and Olson (1991), were defined to include introductions, speeches, training, tangents, scheduling and planning activities. These were aggregated separately); fifth, the Process-Task model (introduced in Chapter 3); sixth, the JAD index was created (see description in Section 4.4) which includes structure measures as well as other related measures; seventh, in addition to qualitative data, Questions 27 (structure) and 39 (time utilization) dealt with structure. Question 23 (satisfaction with agenda) was also used to
triangulate user perception of agenda.

_User mental models_ were measured in Questions 8 through 12. Questions 9, 11 and 12 were combined into the MENTAL-MODEL index. Question 8 is referred to as MMB—mental model before the session began. Question 10 was dropped. It was useful to compare MMB to the mental model index, as the MMB indicated the state of user mental models before the session, and the index indicated their state after the session. If the index was smaller than the MMB, it was interpreted as suggesting confusion. If the index was larger than the MMB, it was interpreted as suggesting an effective session.

### 4.3.3 Other variables

Several additional variables were tracked:

*GroupSystems tools used and fit with task.* Fit of tool and task was operationalized by questions which were tailored to each session (Question 42). For each session, identifiable tasks were listed in the questionnaire as shown below:

Suppose that you need to pound a one-inch nail into a wooden beam. To do this you have to choose from several tools. You would like to choose the best one.

1. a piece of cardboard it clearly does not work
2. a hardcover book its awkward, very slow and breaks down
3. frying pan not elegant but gets the job done
4. small one-pound hammer the right tool, but not the right size
5. larger three-pound hammer the perfect tool

Using the above analogy, how well did the highlighted tool assist in doing the task?

- Task 1 with tool alpha
- Task 2 with tool beta
- Task 3 with tool gamma
- Task 4 with tool delta
- Task 5 with tool epsilon
The hammer metaphor has already been used and validated in several other studies of EMS (cf. Herniter, 1991). The fit questions allowed for a detailed analysis of individual tasks in each session.

*Session objectives and success of the session* were measured qualitatively from interviews and observations.

*Planning, preparation and follow-up* was assessed qualitatively from interviews, observations, and memorandums. Questions 35 to 38 dealt with various aspects of this topic, but Questions 35 and 36 were assessed to be unreliable.

*Cost of sessions*. Cost figures were derived from conversations with participants at the sites and from estimates.

*Group size* was easily determined from observation.

### 4.3.4 Blocking variables

Demographic information about the project, the organization or the environment can serve as blocking variables to inspect issues that appear and are not predicted. Kling (1982) proposes that software development be sliced into several behavioral levels: the individual, team, project, company, and business milieu. This dissertation examines particularly the team and project variables (in one slice of time). Several types of data were collected for the organization and business milieu levels. Data on individuals were collected on a purely opportunistic basis. Organizational data were collected primarily through pre-session interviews, and to a lesser extent, from informal conversations with participants. A few items were derived from economic and financial sources (e.g., volume of sales).
Questionnaire statistics were run on SPSS (a statistical analysis package). The eleven (slightly different) questionnaires were transformed into one master set of data, by re-ordering the questions to a master format, as it appears in Appendix F.

The questionnaire data are somewhat unusual in that they are implicitly both an individualized set of data and a session set of data. The sum of the individual data is of little interest, but having the individual data allowed me to perform a number of improvements on analysis, such as removing all IS respondents from the data for most analyses, as explained further below.

Analysis of the questionnaire data was done in four principal stages: 1) index building and reliability testing; 2) session analysis; 3) independent variable analysis; 4) fit analysis. Each stage is explained in detail:

1. The questions which sought to measure the same construct were combined into indices and tested for reliability. Not all tests were successful. The questions combined into indices all had Cronbach alphas greater than 0.6 (See Table 4.6). The table shows that five indices were created to measure constructs of interest.

2. The data were summarized by session (see the 22 tables beginning with Table A.2). The average, standard deviation, number of respondents and missing value count were summarized for each measure in each session.

<table>
<thead>
<tr>
<th>Index</th>
<th>Question Numbers</th>
<th>Cronbach's Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations</td>
<td>5,6</td>
<td>0.6108</td>
</tr>
<tr>
<td>Mental-model</td>
<td>9,11,12</td>
<td>0.7479</td>
</tr>
<tr>
<td>Bonding</td>
<td>14,15,16,17</td>
<td>0.7687</td>
</tr>
<tr>
<td>Creativity</td>
<td>25,26</td>
<td>0.7381</td>
</tr>
<tr>
<td>Contentiousness</td>
<td>28,29</td>
<td>0.6085</td>
</tr>
</tbody>
</table>

Table 4.6: Reliability tests on indices; Cronbach's Alpha

4.3.5 Statistical analysis
Both session data and individual data excluded the respondents who answered the questionnaire and were not "users." This means that nine respondents were taken out of the pool of cases and analyzed separately. In other words the main body of analysis from the questionnaire cases does not include the IS personnel. The reasoning is that not all sessions included IS personnel who participated and filled out questionnaires. It was presumed that IS personnel may differ in their answers from the users in a T-JAD/E-JAD session. It was feared that IS personnel, who are interested parties, might answer in a self-serving way. For example, in one session an involved IS person painted a glowing picture of the session completely at odds with what the users seemed to think. Yet, by and large, the IS participants did not differ greatly from the user averages, although they tended to be, generally speaking, on the more "positive side," with the exception of the ARMY-TRA VISS session, where the opposite was true.

3. Once all the measures were computed per session, then the averages of these measures were taken for each of the two independent variables. Hence, generally speaking, measures of T-JAD sessions are derived from five data points and measures for E-JAD sessions are derived from six data points. The summary statistics are displayed in Table 5.1.

Difference tests (Mann Whitney/ Wilcoxon non-parametric tests) were run on all of the measures: all failed due to the small sample size. Yet the differences between the E-JAD and T-JAD figures in Table 5.1 are critical to the findings, and therefore some "test" was needed to decide what differences are meaningful. It was determined upon inspection of the results, that a "reasonable significant difference threshold" is 7.5% which translates into a delta of 0.30 on a range that is 4.0 units (most questions have a five-point scale and hence the range of extremes is 4.0). Most differences turned out to be smaller than this threshold and hence failed the "test." For example, inspection of Table 5.1 indicates that the first measure, completeness, exceeds the threshold, while

\[1\text{There is one exception: The McD case had four respondents, only one of which can be classified as a "pure" user. It was decided to use three out of the four respondents, excluding the facilitator.}\]
the second measure, creativity, does not.

4. Fit data are that which deals with the fit of tasks to tool in the sessions. In each session, different tasks were executed using different tools. The averages were computed for each session (Table 5.10 and 5.11) and then were aggregated further into groupings: by tool (Table 5.12), by session (Table 5.13), and by task type (Table 5.14).

4.4 The instruments

Several data collection instruments are used in each case. This provides several benefits. First, a richer set of data are collected about each session in both qualitative and quantitative form. Second, triangulation is provided in that several sources are measuring the same construct, and hence contributing to data reliability and validity (Swanson and Beath, 1987). For example, interview data both validate and are validated by the results of the questionnaire—which has a larger pool of respondents and benefits from anonymity.

Interviews The interview questions were generated from the list of constructs of interest. Questions were all open-ended. Wording of each question, which was presented verbally, changed slightly depending on the prior questions, intimacy and appropriateness. Some of the interviews were administered over the phone. In all, this study generated dozens of pages of interview notes. For each case, the goal was to interview, both before and after the session, at least two of the following: the facilitator, the principal user, and the IS person in charge. As Table 4.5 indicates, this was achieved in most cases.

Interview bias is a concern in this type of study. Warwick and Lininger (1975) warn of four interviewing biases, which were handled as follows: first, rephrasing questions was considered acceptable because data were not quantitative; second, several interviews
(rather than just one) were conducted (in most cases) with the same set of questions, resulting in another layer of triangulation; third, tape-recording and careful note-taking reduced data recording bias; fourth, motivating participants to speak was quite easy.

In interviews I tried to volunteer little information or impressions in order not to bias the interviewee. But occasionally I would, as part of conversation, respond with an observation or anecdote. I was very careful about this and used this method to draw out information.

The interviewees are also likely to exhibit interview bias. There were two types of bias of concern: social desirability bias (when interviewees construct answers to conform to norms of their professional group); and self-presentation bias (when interviewees describe their role in a more favorable light than was the case). Both of these biases were evident in numerous interviews, as is expected in any subjective evaluation, including a questionnaire. It is not surprising that a session leader, who has been involved in a project for weeks and often has his professional career assessed based on its success, will not find many weaknesses in what took place. The self-serving answers were probed further. Ultimately self-serving answers were discounted in the final assessments as a result of data gathered from other interviews and observations. This is where the power of the case study surfaces: bias is not treated as data.

Observations are those of the author (except for the IBM-Lease case, where the data are from the UA facilitator who ran the sessions). These include impressions and discussions with participants both during the meeting and outside of it. Observations were summarized immediately after the sessions. In all, the study generated approximately 100 pages of “raw” notes. Three specialized data collection instruments were used in the sessions:

Timetable of activities was a very useful instrument. Each activity was classified by a variety of categories. One particularly useful category is overhead, which includes:
introductory speeches, coordination activities, plans for the next step, and training (e.g., on GroupSystems). In general, most events and impressions were recorded next to a time stamp. These notes then provided all time data, activity data and chronologies.

*Speaking table.* Every four minutes during the session, when the second hand hit the top of the cycle, I would record who was speaking. Over the course of a meeting, a large number of such notations were collected and represent a good sample of who were the active participants. I was careful to record only at the top of the clock cycle, so as to avoid bias. Since I often was concentrating on other activities, not all recordings were four minutes apart and occasionally missed by a few minutes. Since these errors tend to be random, this was not judged to be of concern.

Several conventions were used in this process, based on context. In one session when GroupSystems was in use, it was marked as the “speaker;” when there were more than one person speaking, then all were noted and then in the aggregate, each of them received a fraction of a point. In one session where the group would often watch as the facilitator wrote on the board, this was marked as the facilitator speaking, since he had the floor, “so to speak.”

A summary of the speaking notations results is presented in Table 5.5. In all, speaking tables were employed in six out of the 11 sessions.

*Issues table* was used in three sessions and proved a useful but difficult tool. Any issue that came up which served as a source of disagreement was recorded, as was the initiator of that issue. Later, the resolution and who resolved it was also noted. Some of these notations supported summaries for conflict and participation variables. However, there were difficulties in identifying who exactly brought up an issue, and who resolved it. Usually, there is no clear indication during discussion that, say, “now issue number 754 is about to begin.” Because of these difficulties the issues tables were incomplete for even the shortest session. In one E-JAD session a similar technique was used to
Table 4.7: Questionnaire delivery media type

<table>
<thead>
<tr>
<th>Session</th>
<th>Media type</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHX1 T-JAD</td>
<td>diskette</td>
</tr>
<tr>
<td>PHX2 T-JAD</td>
<td>diskette</td>
</tr>
<tr>
<td>GFC-TAX T-JAD</td>
<td>diskette</td>
</tr>
<tr>
<td>TUSD T-JAD</td>
<td>paper</td>
</tr>
<tr>
<td>MCD T-JAD</td>
<td>diskette</td>
</tr>
<tr>
<td>IBM-DB E-JAD</td>
<td>EMS</td>
</tr>
<tr>
<td>IBM-L E-JAD</td>
<td>EMS</td>
</tr>
<tr>
<td>IBM-MPI E-JAD</td>
<td>paper</td>
</tr>
<tr>
<td>GFC-MR E-JAD</td>
<td>EMS</td>
</tr>
<tr>
<td>ARMY-TRAV E-JAD</td>
<td>EMS</td>
</tr>
<tr>
<td>ARMY-MAS E-JAD</td>
<td>EMS</td>
</tr>
</tbody>
</table>

track participation in issue list discussions. The detailed analysis is found in Appendix A in the ARMY-TRAVISS case.

Questionnaire to participants appears in Appendix F. It was generated from a number of sources. Over a dozen constructs were of interest in the questions; these were discussed in Chapter 3 and previously in this chapter.

**Tailoring.** The questionnaire was not uniform for all sessions. It was tailored to each session at the end of the session. Tailoring involved changing a few names (usually with a global command), deleting a few non-applicable questions, and modifying the introduction and ending to fit the circumstances. The goal all along was to remain true to the original source as much as possible in both language and intent.

**Distribution.** The questionnaire was administered in three ways: twice on paper, four times on diskette, and five times on the EMS immediately after the session (see Table 4.7). The electronic questionnaire, developed by a UA graduate student, was received very well. It was flexible enough to allow quick modifications of the survey immediately after the session.
All participants who filled out the electronic questionnaire (whether on EMS or diskette-based) saw the same type of questionnaire. In the five cases of EMS administration, the electronic questionnaire was loaded to all stations, at the very end of the session, and the participants spent the next 10-20 minutes filling them out. When administered by diskette, the user needed only to insert the diskette in a PC drive and type GO at the prompt. The rest is self-explanatory. In JAD sessions, I would stay after the session and make a few quick modifications to the questionnaire on a PC, or in two cases, I mailed the diskettes the next day.

Finally, in two cases, electronic delivery was determined to be inappropriate and near-identical paper versions of the electronic-questionnaire were generated and distributed along with postage-paid envelopes. Response in both these cases was above 65%.

Methodologically, delivering questionnaires in several formats might bias the results. In this case, the bias between paper and electronic form is believed to be low for the following reason: the visual layout of the paper and electronic questionnaires was preserved, as was the font type. Another confound may have stemmed from the delay in answering the questionnaires. The individual participants who used the diskette- and paper-based questionnaires filled out the questionnaires anywhere from a few hours to a few days after the session (in a few isolated cases it was a few weeks). The individual variations are unknown, partially because some sites “batched” their replies, and partially because there is no information about the individual times between the session and questionnaire completion versus the time between completion and returning the questionnaire. No differences were evident, between sites, although it is objectively difficult to determine what, if any, effect the delay had.

Tailoring questions allowed me to focus in on some aspects of each session which were unique. For example, Question 8 appeared as follows for the ARMY-TRAVISS session:
Complete the following sentence:
I expect that TRAVISS will be a _____
1. disaster
2. poor system
3. adequate system
4. good system
5. dream system

And this is how the question was worded for GFC-TAX and for PHX1 sessions, respectively:

I expect that the new CMS II-Tax will be a _____

I expect that the new RMS (Risk Management System) will be a __

The fit (hammer metaphor) questions had to--by definition--be tailored to each session because each session was so different in its components. It should be noted that the semantic differential answers were not changed. In summary, about 10 questions were slightly changed in each session, in addition to the hammer metaphor questions.

The master list of questions. The questionnaire presented in Appendix F is the generic questionnaire. Not all groups answered all of these questions. For statistical purposes, the questions were assigned to their original source question and aggregated accordingly.

Validity. As mentioned, the fit questions were used in two prior studies. Satisfaction questions have been shown to be valid for a variety of wordings.

The JAD index. It became apparent early in the investigation that a method to normalize the diverse sessions would be helpful. This was particularly acute for the issue of structure and discipline, which varied in the sessions and may have affected the process. As a result, a JAD index was developed. A list of 13 important dimensions of JAD were weighted by nine JAD experts. The weights were used in compiling a numerical rating for each session in the study. A complete description of the methodology and results of the JAD index survey is found in Appendix I.
The session ratings were done by the author. This is the rating of only one expert. For logistical reasons, it was impossible to replicate. The results of 10 observed sessions are displayed in Table 5.8 and Figure 5.1. The ratings were given immediately after each session at the time of the summary writings. Ultimately, the ratings are relative. Hence, after all sessions were observed, the individual ratings were calibrated somewhat.
CHAPTER 5

FINDINGS AND STATISTICS

This chapter presents the heart of the study: the findings from eleven Traditional JAD (T-JAD) and Electronic JAD (E-JAD) sessions conducted in six organizations. The chapter examines each of the ten propositions presented in Chapter Three, one by one. Extensive case descriptions are presented in Appendix A. Numerous summary tables and figures are used to support the narrative. A comparative discussion will come in Chapter Six.

The convention used in examining each of the ten propositions follows: applicable qualitative data are presented first, followed by questionnaire (quantitative) data (summarized in Table 5.1), ending with a conclusion for each proposition. The language used in examining each of the propositions is inspired from Cusumano and Kemerer (1990), who use the terms: support and not support for each proposition. Two other terms are used in this manuscript in this context: limited support and inconclusive. Although all these terms are reminiscent of those used in hypothesis testing, they are not meant to imply that rigorous hypothesis testing was conducted. However, the analysis will make use of the "reasonable significant difference threshold" of 7.5% that was introduced in Section 4.3.5. The "N" that is displayed throughout this chapter represents the number of sessions that had valid data for the measure (it is not an "N" of the number of respondents, a breakdown which appears in Appendix A).
5.1 Major findings: T-JAD versus E-JAD

Proposition 1: E-JAD sessions are more efficient than T-JAD sessions.

Six of the sessions involved work on processes as a unit of analysis (see Table 5.2). The overall picture is as follows: the four E-JAD sessions had a range of 2.2 to 8.8 processes completed per hour, while two T-JAD sessions ranged from 1.7 to 4.3 processes completed per hour. Hence, the averages show greater efficiency for the E-JAD sessions (4.6) over the T-JAD sessions (3.0).

Table 5.2 also notes some qualifications and comments that are important when comparing the efficiency figures. In several sessions, some of the work (the decomposition) was done ahead of time. This tends to increase efficiency in the session. A business process can be described with a great deal of detail, or with very little (so-called high-level descriptions). A process described in great detail will naturally take longer. These differences are captured in the extreme right column of Table 5.2. An additional qualification, not noted in the table, needs to be made about the IBM-DB case. The figure for that case is the number of processes produced by the analyst, after the session, after more decomposition work was done. The analyst did note however that he simply decomposed, and did not add significantly to the descriptions. In summary, the net direction of these qualifications impact both the T-JAD and E-JAD sessions about equally and do not affect the above finding.

Another way to view the calculation of processes completed per hour is to take into account the number of participants in each session. Since the E-JAD sessions tended to have more participants than the T-JAD sessions, then it might be argued that simply inviting more users into the session would increase output, at no “cost” in terms of the ratio of “processes per hour.” Therefore the second column in Table 5.2 takes this into account and computes the total processes per user-hour. Here the advantages of E-JAD reverse themselves, with an average of 0.78 processes per user-hour for T-JAD
<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD</th>
<th>E-JAD</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completeness</td>
<td>5=very complete</td>
<td>3.67</td>
<td>3.07</td>
<td>0.60 +</td>
</tr>
<tr>
<td>Creativity (index)</td>
<td>5=highest</td>
<td>3.83</td>
<td>4.03</td>
<td>0.20</td>
</tr>
<tr>
<td>Influence 1</td>
<td>Team resolution</td>
<td>1.61</td>
<td>1.28</td>
<td>0.33 +</td>
</tr>
<tr>
<td></td>
<td>1=yes, 2=no equal contribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influence 2</td>
<td>1=very equal</td>
<td>3.38</td>
<td>3.08</td>
<td>0.30 +</td>
</tr>
<tr>
<td></td>
<td>my role was</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influence 3</td>
<td>1=nil; 5=major part</td>
<td>2.94</td>
<td>3.02</td>
<td>0.08</td>
</tr>
<tr>
<td>Contentiousness</td>
<td>5=highest</td>
<td>3.21</td>
<td>3.29</td>
<td>0.08</td>
</tr>
<tr>
<td>Conflict 1</td>
<td>disagreements; 5=highest resolution; 5=none resolved</td>
<td>2.47</td>
<td>2.51</td>
<td>0.04</td>
</tr>
<tr>
<td>Conflict 2</td>
<td>satisfaction with output resolution; 5=none resolved</td>
<td>1.98</td>
<td>2.52</td>
<td>0.54 +</td>
</tr>
<tr>
<td>SATOUT</td>
<td>satisfaction with output</td>
<td>4.16</td>
<td>3.59</td>
<td>0.57 +</td>
</tr>
<tr>
<td>SATGS</td>
<td>satisfaction with GrpSys.</td>
<td>N/A</td>
<td>4.00</td>
<td>N/A</td>
</tr>
<tr>
<td>SATF</td>
<td>satisfaction with facilitation</td>
<td>4.08</td>
<td>4.22</td>
<td>0.14</td>
</tr>
<tr>
<td>SATAG</td>
<td>satisfaction with agenda</td>
<td>3.54</td>
<td>3.71</td>
<td>0.17</td>
</tr>
<tr>
<td>SATALL</td>
<td>satisfaction overall</td>
<td>3.65</td>
<td>3.83</td>
<td>0.18</td>
</tr>
<tr>
<td>Bonding (index)</td>
<td>IS-user bonding; 5=highest</td>
<td>3.59</td>
<td>3.41</td>
<td>0.18</td>
</tr>
<tr>
<td>Expectations (index)</td>
<td>5=highest</td>
<td>4.28</td>
<td>3.87</td>
<td>0.41 +</td>
</tr>
<tr>
<td>Structure</td>
<td>5=highest</td>
<td>2.87</td>
<td>2.67</td>
<td>0.20</td>
</tr>
<tr>
<td>TIMEUTIL</td>
<td>wasted time; 5=best</td>
<td>4.53</td>
<td>4.20</td>
<td>0.33 +</td>
</tr>
<tr>
<td>MMB</td>
<td>mental model before the session began; 5=highest</td>
<td>3.36</td>
<td>3.16</td>
<td>0.20</td>
</tr>
<tr>
<td>MENTAL-MODEL (index)</td>
<td>mental model as a result of session; 5=highest</td>
<td>3.30</td>
<td>3.42</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Table 5.1: Questionnaire results: summary of all comparative statistics. Note: + indicates the delta exceeded the threshold.
Table 5.2: Efficiency by session. (Level of detail: L=low to medium; H=medium to high).

<table>
<thead>
<tr>
<th>Session</th>
<th>Efficiency</th>
<th>Level of effort</th>
<th>Decomposed before?</th>
<th>Level of detail</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Processes</td>
<td>Screens</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>p/hour</td>
<td>p/user-hour</td>
<td>p/hour</td>
<td>p/user-hour</td>
</tr>
<tr>
<td>PHX1 T-JAD</td>
<td>4.3</td>
<td>1.40</td>
<td>0.5</td>
<td>0.17</td>
</tr>
<tr>
<td>PHX2 T-JAD</td>
<td>1.7</td>
<td>0.17</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>GFC-TAX T-JAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUSD T-JAD</td>
<td>8.8</td>
<td>0.80</td>
<td>1.5</td>
<td>0.18</td>
</tr>
<tr>
<td>MCD T-JAD</td>
<td>3.8</td>
<td>0.34</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>IBM-DB E-JAD</td>
<td>3.5</td>
<td>0.17</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>IBM-L E-JAD</td>
<td>2.2</td>
<td>0.25</td>
<td></td>
<td>•</td>
</tr>
</tbody>
</table>

and 0.39 processes per user-hour for E-JAD. This shows that the E-JAD size dilutes the efficiency finding presented above. However, the dominant economic consideration for an organization should be processes per hour and not processes per user-hour, otherwise there would be a tendency to conduct small JAD sessions, which is unwise because this leaves out key people.

The middle columns in Table 5.2 measure another common type of output of JAD sessions—that of screens. Two sessions (one each from T-JAD and E-JAD) dealt with this task. The E-JAD session showed greater efficiency than the T-JAD session. It should be noted, however, that the level of detail in the T-JAD session was much greater. Hence no direction can be derived from treatment of screens.

In summary, based on data for processes per-hour, there is limited support for Proposition 1, that E-JAD sessions are more efficient.

*Proposition 2: There is no difference between E-JAD sessions and T-JAD sessions in*
As Table 5.3 suggests, there is only one meeting (of both T-JAD and E-JAD) where all sources indicated that the output was complete (qualitatively). The reasons for the failures in completeness vary widely: the objectives were not met (often because they were unrealistic); there was no closure; there were unfinished tasks; the creative element was missing; or the meeting moved too fast.

Although there are many reasons for completeness failures, there may be some reasons that point to the effect of technology, or the effect of the management of the electronic session, which are of interest for this study. Lack of closure and unfinished text are indicated for four out of the five sessions in Table 5.3. Both factors have to do with possible limitations of GroupSystems: closure, which is discussed in the context of Proposition 5; and unfinished text, which refers to an incomplete document (or set of documents). These factors also suggest a possible failure on the part of E-JAD facilitation to overcome the limitations inherent in GroupSystems to achieve the session objectives. This finding will be revisited in Chapter Six.

The questionnaire results point to a higher rating for completeness for the T-JAD sessions. Although the difference exceeds the threshold, this must be strongly qualified...
by the particularly sparse data: n=3 for the T-JAD sessions (two of them being the City of Phoenix JAD sessions which had few respondents).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD N</th>
<th>E-JAD N</th>
<th>diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPLETENESS</td>
<td>5=very complete</td>
<td>3.67</td>
<td>3.07</td>
<td>0.60</td>
</tr>
</tbody>
</table>

In summary there is inconclusive evidence to indicate an advantage to either T-JAD or E-JAD for this construct.

**Proposition 3: Innovation and creativity is higher in E-JAD sessions than in T-JAD sessions**

Qualitatively, nothing useful can be said about this variable and no differences are noted between the two independent variables.

The questionnaire data are inconclusive:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD</th>
<th>E-JAD</th>
<th>diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREATIVITY (index)</td>
<td>5=highest</td>
<td>3.83</td>
<td>4.03</td>
<td>0.20</td>
</tr>
</tbody>
</table>

In summary, the data are inconclusive for this construct.

**Proposition 4: E-JAD sessions exhibit a higher degree of equality of participation and equality of influence.**

All of the sessions—electronic and non-electronic—show an uneven contribution of users. There are four reasons for inequality of participation in a session: expertise is skewed, rank is pulled, shyness, or uneven motivation. The latter two factors cannot be assessed here. As indicated in Table 5.4, of the ten sessions with on-site observations, skewed expertise accounted for uneven participation of three of the E-JAD sessions and none of the T-JAD sessions, while rank accounted for inequality of participation in three of the T-JAD sessions and in two of the E-JAD sessions.
Equality of participation was assessed by the number of dominant, or strongly active, user participants. This is also shown in Table 5.4. Equality of participation in the verbal (non-electronic) part of the session was roughly the same (the percentages average out to 27% for both E-JAD and T-JAD).

Equality of participation also means that neither the facilitator, nor the IS staff, dominate the session time. This analysis is captured in Table 5.5 which shows the distribution of participation that resulted from the tallies done during the sessions. No clear trend is evident that breaks down by independent variable.

The next step involves examining contribution of the electronic component to equality of participation. An important assumption is made here: that participation in a GroupSystems tool is—by definition—democratic and equal, and thus serves to equalize participation. This assumption is made based on two points: first, past EMS research has supported this; and second, observations were made during all these sessions that, as a general rule, all users contributed to the electronic sessions through the keyboard.

In order to make use of this assumption, the time involved in electronic work is
Table 5.5: Summary participation statistics (in percent of total time).

<table>
<thead>
<tr>
<th>Session</th>
<th>Users</th>
<th>Facilitator(s)</th>
<th>IS</th>
<th>GrpSys.</th>
<th>No. notations</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHX1 T-JAD</td>
<td>25%</td>
<td>66%</td>
<td>9%</td>
<td>N/Applic</td>
<td>44</td>
</tr>
<tr>
<td>PHX2 T-JAD</td>
<td>51</td>
<td>47</td>
<td>2</td>
<td>N/Applic</td>
<td>55</td>
</tr>
<tr>
<td>GFC-TAX T-JAD</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>N/Applic</td>
<td>none</td>
</tr>
<tr>
<td>TUSD T-JAD</td>
<td>64</td>
<td>36</td>
<td>0</td>
<td>N/Applic</td>
<td>68</td>
</tr>
<tr>
<td>MCD T-JAD</td>
<td>38</td>
<td>31</td>
<td>31</td>
<td>N/Applic</td>
<td>28</td>
</tr>
<tr>
<td>IBM-DB E-JAD</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>none</td>
</tr>
<tr>
<td>IBM-L E-JAD</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>none</td>
</tr>
<tr>
<td>IBM-MPI E-JAD</td>
<td>15</td>
<td>10</td>
<td>15</td>
<td>57</td>
<td>68</td>
</tr>
<tr>
<td>GFC-MR E-JAD</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>none</td>
</tr>
<tr>
<td>ARMY-TRAV E-JAD</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>none</td>
</tr>
<tr>
<td>ARMY-MAS E-JAD</td>
<td>40</td>
<td>60</td>
<td>Not/avail</td>
<td>Not/avail</td>
<td>12</td>
</tr>
</tbody>
</table>

needed. This is available from two sources: first, Table 5.5 shows the time on GroupSystems for the IBM-MPI session. This figure shows that a total of 72% of time was "user time" (i.e., 15 percent plus 57 percent). The second source of data is from the timetables kept in the sessions. The net percent time of (non-chauffered) GroupSystems work in four other sessions (ARMY-T, ARMY-M, IBM-DB, GFC-MR) was 78%, 77%, 46%, and 47% of time, respectively on the collaborative tools, for an average of 62%. This does not include verbal air time, of course.

A JAD session should ideally show a high percent of user participation. Although there is no rigid formula, 50% or better would be reasonable. If verbal air time of the user participants is added to the figures from the timetables (62%, on average), then it seems that in the E-JAD sessions well over half the time is user time. Although this analysis suggests that the degree of user participation in E-JAD sessions is high, a comparison is not meaningful with the sparse data for T-JAD sessions.

It is more difficult to assess equality of influence. As Table 5.4 shows qualitatively, all sessions showed uneven influence of participants. Both E-JAD and T-JAD sessions included dynamics of rank/power or skewed expertise.
The questionnaire results, as measured by the three influence measures, INFLUENCE1, INFLUENCE2, and INFLUENCE3, unanimously point to a perception, on the part of the users, of greater equality in E-JAD sessions.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD N</th>
<th>E-JAD N</th>
<th>diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFLUENCE1</td>
<td>Team resolution</td>
<td>1.61</td>
<td>1.28</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>1=yes, 2=no</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INFLUENCE2</td>
<td>equal contribution</td>
<td>3.38</td>
<td>3.08</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>1=very equal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INFLUENCE3</td>
<td>my role was</td>
<td>2.94</td>
<td>3.02</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>1=nil; 5=major part</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first measure strongly indicates that the users perceived a greater degree of team resolution in E-JAD than T-JAD. The difference here between the two is actually much greater than it appears because this is the only question on a two-point rather than a five-point scale. On the other hand, it should be emphasized that the answers to this and the next two measures may have been biased in favor of E-JAD because the T-JAD sessions were smaller in size. The second measure indicates that there was a higher perception of equal participation in E-JAD. The third and final measure is perhaps the strongest indication even though it did not meet the threshold. In spite of the considerably larger groups in the E-JAD sessions, on average, each of the participants felt that they contributed more than those in T-JAD sessions.

In summary, the combination of qualitative and quantitative observation data about equality of participation were inconclusive. However, questionnaire data show greater equality of influence in E-JAD sessions, hence the conclusion is that E-JAD sessions exhibit a higher degree of equality.

**Proposition 5:** T-JAD sessions are better at identifying conflicts and resolving conflicts.
Qualitatively, the handling of conflicts, issues and consensus, were not dependent on the GroupSystems tools— but on the facilitator. Table 5.6 summarizes three dimensions: whether issues (disagreements) were tracked in some orderly fashion (as in standard JAD methodology); whether disagreements were resolved in some orderly fashion; and whether there were political camps that were evident at the meeting.

The data in Table 5.6 suggest that the independent variable (E-JAD versus T-JAD) had little to do with the constructs of conflict and conflict resolution but rather with the style of meeting management. However, it should be emphasized that in all (observed) E-JAD sessions, since GroupSystems tools cannot fully support conflict discovery and conflict resolution, the facilitators had a tendency to either be unaware of, or to neglect, this area somewhat. In the two Army sessions, it was only the suggestion of this author that led to allocation of time during which issues were aired in an orderly fashion and then resolved.

Questionnaire data were inconclusive for the first two measures. But there was a large difference in perception of how many of the issues were indeed resolved in the session: E-JAD participants felt that fewer were resolved. The E-JAD number includes one session that was significantly higher than the others, GFC-MR, in which the users...
gave this measure an average of 4.64 (see Table A.17).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD N</th>
<th>E-JAD N</th>
<th>diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTENTIOUSNESS</td>
<td>5=highest</td>
<td>3.21</td>
<td>3.29</td>
<td>0.08</td>
</tr>
<tr>
<td>(index)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONFLICT1</td>
<td>disagreements; 5=highest</td>
<td>2.47</td>
<td>2.51</td>
<td>0.04</td>
</tr>
<tr>
<td>CONFLICT2</td>
<td>resolution; 5=none resolved</td>
<td>1.98</td>
<td>2.52</td>
<td>0.54</td>
</tr>
</tbody>
</table>

An interesting finding on the contentiousness index is that the IS personnel, who were tracked separately for the questionnaire data, scored quite differently from the average user score on this measure in three out of four sessions for which there was such data. For example, one IS professional assessed the users to be contentious while the users did not feel that they were. The more baffling aspect is that the direction of the misperception is not the same in all cases.

In summary, the qualitative data did not show a clear indication in either direction. The questionnaire data, however, show limited support for T-JAD sessions being better at resolving conflicts than E-JAD sessions.

Proposition 6: User satisfaction is higher for E-JAD than for T-JAD.

Qualitative assessments of satisfaction were not meaningful. Participants expressed (dis-) “satisfaction” about a variety of issues during conversations, but this cannot be aggregated in a meaningful way. Quantitatively, the questionnaire asked the participants for their input on five types of satisfaction:
The questionnaire results indicate that only one measure (SATOUT) exceeds the threshold (in favor of T-JAD), however all other measures point in the other direction (in favor of E-JAD). This is a worrisome contradiction. Given the artificiality of the threshold, the findings for this construct should best be judged as inconclusive.

Interestingly, satisfaction with facilitation is rated as highest in both E-JAD and T-JAD sessions relative to the other measures of satisfaction. This may help explain some broader conclusions in this study and will be brought up again in Chapter Six.

**Proposition 7: There is no difference between E-JAD and T-JAD in building IS-user relations and bonding.**

No qualitative assessments can be made about the effects of the independent variable on IS-user relations (see Table 5.7). No visible warming or freezing took place that was observable or that emerged from interviews.

Most differences would be attributable to factors that have nothing to do with the technology— the independent variable. For example, based on questionnaire data, the lowest scoring and highest scoring sessions for the BONDING index measure were both T-JAD sessions (see Table A.7). The former did poorly most likely because of two factors: the short duration of the session, which did not allow the participants to create bonding with the IS staff; and second, the uncomfortable behavior of one the participants. The best-performing session on the BONDING index was most likely highly rated because it was the tenth time that a JAD session was being conducted over...
the course of several months and the two sides had become very familiar with each other.

Questionnaire results for this construct are inconclusive:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD N</th>
<th>E-JAD N</th>
<th>diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BONDING (index)</td>
<td>IS-user bonding; 5=highest</td>
<td>3.59</td>
<td>3.41</td>
<td>0.18</td>
</tr>
</tbody>
</table>

In summary, there are very few indications of differences and the findings are inconclusive.

Proposition 8: User expectations of system success are higher in E-JAD than in T-JAD.

There were no qualitative observations that can shed light on this proposition. However, the questionnaire results indicate that expectations are higher in T-JAD sessions ($\mu < 0.11$). There are no qualitative data to explain the higher expectations in T-JAD sessions.
Proposition 9: There is no difference in degree of structure between T-JAD and E-JAD.

Several operationalizations of "structure" separate E-JAD from T-JAD sessions.

The JAD index results are displayed in Table 5.8 and pictured in Figure 5.1. When the numbers in the bottom row of Table 5.8 are averaged, the JAD index aggregates are arrived at: the average rating for T-JAD sessions is 76, the average rating for E-JAD sessions is 69, and the average rating for all sessions is 72.8. These data show that T-JAD sessions were rated better on average. The common weakness in the E-JAD results has to do with basic JAD techniques of running a meeting. Some of the elementary JAD "rules of thumb" and "group dynamics" techniques were not used at all in some E-JAD sessions.

The T-JAD sessions performed far better in terms of utilization of time (Figure 5.2). There are two measures of time utilization depicted in the figure: net group work and
Figure 5.1: The JAD index. Bar chart.
Figure 5.2: Utilization of time. Bar chart.
net session time. Net group work is the time that the participants actually spent working (and not listening to introductions, training, etc.). Net session time is the time in the JAD session, net of breaks. Both should, ideally be very high, and ideally, the net group work should be close to the level of net session time.

Table 5.2 shows that the net group work was notably higher in T-JAD sessions than E-JAD sessions. In addition, net session time was higher in T-JAD sessions. A qualification must immediately be made in that the E-JAD sessions in the study tended to be considerably longer on average than the T-JAD sessions, which were all one day or less. However, the JAD guidebooks and literature strongly urge that time and effort in JAD sessions be optimized. One possible explanation for the lower performance in E-JAD is that computer work (e.g., typing, reading screens) is such that the everyday user cannot do it for an extended period of time without diversions.

Table 5.9 presents four subjective assessments of factors that influence structure: mood assessment, task structure, process structure and documentation discipline. The latter three factors do not break down along the dimension of the independent variable. However, mood assessment shows some indications of groupings on the dimension of the independent variable. Three out of five observed E-JADs, at three separate
sights, coordinated by three different facilitators, show a startling assessment: that the mood was "very informal." One session was described as a "frat party," another as somewhat "silly," and the third in terms such as "warfare" and "disruptive." One possible explanation is that the absence of the leader/facilitator removes the element of discipline and cohesion participants need and allows some of them to wander to (respectively): listen to rock music, eat at the buffet, to smoke outside.

The questionnaire has two measures of structure:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD</th>
<th>E-JAD</th>
<th>N</th>
<th>N</th>
<th>diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRUCTURE</td>
<td>5=highest</td>
<td>2.87</td>
<td>2.67</td>
<td>5</td>
<td>6</td>
<td>0.20</td>
</tr>
<tr>
<td>TIMEUTIL</td>
<td>wasted time; 5=best</td>
<td>4.53</td>
<td>4.20</td>
<td>5</td>
<td>6</td>
<td>0.33</td>
</tr>
</tbody>
</table>

The first measure, the STRUCTURE index, is inconclusive, while the second measure, TIMEUTIL, indicates that there was less wasted time in T-JAD sessions.

In summary, most of the qualitative and quantitative indicators point to E-JAD sessions being less structured than T-JAD sessions.

*Proposition 10: There is no difference between T-JAD and E-JAD in the ability of the users to form mental models of the system in question.*

Qualitative observations were not meaningful for this construct, so only questionnaire data can shed light on this proposition. The three measures below are all inconclusive: MMB is the mental model that the participant had before the session; MENTAL-MODEL is an index of three questions regarding the mental model that the respondent had as a result of the session; MMA is Question 9, that asks specifically about the mental model after the session. It is one of the questions in the index and is presented separately for further analysis below.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
<th>T-JAD</th>
<th>N</th>
<th>E-JAD</th>
<th>N</th>
<th>diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMB</td>
<td>mental model before the session began; 5= highest</td>
<td>3.36</td>
<td>4</td>
<td>3.16</td>
<td>6</td>
<td>0.20</td>
</tr>
<tr>
<td>MENTAL-MODEL(index)</td>
<td>mental model as a result of session; 5= highest</td>
<td>3.30</td>
<td>4</td>
<td>3.42</td>
<td>5</td>
<td>0.12</td>
</tr>
<tr>
<td>MMA</td>
<td>mental model after</td>
<td>3.43</td>
<td>4</td>
<td>3.58</td>
<td>6</td>
<td>0.15</td>
</tr>
</tbody>
</table>

It is also worth examining whether there was improvement in the mental model on a “before” (MMB) and “after” basis (MENTAL-MODEL, or MMA). The aggregate numbers above show differences that are not meaningful. Examining this data by the individual sessions (comparing Tables A.5 and A.6) shows that in all sessions but three there is an increase in the perception of the users’ mental models (a similar analysis comparing MMB to MMA yielded roughly the same differences). In two T-JAD sites and one E-JAD site the index is less than the MMB, indicating a possible confusion that occurred in the users’ mental models of the new system. This can be a fatal outcome of a meeting and points to some serious failure in the meeting. But it is not at all clear if the failure has to do with the independent variable, or perhaps with the measure itself.

5.2 Other findings: T-JAD versus E-JAD

A field study allows the tracking of additional variables that are not formally stated as dependent variables.

The fit of tasks to tools and techniques.

The questionnaire had measures for each session dealing with the fit of the tasks to the tools used—whether they be GroupSystems or manual (i.e., non-GroupSystems) tasks.
Tables 5.10, 5.11 \(^1\) present the participants' perception of fit for each task in each session. Table 5.12 averages the fit for each of the GroupSystems tools. The tools are presented by decreasing order of fit. TC and IO were the tools that had the best ranking. Table 5.13 averages the fit for each of the sessions and is thus a rough surrogate for participants' satisfaction with GroupSystems as a whole in each session. Table 5.14 examines the fit by groupings of the task type. The task types were derived to support the discussion of conflict that appears in Chapter Six. Several terms are introduced in these categories that merit further definition: divergence means allowing the participants to perform their own assignments uncoordinated with the others; convergent tasks are those that require the group to produce a product, a document, or a decision together. The category assignments are those which were clearly identifiable and include all GroupSystems tasks including those for IBM-L.

The bottom two rows in Table 5.12 are particularly interesting for assessment of overall fit of tools to task. The data indicate that, on average, the electronic tools of E-JAD were given slightly higher fit ratings than the manual techniques used in a number of sessions. The difference here is small and fails in a t-test. These results offer weak support that the GroupSystems tools are indeed performing well at what they are intended to do: supporting the traditionally manual JAD process.

*Objectives and success.*

Quite a few of the sessions fell short on setting unambiguous, realistic objectives that are clear to all participants (and that all participants agree with!). The independent variable does not seem to be a factor in the success or failure of this construct.

*Planning and preparation.*

There are qualitative indications that planning and preparation were poor in several of the sessions. There are four sessions which stand out in this regard and three of them

\(^1\)These two tables are "logically" one table that cannot fit on one page.
<table>
<thead>
<tr>
<th>Session</th>
<th>Task</th>
<th>Tool</th>
<th>Fit</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUSD</td>
<td>Compose new flows</td>
<td>use three lists</td>
<td>3.62</td>
<td>1.2</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Define Methodology</td>
<td>PF</td>
<td>2.67</td>
<td>0.5</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Brainstorm about Methodology</td>
<td>EBS</td>
<td>3.22</td>
<td>1.2</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Pieces that go into methodology</td>
<td>IA</td>
<td>3.22</td>
<td>2.0</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Decompose model</td>
<td>Knowledgeware</td>
<td>1.89</td>
<td>0.6</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Define steps of Logi. data model</td>
<td>EBS</td>
<td>3.00</td>
<td>1.6</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Develop categories</td>
<td>whiteboard</td>
<td>3.89</td>
<td>0.9</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Assign components into categories</td>
<td>IA</td>
<td>4.12</td>
<td>0.8</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Identify deliverables</td>
<td>whiteboard</td>
<td>3.89</td>
<td>1.1</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Expand list of deliverables</td>
<td>whiteboard</td>
<td>3.67</td>
<td>1.0</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Expand on definitions</td>
<td>IA</td>
<td>4.00</td>
<td>0.5</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Logical deliverables</td>
<td>TC</td>
<td>4.44</td>
<td>1.0</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Physical deliverables</td>
<td>TC</td>
<td>4.44</td>
<td>1.0</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Physical task plan</td>
<td>TC</td>
<td>4.67</td>
<td>0.5</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Enterprise deliverables</td>
<td>TC</td>
<td>4.67</td>
<td>0.5</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Enterprise tasks</td>
<td>TC</td>
<td>4.67</td>
<td>0.5</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Architecture categories</td>
<td>whiteboard</td>
<td>4.11</td>
<td>0.9</td>
</tr>
<tr>
<td>IBM-DB</td>
<td>Architecture deliverables</td>
<td>TC</td>
<td>4.55</td>
<td>0.7</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Problems and Issues</td>
<td>EBS</td>
<td>4.43</td>
<td>0.8</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Critical Success Factors</td>
<td>IO</td>
<td>4.50</td>
<td>0.5</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Identify High Level Processes</td>
<td>IO</td>
<td>4.50</td>
<td>0.8</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Decompose Processes</td>
<td>EA</td>
<td>4.00</td>
<td>0.8</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Define People and Info Flows</td>
<td>GM</td>
<td>3.50</td>
<td>0.9</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Creative Brainstorming</td>
<td>TC</td>
<td>4.50</td>
<td>0.8</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Select and Filter Ideas</td>
<td>IO</td>
<td>4.13</td>
<td>1.0</td>
</tr>
<tr>
<td>IBM-L</td>
<td>Refine Proposals</td>
<td>GE</td>
<td>3.87</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Table 5.10: Fit of GroupSystems tools to task: by task
<table>
<thead>
<tr>
<th>Session</th>
<th>Task</th>
<th>Tool</th>
<th>Fit</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM-MPI</td>
<td>Generating/voting on screens</td>
<td>VO,</td>
<td>4.83</td>
<td>0.4</td>
</tr>
<tr>
<td>GFC-MR</td>
<td>Identify Improvements</td>
<td>EBS</td>
<td>3.81</td>
<td>1.0</td>
</tr>
<tr>
<td>GFC-MR</td>
<td>Focus on Details</td>
<td>TC</td>
<td>3.75</td>
<td>1.1</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Define Challenges</td>
<td>EBS</td>
<td>3.78</td>
<td>1.4</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Articulate Critical Success Factors</td>
<td>IO</td>
<td>3.78</td>
<td>1.4</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Rank the CSF</td>
<td>VO</td>
<td>3.57</td>
<td>1.5</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Review and edit FD document</td>
<td>PE</td>
<td>3.50</td>
<td>1.1</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Review/edit/decompose FD processes</td>
<td>EA</td>
<td>3.42</td>
<td>1.0</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Review/edit Reports and forms</td>
<td>EA</td>
<td>3.64</td>
<td>1.2</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Identify sources/uses in process/reprt</td>
<td>GM</td>
<td>3.78</td>
<td>1.0</td>
</tr>
<tr>
<td>ARMY-TRAV</td>
<td>Identify outstanding issues</td>
<td>IO</td>
<td>4.35</td>
<td>0.6</td>
</tr>
<tr>
<td>ARMY-MAS</td>
<td>Discuss current issues</td>
<td>EBS</td>
<td>4.80</td>
<td>0.5</td>
</tr>
<tr>
<td>ARMY-MAS</td>
<td>Compile objectives</td>
<td>editor</td>
<td>4.40</td>
<td>0.9</td>
</tr>
<tr>
<td>ARMY-MAS</td>
<td>Define high-level processes</td>
<td>editor</td>
<td>4.00</td>
<td>1.2</td>
</tr>
<tr>
<td>ARMY-MAS</td>
<td>Compile CSF</td>
<td>editor</td>
<td>3.40</td>
<td>0.6</td>
</tr>
<tr>
<td>ARMY-MAS</td>
<td>Rank CSFs</td>
<td>VO</td>
<td>3.40</td>
<td>0.6</td>
</tr>
<tr>
<td>ARMY-MAS</td>
<td>Write FD</td>
<td>PE</td>
<td>4.20</td>
<td>0.8</td>
</tr>
<tr>
<td>ARMY-MAS</td>
<td>Identify issues</td>
<td>IO</td>
<td>5.00</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 5.11: Fit of GroupSystems tools to task: by task (Continued)

<table>
<thead>
<tr>
<th>Tool</th>
<th>Number of times used</th>
<th>Number of sessions used</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>8</td>
<td>3</td>
<td>4.45</td>
</tr>
<tr>
<td>IO</td>
<td>7</td>
<td>4</td>
<td>4.38</td>
</tr>
<tr>
<td>VO</td>
<td>3</td>
<td>3</td>
<td>3.93</td>
</tr>
<tr>
<td>EBS</td>
<td>6</td>
<td>5</td>
<td>3.87</td>
</tr>
<tr>
<td>GE,PE</td>
<td>3</td>
<td>3</td>
<td>3.85</td>
</tr>
<tr>
<td>IA</td>
<td>3</td>
<td>1</td>
<td>3.78</td>
</tr>
<tr>
<td>EA</td>
<td>3</td>
<td>2</td>
<td>3.68</td>
</tr>
<tr>
<td>GM</td>
<td>2</td>
<td>2</td>
<td>3.64</td>
</tr>
<tr>
<td>PF</td>
<td>1</td>
<td>1</td>
<td>2.67</td>
</tr>
<tr>
<td>Total/Average</td>
<td>36</td>
<td>6</td>
<td>4.04</td>
</tr>
<tr>
<td>All manual tasks</td>
<td>8</td>
<td>3</td>
<td>3.87</td>
</tr>
</tbody>
</table>

Table 5.12: Fit of GroupSystems tools to task: by tool
<table>
<thead>
<tr>
<th>Session</th>
<th>Number of tasks in questionnaire</th>
<th>Average fit rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUSD T-JAD</td>
<td>1</td>
<td>3.62</td>
</tr>
<tr>
<td>IBM-DB E-JAD</td>
<td>17</td>
<td>3.82</td>
</tr>
<tr>
<td>IBM-L E-JAD</td>
<td>8</td>
<td>4.17</td>
</tr>
<tr>
<td>IBM-MPI E-JAD</td>
<td>1</td>
<td>4.83</td>
</tr>
<tr>
<td>GFC-MR E-JAD</td>
<td>2</td>
<td>3.78</td>
</tr>
<tr>
<td>ARMY-TRAV E-JAD</td>
<td>8</td>
<td>3.67</td>
</tr>
<tr>
<td>ARMY-MAS E-JAD</td>
<td>7</td>
<td>4.17</td>
</tr>
</tbody>
</table>

Table 5.13: Fit of GroupSystems tools to task: by session

<table>
<thead>
<tr>
<th>GroupSystems task type</th>
<th>Num of sessions</th>
<th>Num of tasks</th>
<th>Avg. fit unweighted</th>
<th>Avg. fit weighted by session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criticize and suggest</td>
<td>2</td>
<td>2</td>
<td>4.66</td>
<td>4.66</td>
</tr>
<tr>
<td>Diverge and converge</td>
<td>3</td>
<td>3</td>
<td>4.61</td>
<td>4.61</td>
</tr>
<tr>
<td>Decompose and go into detail</td>
<td>5</td>
<td>14</td>
<td>4.03</td>
<td>3.91</td>
</tr>
<tr>
<td>Generate ideas</td>
<td>4</td>
<td>4</td>
<td>3.81</td>
<td>3.81</td>
</tr>
<tr>
<td>Converge on text</td>
<td>1</td>
<td>1</td>
<td>2.67</td>
<td>2.67</td>
</tr>
<tr>
<td>All other EMS tasks</td>
<td>4</td>
<td>11</td>
<td>3.83</td>
<td>3.85</td>
</tr>
</tbody>
</table>

Table 5.14: Fit of GroupSystems tools to task: by task type
were E-JAD sessions. In both of the ARMY sessions, there was a tendency on the part of the IS coordinators and officers to allow the EMS to “take care of the meeting.” In this context, there are indications that some E-JAD facilitators tend to do less planning and preparation than is called for in JAD sessions (Wood and Silver 1989; August 1991).

Cost factors.

A full cost-benefit analysis was not conducted because the benefit stream of JAD sessions is so difficult to rigorously assess. However, given the research question, it is important to inquire, at least, about cost issues. The costs for the sessions are displayed in Figures 5.3, 5.4, and 5.5. Figure 5.3 shows that E-JAD sessions in the sample are much more expensive on a daily basis than T-JAD sessions. The primary reason is not the cost of the EMS environment, but rather the cost of travel and lodging and the labor cost of larger groups of participants involved in the sessions. This point is pictured in Figure 5.4 which displays the relative cost of the JAD environment to total direct cost of the JAD meeting. The JAD environment costs include: facilitation, meeting room, and food. The figure suggests that the additional cost of E-JAD over T-JAD may be minor when weighed against the other costs of the JAD session.

Group size.

Perusing Table 4.4 reveals that the E-JAD sessions had more participants than the T-JAD sessions. This is probably not a coincidence for two reasons: a “Push” reason and a “Pull” reason. Push: Organizations are more likely to choose an electronic JAD session when it is for a larger group, with “more at stake.” Pull: GroupSystems– the software, the concept, and the environment– do better when the number of participants is “large.” There is no formal number for “large” but the rule of thumb used is eight. Some EMS research has pointed to better effects for large groups (cf. Nunamaker, et al. 1991b).
5.3 Summary

The bulk of the data have been summarized and analyzed for the ten propositions comparing E-JAD to T-JAD. The data supported several propositions while not supporting others. These conclusions leave us with a somewhat mixed picture vis-a-vis the research question: E-JAD can be judged an improvement on some measures, and not on others. What to make of these findings, then? The discussion of the findings and an assessment of the research question will be provided in the next chapter.
Figure 5.3: Cost of one day of session. Bar chart.
Figure 5.4: Relative cost of the JAD environment. Bar chart.
<table>
<thead>
<tr>
<th>Participants</th>
<th>PHX/MP</th>
<th>GFC-T</th>
<th>MoD</th>
<th>TUSD</th>
<th>IBM-DB</th>
<th>IBM-MP</th>
<th>GFC-MR</th>
<th>Army-T</th>
<th>Army-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>days</td>
<td>0.5</td>
<td>0.25</td>
<td>0.33</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>salary</td>
<td>$681</td>
<td>$511</td>
<td>$375</td>
<td>$11,350</td>
<td>$12,485</td>
<td>$2,724</td>
<td>$6,600</td>
<td>$23,835</td>
<td>$6,810</td>
</tr>
<tr>
<td>opp cost</td>
<td>$341</td>
<td>$255</td>
<td>$187</td>
<td>$5,675</td>
<td>$6,253</td>
<td>$1,362</td>
<td>$3,300</td>
<td>$11,818</td>
<td>$3,405</td>
</tr>
<tr>
<td>travel</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$4,800</td>
<td>$4,500</td>
<td>$0</td>
<td>$8,400</td>
<td>$4,000</td>
</tr>
<tr>
<td>b/lodging</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$5,000</td>
<td>$1,350</td>
<td>$0</td>
<td>$7,875</td>
<td>$2,250</td>
</tr>
<tr>
<td>Room</td>
<td>$0</td>
<td>$0</td>
<td>$50</td>
<td>$1,250</td>
<td>$1,900</td>
<td>$1,000</td>
<td>$1,200</td>
<td>$10,000</td>
<td>$6,000</td>
</tr>
<tr>
<td>Support</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$8,000</td>
<td>$2,270</td>
<td>$454</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Other</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$200</td>
<td>$300</td>
<td>$0</td>
<td>$250</td>
<td>$150</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$1,022</td>
<td>$766</td>
<td>$612</td>
<td>$26,275</td>
<td>$32,898</td>
<td>$11,390</td>
<td>$11,400</td>
<td>$62,278</td>
<td>$22,615</td>
</tr>
<tr>
<td>Total/day</td>
<td>$2,143</td>
<td>$3,665</td>
<td>$1,854</td>
<td>$5,255</td>
<td>$6,580</td>
<td>$11,390</td>
<td>$22,800</td>
<td>$12,456</td>
<td>$7,538</td>
</tr>
</tbody>
</table>

- **Daily rate**: 227
- **Daily exec**: 600
- **Opp cost factor**: 0.5

<table>
<thead>
<tr>
<th>Participants</th>
<th>Total participants in the session</th>
</tr>
</thead>
<tbody>
<tr>
<td>days</td>
<td>Number of days (8 hour computation if less than one day)</td>
</tr>
<tr>
<td>salary</td>
<td>loaded salary x participants x num days</td>
</tr>
<tr>
<td>opp cost</td>
<td>loaded salary x opp cost factor. Cost of being &quot;away from work&quot;</td>
</tr>
<tr>
<td>travel</td>
<td>cost of travel in session. Num out-of-towners x approx air fare</td>
</tr>
<tr>
<td>b/lodging</td>
<td>num out-of-towners x est hotel cost</td>
</tr>
<tr>
<td>Room</td>
<td>cost of using the session room. Rental cost, or est. amortized cost.</td>
</tr>
<tr>
<td>Support</td>
<td>Labor cost of facilitation and other support</td>
</tr>
<tr>
<td>Other</td>
<td>Catering and mise.</td>
</tr>
<tr>
<td>daily rate</td>
<td>loaded daily salary for all participants (exc GFC-MR)(est.)</td>
</tr>
<tr>
<td>daily exec</td>
<td>loaded daily salary for GFC-MR executives(est.)</td>
</tr>
<tr>
<td>opp cost factor</td>
<td>Estimate of opportunity cost factor of &quot;being away from work&quot;</td>
</tr>
</tbody>
</table>

**Figure 5.5**: Session cost breakdowns. Spreadsheet
CHAPTER 6

DISCUSSION

The previous five chapters presented the groundwork for this study. Chapter 5 presented each proposition and variable separately. This chapter summarizes the findings in a broader context and attempts to explain what was discovered.

As stated earlier, this study is the first to explore the potential of using EMS to automate and support a critical aspect of system development: the JAD methodology, a methodology based on assimilating the users in the process of building systems. The question raised was whether automating JAD is worthwhile. Broadly speaking, based on the ten propositions debated in Chapter 5 and summarized in Table 6.1, E-JAD is worthwhile. This chapter will now discuss E-JAD's strengths and weaknesses and why this assertion is made.

6.1 T-JAD versus E-JAD: Primary findings

First, E-JAD shows benefits relative to T-JAD in two areas predicted from past EMS research:

1. There is some support to suggest that E-JAD sessions are more efficient than T-JAD (Proposition 1). A group of participants can get more done in a given period of time using an E-JAD environment. Efficiency addresses one of the five problems in SD listed in Table 1.1. Ultimately, SD is an economic process, one which attempts to maximize the product while investing minimal resources.
Compressing the life cycle, and more specifically, compressing the time required in JAD sessions, is an economic benefit of significance. Hence, the finding that E-JAD is more efficient is perhaps the most important of all findings. The finding must be qualified by restating that there were but a small number of data points (four versus two) which supported it.

2. E-JAD did better than T-JAD in equalizing participation and influence (Proposition 4). Group members (both dominant voices and non-dominant) participate more equally using an E-JAD environment; this, in turn, leads to greater equality of influence. Equality of participation and influence is self-fulfilling— the EMS environment serves to enhance this feeling in the participants, who then develop a greater sense of accomplishment, which equalizes participation still more. When all participants are contributing to the process, the resulting system should be of higher quality.

E-JAD seemed not to be as useful as T-JAD in two areas:
1. There was limited support to the proposition that T-JAD sessions are better than E-JAD in handling conflict and conflict resolution (Proposition 5). E-JAD sessions were less likely to uncover conflicts and resolve them during the session. This finding was predicted from past EMS research. Further discussion regarding conflict and conflict resolution is presented in Section 6.2.

2. T-JAD did better than E-JAD in enforcing structure (Proposition 9). There was a lower degree of structure and discipline in E-JAD sessions as assessed by several qualitative and quantitative measures. This finding was not anticipated from the literature. Further discussion regarding structure is found in Section 6.3.

Users’ expectations of system success were found to be higher in T-JAD sessions (Proposition 8). Theory does not give us a guide as to why this might have happened. As discussed in Chapter Three, it is not clear whether high expectations are good or bad.

Finally, data were inconclusive for five constructs:

1. No differences were found in supporting completeness of design (Proposition 2). This is the most difficult construct to measure in any systems development effort besides a controlled environment. The inconclusive evidence merits further investigation of this critical area.

2. In spite of the research that points to EMS helping groups in being creative relative to non-supported groups, the data in this study were inconclusive (Proposition 3).

3. The questionnaire data that assessed satisfaction were mixed and inconclusive (Proposition 6). This was another construct that was expected to show results that favored E-JAD.

4. The data for the effect of the session on building closer IS-user relations (Proposition 7) were sparse and inconclusive. Either purposely, or inadvertently, the facilitators were able to overcome the “walls” created by the technology between
the users and IS. It is also possible that the technology actually aided in reducing the tension between users and IS.

5. Questionnaire data that were used to assess the users' mental models of the system were inconclusive as to differences between the two approaches (Proposition 10).

E-JAD did not show superiority over T-JAD in all ten aspects examined and yet the beginning of the chapter stated: E-JAD is a worthwhile undertaking. How can this conclusion be justified? There is no one measure, aspect, or proposition, or set of factors which can be determined to be critical to this conclusion. The ten propositions cannot somehow be weighted or scored.

Additionally, none of the JAD approaches were done systematically. There is no E-JAD methodology as of yet. Most of the E-JAD sessions had a large component of ad hoc methods (there was a great deal of ad hoc work in the T-JAD sessions, as well).

Recall that in Section 3.5 an over-arching proposition was introduced: E-JAD outperforms T-JAD for all dependent variables by offering one or more layers of tools to the proven set of techniques and procedures in the JAD approach. The assumption is that these tools can and should be applied when beneficial, improved where lacking, and not applied to tasks and situations where other "manual" methods are judged superior. The discussion must focus on the successes and failures observed in this study and draw conclusions with the goal of pointing to specific aspects of the JAD methodology where E-JAD can and should be used, where the E-JAD approach can be improved, and finally, where automation should not play a role.

The challenge in the rest of this chapter is to draw conclusions from the strengths and weaknesses of E-JAD. There are two components present in any E-JAD session that govern the process: the GroupSystems tools and the human facilitator. Each will be discussed in turn.
6.2 The GroupSystems tools

As shown in the summary figures of Table 5.12, the fit of the E-JAD tools to individual tasks is slightly higher for automated tasks than for manual (i.e., T-JAD) tasks. This in itself is a powerful finding. But, the findings associated with Proposition 5 point to a possible weakness of the E-JAD approach in identifying conflicts and for conflict resolution. Conflict is the central dialectic of the JAD dynamic, and therefore, the remainder of this section will discuss this issue using the framework of convergence and divergence.

There are group tasks, group dynamics, and GroupSystems tools which tend to be *divergent*, while others are *convergent*. Divergence means allowing the participants to perform their own assignments uncoordinated with the others. Convergent tasks are those that require the group to produce a product, a document, or a decision together. An example of a divergent tool in GroupSystems is EBS; a convergent tool is GW (see Table 6.2).

How does E-JAD deal with conflict and conflict resolution tasks? Figure 3.1 decomposed the six steps of conflict and conflict resolution fundamental to a well-managed JAD meeting process. Step 1 (discover conflicts) is a divergent task, which is well supported by GroupSystems tools. Step 3 (document the conflicts) is also implicitly supported through the system. However, the critical Step 5 (resolving the conflict), a convergent task, has only limited GroupSystems support. Furthermore, Steps 2 and 4 (identify conflicts, and discuss alternatives) are similarly not built into the GroupSystems tool usage. Easton, et al. (1990) found that for intellective tasks—those requiring consensus and decision-making—a tool that supports conversation is better (as measured by decision quality). They echo the observations made above—that these are tasks that require convergence. In the Easton, et al. study, users was more likely to reach consensus using the EDS tool (an older version of GroupWriter—GW), since the subjects were
Table 6.2: Convergence and divergence: for some GroupSystems tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Divergent</th>
<th>Convergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBS</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>IO</td>
<td>Somewhat</td>
<td>Somewhat</td>
</tr>
<tr>
<td>VO</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>GO</td>
<td>Somewhat</td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>Somewhat</td>
<td></td>
</tr>
<tr>
<td>GM</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>GW</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

able to concentrate more on just a few unique solutions.

With the convergence-divergence spectrum as a point of reference, Tables 5.10 through Table 5.14 reveal some interesting findings about the success of the GroupSystems tools.

Tables 5.10 and 5.11 show that the four highest fit ratings were given for two divergent tasks, and two tasks which had both convergent and divergent elements. On the other extreme, the four tasks with the lowest fit ratings were given to three convergent tasks and one divergent task. In other words, there are more divergent tasks in the high ratings and more convergent tasks in the low ratings.

Using Tables 5.10 and 5.11 again, another type of analysis summarizes the extreme task-tool ratings for each of the four most active E-JAD sessions (IBM-DB, IBM-L, ARMY-T, ARMY-M). This analysis reveals that all the low ratings were given to convergent tasks while the high scores were for tasks that had at least some element of divergence. In summary, this analysis also showed that divergent tasks reflected a high fit while convergent tasks reflected a low fit.

Table 5.14 shows that the two task types rated highly were: "criticize and suggest" (a divergent task); and "divergent and convergent." The conclusion here is similar to the above analyses: the participants assessed the task-tool fit as high for divergent tasks. Furthermore, there is some weak support to indicate that purely convergent tasks are
unpalatable in E-JAD. The rating for the one convergent task in Table 5.14 is the lowest of all fit ratings.

As Easton, et al. suggest, GroupSystems tools can be used for convergence, when the nature of the task is kept in mind, in other words, where there is a strong fit between the task— a convergent task— and a convergent tool. The fit rankings in two of the Army sessions verify this: use of IO for issue discovery and issue resolution were ranked the highest for those sessions, and amongst the highest fit rankings for all 44 activities measured in the study.

In summary, the hammer-nail metaphor questions regarding fit shed light on several strengths and possible weaknesses in E-JAD. Several tools seem promising for certain task types and E-JAD supported tasks received slightly higher ratings overall, but convergent tasks should be carefully assessed before attempting them with the current generation of tools.

6.3 Facilitation

One of the cornerstones of both EMS and JAD is the facilitator, or session leader. This section summarizes comparative findings concerning the facilitator. The section begins with a summary of the dominant approaches to facilitation in JAD and with users of GroupSystems. Next, it discusses two areas in which facilitation may have played a role in E-JAD weakness: planning and meeting structure.

E-JAD introduces a technology component into the JAD methodology. To varying degrees, the technology component serves to lessen the role of the facilitator. Although use of EMS in JAD meetings is not yet common, there is ever increasing experience with use of another SD support technology in JAD meetings: CASE (see Appendix D).
Many JAD practitioners strongly object to the use of CASE in JAD, and express a "low-tech" sentiment. Hill (1991) attacks use of CASE in JAD meetings arguing that CASE is not designed to interact with a group of people. He emphasizes that "facilitation is the single most important ingredient in the success of a group meeting." Anecdotally, there has been a reluctance to conduct JAD sessions in an electronic meeting room. Some of the most reluctant decision makers are professional JAD facilitators. There are numerous reasons for this, but perhaps the dominant one is the fear that the "group dynamics" are altered unfavorably by the system. Similar sentiments are expressed for groupware: "technology matters, but team dynamics matter more" (IFTF, 1990); and for EMS–facilitators feel that traditional facilitation skills are more important than technology skills McGoff, et al. (1990).

While JAD facilitation techniques stress a very high degree of process intervention, the modus operandi for both IBM and UA GroupSystems facilitators can best be characterized as "low-intervention." Low intervention translates into low involvement in planning, infrequent follow-up, and (relatively) few interruptions during the session (see

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1 For example, this was the gist of many of the audience's questions at a talk I gave about E-JAD as part of the International JAD/CASE conference in Washington, D.C. in June, 1991.
Table 6.3). Of the five E-JAD sessions observed in this study, three can be characterized as “low intervention” and the other two (IBM-DB and ARMY-M) can be characterized as an “evolving” form of facilitation. Despite low intervention facilitation in some sessions (both E-JAD and T-JAD), the participants ranked facilitation as highest (or tied for highest) of all the satisfaction measures in eight of the 11 sessions.

Facilitation responsibilities include activities outside the meeting room and not in view of the participants: in planning and preparation. According to the JAD literature (e.g., Wood and Silver, 1990; August, 1991; Guide, 1986), the JAD methodology entails a great deal of planning and preparation. McGoff, et al. (1990) found that GroupSystems facilitators rated planning as the most important component of DSC success (Decision Support Center is IBM’s name for their electronic meeting room). Yet, qualitative observations in this dissertation indicate that planning for E-JAD sessions falls far short of the planning activities and depth suggested by the above-mentioned JAD literature because of the traditions captured in Table 6.3.

The JAD facilitator is largely responsible for enforcing the structure of the meeting through: a careful agenda; enforcing rules of conduct; enforcing a “work ethic;” and including techniques, frameworks, and methodologies. Analysis of Proposition 9 made use of several operationalizations of structure. T-JAD sessions were assessed to have a higher degree of “structure” for most of these measures. All of these measures (e.g., time utilization, session mood, agenda, and discipline) are largely enforced by the facilitator and not by the technology per se.

In summary, the responsibilities of the E-JAD facilitator were not fully fulfilled. Interestingly, there is consensus among the participants, the facilitators, the literature, and practitioners that facilitation is vitally important. Therefore E-JAD, as a methodology that builds on JAD, must take this into account.
6.4 Summary

The weaknesses in tool use and in facilitation received a lot of attention because they illuminate the comparison of E-JAD and T-JAD: the author argues here that all of the weak points discussed can be ameliorated by a combination of: use of an E-JAD methodology, training, and use of correct techniques. Discussion of GroupSystems tools pointed to task-tool combinations that work well. Discussion of facilitation suggests the need for active participation in the E-JAD setting. These items combined with documented benefits of E-JAD over T-JAD suggest that indeed E-JAD is a worthwhile tool.

This chapter took E-JAD, an imprecise construct made up of many dynamics factors, and offered an overall picture of the findings. As is the norm in case/field studies, the analysis and conclusions have been inductive and synthesized broad environmental and organizational factors. The next chapter addresses some of these broader issues.
CHAPTER 7

CONCLUSIONS

This chapter’s purposes are threefold: to summarize what has been learned; to discuss limitations of this study; and to motivate future research.

7.1 What has been learned

Not surprisingly, most people who deal with technology tend to be technology proponents. Many CASE professionals have caught this disease. This author, as a researcher investigating the worth of automating JAD, had to be aware of this tendency.

Technology does not resolve all problems, not even in software engineering. As Card, et al. (1987) found, technology, methodologies and techniques have no explanatory effect on the dependent measure with which software engineering is so concerned—productivity. Franz and Robey (1984) found that software development is both a rational process (i.e., one for which CASE may be used) and a political process. JAD is very much a socio-political process, and technology has a spotty record at addressing social processes. Nevertheless, this dissertation’s findings suggest that applying Electronic Meeting Systems to Joint Application Development is valuable, but that it should be applied judiciously. We need to use it where it is proven to be useful and set it aside where it is not.

Chapter Six discussed the relative fit of the specific GroupSystems tools to the specific JAD tasks. McGrath’s typology (1984) of group tasks is very useful in this regard. Of
the four group tasks: generate, choose, negotiate, and execute, the JAD methodology uses the first three (and not the fourth, since programs are not typically written in the meeting room). EMS have been shown in this study, as well as others, to be an effective technology for the "generate" tasks: idea generation, creativity tasks, alternative generation, and brainstorming. On the other hand, EMS have had mixed or negative results in "choose" and "negotiate." It is in these areas that E-JAD did not show clear advantages.

Doyle and Straus (1976) state that the skill of the problem-solver (the facilitator in our case) is analogous to a carpenter having more tools in his toolbox. The more tools available, the better the meeting can address its objectives and tasks. This brings up the overarching assumption argued in Chapter Three: E-JAD is superior because it introduces another 10-20 tools to a finite set of JAD tools. In abstraction, this must be true. Instead, the dynamics occurring in some E-JAD sessions relied on GroupSystems tools at the expense of the "traditional toolbox" of JAD techniques. Chapter Six also suggested that the principal weakness in E-JAD may be the under-emphasis of facilitation. It is here that the greatest strides can be made in E-JAD: the facilitator needs first of all to be a JAD facilitator and only secondly to be an electronic meeting systems facilitator. Many JAD facilitators have their assistants or co-facilitators run CASE tools during the session. Similar approaches can be introduced to E-JAD sessions. All of this needs to be part of a specific E-JAD methodology which is captured in a manual much like Guide (1986), or IBM (1986).

What I have learned

As a researcher I consciously had to disassociate myself from the process. Nevertheless, I did have an influence in some instances, and affected three of the E-JAD sessions—positively, in my assessment. This served as a validation of some E-JAD methodology lessons that I began formulating. The GFC E-JAD session in the electronic meeting room took place at my initiative and as a result of discussions with the staff at GFC.
I was also influential in meeting planning. The participants in the two Army E-JAD sessions each spent half a day discussing “issues” at my suggestion. The tool used—GroupSystems’ IO—and the way it was used, was also a result of my suggestions. The task was well received and was rated the highest in fit in both sessions.

7.2 Limitations and Strengths

It is necessary in the final chapter to review the limitations of the research. Principally, these limitations revolve around sample size and sample choice, and hence generalizability. Thousands of JAD sessions take place every year in the United States. There was no systematic sampling of this population. Furthermore, since eleven sessions represent but a small sample of these, none of the study’s conclusions can be verified satisfactorily using statistical tools. However, the limitation was also a strength: the small data set allowed the researcher an intimate look at each JAD session, which would not have been feasible otherwise.

7.3 Future research

This study has practical implications similar to those of Olson and Olson (1991). Their stated goal is to:

Analyze the [users’] current practice so we can identify opportunities for technology intervention and establish a baseline of current practice in order to assess the effects of introducing new technology.

In this context, several topics merit further research in JAD/E-JAD, as well as advancements in SD methodologies:
- E-JAD alters the "group dynamics" of JAD. E-JAD introduces a continuum of group work types into the JAD session, most of which are new, and with which, collectively, we have little experience. Table 7.1 integrates classification of meeting processes from Nunamaker, et al. (1991b) with others observed in this study, as well as some which are anticipated in the future. The table comprehensively categorizes group dynamic types that can take place in E-JAD and the corresponding level of facilitation control. E-JAD itself changes the central dynamic of a classic JAD session: a tightly controlled meeting run by a facilitator standing in front of the users, steering them to a set of desired goals. Most GroupSystems tools essentially create islands of independent work— as many islands as there are participants. These participants cooperate with each other frequently, but may work independently for several minutes or more, without any regard for group progress. Meanwhile, the facilitator is largely passive.

In this context, the most interesting sessions were the two Army E-JAD sessions. The facilitator decided to run the sessions in a manner unusual for both JAD and for GroupSystems: the large group was broken into smaller groups of from three to five people who were assigned specific topics and responsibilities. (classified as "small group" in Table 7.1). The Army sessions spent approximately 52% and 50% (respectively) of gross work time in small group work. Although this was done in several E-JAD Army sessions before, it is not a formalized routine. During the ARMY-T session I took qualitative "snapshots" of the four small working groups. Each group formed a very different set of work patterns and cooperation. For example, in a few groups, one person typed while others watched; in others all were typing simultaneously; one IS person acted as a "local facilitator" in several of the groups, while in others there was no leader.

There are dangers in small group work: in maintaining consistency and in managing dependencies. These dangers are very similar to the problems of version management in development environments, or in host-based CASE tools.
Yet, we still know very little about how best to manage the continuum of group work in Table 7.1 and consequently further research and experimentation is needed. The last two JAD settings in the table are called “distributed E-JAD.” This area is presently in the conceptual phase. Researchers at the University of Arizona have been working on distributed GroupSystems for over a year (at this writing) in both the technical and conceptual areas.

All of these group work types raise questions about the design of the future electronic meeting room: Should the room be modular? How large should the room be? What types of partitions and displays should it have? (see IFTF, 1990).

- CASE, JAD and EMS will continue to merge in some areas. Appendix D discusses the contribution of CASE to JAD. Certainly, a combination of full-fledged CASE tools in an E-JAD environment is inevitable (it was tried in the IBM-DB case) and needs more research as to its impact.

- GroupSystems tools can be modified or enhanced to map fully to all conventional JAD activities, particularly various kinds of list-making.

- JAD and academic research have not yet mixed. There are numerous interesting avenues to research in several referent fields using any number of research methodologies.
<table>
<thead>
<tr>
<th>Group Dynamic type</th>
<th>JAD setting</th>
<th>Nature of group work</th>
<th>Nature of principal facilitator’s involvement &amp; control</th>
<th>Observed in this study?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chauffeured- manual</td>
<td>Traditional JAD</td>
<td>Entire (large) group</td>
<td>High</td>
<td>•</td>
</tr>
<tr>
<td>Chauffeured- electronic</td>
<td>some E-JAD activities</td>
<td>Entire (large) group</td>
<td>High</td>
<td>•</td>
</tr>
<tr>
<td>Supported- electronic</td>
<td>some E-JAD activities</td>
<td>Entire (large) group some indiv. work</td>
<td>Medium to High</td>
<td>•</td>
</tr>
<tr>
<td>Interactive- electronic</td>
<td>some E-JAD activities</td>
<td>Entire (large) group All indiv. work</td>
<td>Low</td>
<td>•</td>
</tr>
<tr>
<td>Small group- electronic</td>
<td>some E-JAD activities</td>
<td>small group (may have “local” facilitation)</td>
<td>Low</td>
<td>•</td>
</tr>
<tr>
<td>Classic design team (manual)</td>
<td>non-conventional</td>
<td>small group (may have “local” facilitation)</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Individual work (manual)</td>
<td>non-conventional</td>
<td>individ.</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Distributed- electronic (same time/ diff. place)</td>
<td>Distributed E-JAD</td>
<td>varies</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Distributed- electronic (diff. time/ diff. place)</td>
<td>Distributed E-JAD</td>
<td>varies</td>
<td>presumed very low</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.1: Continuum of group work in E-JAD sessions
Chapter One presented five SD problems and the JAD solutions. E-JAD augments some of these solutions and potentially makes them faster and more effective. For most organizations there must be an evolutionary climb up the learning curve in terms of E-JAD. First, organizations have to embrace the new methods in industry today, JAD among them. The informal survey presented in Appendix E seems to indicate that most organizations do not use JAD. Second, organizations need to devote more attention to using JAD correctly, particularly in the area of facilitation and appropriate participation. Finally, when a maturity level has been reached, it is appropriate to introduce in-house E-JAD, or off-site E-JAD sessions at the nearest local electronic meeting room. I hope this study will play a part in creating this awareness for opportunities in E-JAD.
APPENDIX A

THE 11 CASES IN DETAIL

This Appendix contains the "semi-raw" data used in this dissertation. The research produced about 200 pages of summaries, transcripts, notes, memos, over eighty completed questionnaires, and other documents. These were filtered into this appendix which is laid out by case/session, and within each session by the constructs presented in Chapter 3.

A few notes on the conventions used in this appendix: The "speaking table" is referred to often. This is a data collection instrument which is summarized in Table 5.5. Much of the data discussed in this appendix is found in Tables A.2 through A.23 at the end of this chapter. The tables display the questionnaire data by question and by session. Within each session description certain categories (e.g., Completeness) are italicized. Subcategories within those (e.g. document discipline) make use of the regular font.

A.1 City of Phoenix, Session 1 (PHX1 JAD)

This JAD session, early in the SDLC, took place in the conference room of the MIS Department and lasted half a day. The application is a total rewrite of the risk assessment system at the municipality. Both the users and IS had a mental model to work from because the department was currently using a third party software package with which they were not pleased. Three users (supervisors and managers) participated in
the meeting. They represented the entire management level of this small department. There were very few instances when someone in the room did not know the answer to a question.

Facilitation was conducted by a senior IS staff person who was trained in JAD, but this was his first JAD experience. For the users he was them.

The unusual aspect of this session was the heavy use of CASE tools in the session itself (Knowledgeware CASE tool). In this session CASE was used to capture short descriptions in textual formats.

Session mood. The group was small and members all knew one another. The facilitator joked and the participants laughed. There was a comfortable but business-like mood.

Efficiency

High-level definitions were written for each of the seventeen high level processes. The processes were already decomposed in previous work by the analysts. Each definition was about 5-10 lines long. Using the net time in the meeting, output per hour worked out to 5.5 processes per hour; or using the gross time 4.3 processes per hour.

Product

Completeness A post-session interview with the facilitator/project manager indicates that he was pleased with meeting the objectives, "We accomplished what we set out to do: completing the requirements definition was all I wanted to do today." Questionnaire results indicate a mid-range level on the completeness construct.

Effectiveness

Innovation and creativity. This was a session where detail was extracted from the participants about a list of 17 processes that had already been decomposed. This is not
a task that lends itself to creativity.

Questionnaire results place this session amongst the lowest of all sessions at 3.75 (out of five) on the creativity index.

Equality of participation, influence. The two City of Phoenix sessions (PHX1 and PHX2) are characterized by the problem of the facilitator wearing two hats (being both an IS developer and process leader) and by one of the users being dominant in the sessions. Interestingly, this person was not the senior of the users. All participants looked to her for approval. In an interview this participant called herself the “problem child” because the system deals mostly with her area of expertise. The questionnaire results back this up, scoring this session as closest to unequal contribution. Of 44 notations in the speaking tables, some of which were shared by several conversations, the users had only 25% of the floor, while the facilitator, who wore two hats, had a full 66% of the floor. This is lopsided, suggesting that the facilitator dominated and did not encourage enough user participation.

Conflict and consensus. The one user who dominated discussions also dominated resolutions of issues which came up. In a post-session interview, the user indicated that she and the facilitator “argue a lot” and that she has been asked to table things occasionally. Of the 9 issues that were tracked in my observations, both sides agreed that all but one was resolved, though it was not clear to this observer how a few of them were resolved. On one issue that is still open, the facilitator said about their disagreement, “We understand what they mean and they understand what we mean.” Questionnaire results indicate that the session was low on the contentiousness dimension and fairly low on the other two conflict scales. These results reaffirm the interviewees own assessments of low conflict.

Satisfaction. Satisfaction was generally high, ranging from 3 to 4.5. The overall satisfaction was one of the highest of all sessions.
**IS-User relations and bonding.** Relations were already comfortable in this, the fifth session of this series of JADs. Questionnaire results indicate very high ratings on the bonding index (4.5 out of 5.0).

*Expectations* were high— at an average of 4.0 on the five-point scale.

**Structure, agenda, discipline and the JAD index.** The agenda, handed out to participants, was confusing, but the meeting seemed to cover the points in the agenda. The lowest level of satisfaction was with the agenda.

The facilitator in the post-session interview calls the level of structure “about right” adding that the [JAD] methodology should not dictate the structure but rather serve as a source to learn from. The dominant user, on the other hand, said that the session was not structured enough, that the agenda was very broad and that the “its an experiment...” (referring to the approach being new). Questionnaire results indicate a loose assessment of structure in this session, which, again, seems to stem from the comfort level of the participants in the session rather than from discipline.

Documentation discipline. Observations indicate that there was little use of lists. Documentation was directly onto a CASE tool by one of the analysts. It is not clear how much of the discussion was captured in this fashion. My impressions from several times that I looked over her shoulder are that not all of it was captured. So a lot of the discussions and mini-agreements and understandings were lost.

Meeting time utilization: the time was well-used with no severe tangents and only about 7% devoted to overhead issues at the beginning. Questionnaire results confirm this (Table A.23) with both respondents marking the “1-20” percent box in terms of time wasted. Analyzing the meeting along the the two dimensions of structure: There was virtually no task structure. There was good process structure: facilitation, structure of discussion, agenda.
The session was rated high on the JAD index, particularly in the areas of management support, group discipline, and selecting the appropriate users. The session was rated relatively low on the dimensions of list-making and the meeting room, which had numerous distractions.

*User Mental models.* Questionnaire results suggest that the mental models deteriorated as a result of the session, as measured by MMB relative to the mental model index. This is determined by comparing the mental model index (Table A.6), the mental model after the session; to MMB (Table A.5), the mental model before the session began. This was not the only session where there was such a deterioration. It is not altogether clear why this occurred, although it may simply stem from some frustration over some aspect of the session.

**Other variables:**

*Session objectives and success of the session.* The facilitator stated that completing the requirement definitions was all he wanted to do that day and he got it done. He thought it was successful because he was finally able to get agreement on all 17 definitions.

*Planning, preparation and follow-up.* By this session, the momentum had been reached. There was little need for significant preparation. Agendas were handed out. The participants already had large documents of screens and designs from previous sessions.

### A.2 City of Phoenix, Session 2 (PHX2 JAD)

This session is almost identical in the general details to PHX1 detailed above. It took place two months subsequent to the first session at a later stage in the SDLC. This session has to do with screens and screen design. The same participants were present in
both sessions and the duration was roughly the same— a half day. The session was part of a series of meetings bunched together to review screens one at a time. The session observed for this study fell somewhere in the middle of these.

Session mood was very good. The users were focused and serious about the work. They all had a working lunch. There were occasional jokes but the mood was primarily serious without being too formal.

Efficiency.

The topic was screen design and thus the unit of output is number of screens. There was a detailed discussion of each screen beginning with a generation of fields for each screen and then a discussion of their placement. Two screens were designed in this session. Of the 4.25 hours (net) of the meeting, 4.00 hours were spent on two of (what are said to be) the more difficult screens that were on the agenda for the sessions that week. This works out to two hours per screen.

Product

Completeness. In the post-session interview, the facilitator/project manager felt that the output was complete. He felt that the prototype would fill the gaps if any. He also thought that the level of detail was too great: he wanted to leave some details for the prototype review which was scheduled for later. On the other hand, the post session interview with the principal user indicates that she was not pleased with leaving "some things hanging," although she was content with the level of detail.

My assessment is that indeed the output of the session was not complete and that the facilitator was willing to compromise completeness somewhat for speed in the hope of filling gaps later with the prototype. As a general rule, critical screens such as those discussed in this session, require re-visiting so that the participants can allow the information to sink in.
Questionnaire results place this session as the highest of all sessions on the completeness measure. This is probably due to the level of detail in the session.

Effectiveness

Innovation and creativity. This was a session where screens were designed in detail. This is not a task that lends itself to creativity because it dealt with what field should be on what screen and where the field should be placed on the screen.

Questionnaire results are among the lowest of all sessions on the creativity index.

Equality of participation, influence. A post-session interview with the user indicates that at this point she was frustrated with the facilitator stifling discussion and taking up too much time. Of 55 notations in the speaking table, though, this time only 47% were taken up by the facilitator, while the users had 51% of the floor: double the amount of last time. In this session there is more equality of participation between the users themselves, with two of the three users active in discussions.

Conflict and consensus. As in PHX1, I tracked issues on my own (five in this case) that both post-session interviewees agreed were resolved, but it was not clear to me when and how. The active user said afterwards that the users often had to compromise. She also complained about the facilitator being in charge and being "obstinate" and that when conflict arises about "bells and whistles, then he says that it is out of scope." My observations indicate that conflicts were lengthy in this session and that were usually resolved and summarized by the facilitator. Many of the conflicts originated because the facilitator asked a hypothetical question in order to draw out more detail from the users. Questionnaire results indicate that the session was low on the contentiousness dimension, lowest of all sessions on the disagreements being set aside, yet highest of all sessions on the scale of "I disagreed with suggestions made by others." The latter perhaps reflects the slight resentment with the dominance of the facilitator.
Satisfaction was higher than last time, ranging from 3.5 to 4.5. Overall satisfaction and satisfaction with output was higher than in the previous session.

**IS-User relations and Bonding.** As in the previous session, there was good familiarity between the sides. One of the users, though, expressed some pent-up resentment at the dominance of the facilitator. Questionnaire data places this session at the highest level of all sessions on the bonding index (4.88).

**Expectations.** The questionnaire results place this session at the highest of all sessions on the expectations index. This may stem from the advanced stage of this project relative to most others in this study.

**Structure, agenda, discipline and the JAD index.**

The structured method of work was successful. The sequence began with a brainstorming round (on the whiteboard) to generate screen fields. Meanwhile, an analyst acting as a scribe, entered the fields into the CASE tool. When the list was determined to be complete by the participants, the CASE-painted screen was instantly displayed on the public display for comments.

Observations indicate that the process structure used went very well. The facilitator said that they were becoming more structured as they learned. He was “comfortable with the structure.” The dominant user felt that the structure was just right and that it could not be more structured than this; that one can’t rush this step; one needs to be a bit loose with the screens. Questionnaire results indicate a loose assessment of structure in this session, which, again, seems to stem from the comfort level of the participants in the session rather than from discipline.

The agenda was already set from previous sessions: to work very methodically through each screen.

Documentation discipline: Problems, assumptions and issues were not documented
anywhere. In fact, very few lists of any kind were maintained. The facilitator seems almost religiously afraid to write things down. But, as described above, a great deal was implicitly summarized in the CASE tool.

Meeting utilization was very high: there was almost no wasted time and overhead activities, except for the very end of the meeting. They even talked business over lunch. Questionnaire results are a bit surprising here with both respondents marking the "1-20" box in terms of time wasted. This is actually somewhat high relative to all sessions (this, in a session, that seemed very tight).

Analyzing the session on the two dimensions of structure: Task structure was minimal. Process structure was strong with a very clear process that everyone was comfortable with by this session.

The session was rated high on the JAD index especially in group discipline, goals of session, support of management and appropriate participants. The session was rated about average in the area of list-making and documentation.

Other variables:

Session objectives and success of the session. The user thought that the session was successful.

Planning, preparation and follow-up. Preparation seemed to have been minor for this session specifically, as it was part of a series of sessions.

A.3 Greyhound Financial Corp., Tax (GFC-TAX JAD)

The tax subsystem sign-off JAD was conducted at GFC's corporate location at an executive conference room. Tax has two components: revenue taxes and leases. The second of the functions, leases, is now a minor part of the business, but flexibility must be
maintained in the system. The session lasted less than half a day. The stated objective of the session was to get a sign-off on the design document.

Six users were present of which one--the manager--dominated. Facilitation was conducted by the lead analyst on the project who did not have JAD experience, nor strong leadership skills.

Session mood. The user/manager was hostile to the facilitator and the presence of two observers and the MIS Director did not lessen this. The user/manager had the facilitator rush through the contents of the session; by the end the user/manager looked visibly bored. The other users, her subordinates, did not speak much.

Efficiency

Ten menu items of one process were reviewed for purposes of sign-off. The type of review was too uneven to use these figures for any comparative purposes.

Product

Completeness. The objectives for this session were muddled. Although it was a sign-off JAD, ultimately there was no sign-off and hence the output was incomplete. There are a number of reasons for this: the facilitator/analyst, by his own admission, had left several known open issues unresolved and the mini-specs incomplete. He was not able to comment about completeness. Additionally, the facilitator did not press to get a sign-off, but rather allowed the meeting and the principal user to run it.

Effectiveness

Innovation and creativity. This was a sign-off session, which is arguably the least creative activity one can do in a JAD session. The questionnaire results indicate a fairly low level of creativity as assessed by the users.

Equality of participation, influence. Observations indicate that the meeting was very
heavily dominated by the senior user/manager. Other users seemed a bit fearful of the manager and this was verified by a few of the textual comments on the questionnaire. In a post-session interview, the user/manager indicated that she saw the meeting, not as an occasion to hear everyone, but as a way to make all the employees fully aware of the operations of the department.

Interestingly, the questionnaire showed that, although the users rated themselves lowest of all sessions in terms of their own contribution to the session, they perceived that the group’s contribution and influence was fairly equal.

*Conflict and consensus.* Observations indicate that the senior user manager dominated the meeting and was openly aggressive and hostile to the facilitator. Conflicts did not last and were quickly resolved because of fear of the manager on the part of the other users. The Director of MIS, who sat in on the meeting, would frequently bring closure and resolve a conflict. Only then would the user manager allow continuation. A comment in the questionnaire stated, “As always [she] wields a great deal of power.” The questionnaire measures of conflict and contentiousness were rated in the middle relative to other sessions. The third measure—dealing with how many of the disagreements were set aside—was actually lower than expected.

Issue tracking was uneven. The facilitator presented a list of 9 open issues. The manager had a different list of three issues. It was not clear which items on either list were resolved.

*Satisfaction.* This session ranked lowest of all sessions on most measures of satisfaction.

*IS-User relations and bonding.* Not surprisingly, the questionnaire results showed the lowest results on the BOND index of all sessions. This probably stemmed from the short time of the meeting and the tight control by the user/manager.
Structure, agenda, discipline and the JAD index. The dominant aspect of the meeting structure was the agenda. The meeting had an agenda which was adhered to, but it was not one that met with approval by the chief user, who ended up toying with the facilitator. The user changed the rules often, before and during the meeting. This session was among the lowest on the JAD index. It was rated poorly on the dimensions of facilitation, because the facilitator was not in control; problem-solving atmosphere, because solutions were not proposed and settled; and on the duration of the meeting, which did not allow some solutions to be settled for lack of time— it was rushed. The session was rated high on selection of appropriate users and on the group discipline. The questionnaire results indicate a fairly high assessment of structure. This probably stems from the lack of control felt by most of the users over the session proceedings.

Analyzing the meeting along the two dimensions of structure, there was no task structure here— models were reviewed but none were built. Process structure was weak. The leader was not in control and the agenda was subtly changed. The facilitator felt that the structure was about right but then immediately followed with a complaint about the agenda being changed by someone else. The user/manager, in the interview, felt that the structure was just right.

The meeting utilization was very high. There was generally very little overhead. The meeting ran by very quickly. The facilitator agreed in the interview that there was very little wasted time. The questionnaire results verify the observations indicating one of the lowest ratings in terms of time wasted.

Documentation discipline was good since there was a full-time scribe. However, it was not clear what was indeed being captured since none of this was being kept in public view.

User Mental models. Questionnaire results suggest that the mental models deteriorated as a result of the session, as measured by MMB relative to the mental model index.
This may be the result of the political nature of the meeting and somewhat confusing resolutions.

Other variables

Session objectives and success of the session. See completeness above.

Planning, preparation and follow-up. There were several problems in the planning and preparation area: although each user received a thick packet of handouts, they were put together at the last minute because of changes dictated by the user manager. Hence they were difficult to follow. Second, the procedure, and possibly the forms, for sign-off were not there.

A.4 Tucson Unified School District (TUSD JAD)

The personnel system session for TUSD was conducted at the IBM offices in Tucson in a conference room. The session lasted a whole week, of which one full day was observed and studied in detail. The personnel system covers all activities for teachers and other employees and is strongly focused on administrative procedures such as hiring and firing.

The users all came from the same administrative office of TUSD and knew each other well. Facilitation was conducted by an experienced IBM facilitator who had run numerous JADs before.

Session mood. The mood was comfortable. There were refreshments in the room, dress was casual. But, by Day Four, when I observed, the participants were visibly fatigued from the eight to nine-hour days in JAD sessions.

Efficiency.

There were two parts to the session. Of the approximately 12 modules defined for
the personnel system during the week, two were done on the day of observation. The first module, "Status Change," encompassed 12 medium-level processes which were described and diagrammed in 5:17 hours (net) of work. Hence each process took up about 25 minutes on average. Each process had two distinct components to it: text and flow (about 12.5 minutes each).

The next module, "Classification," encompassed 2 medium-level processes which were described and diagrammed in 3:00 hours (net) of work. Each process took up about 1.5 hours on average. But, unlike the first module, this one began at a higher level of analysis. Each process had six distinct components to it. That totals 12 components, plus the definition of the initial high level module, which equals 13 components, or about 14 minutes per component. By averaging out the 14 medium-level processes over 8:17 hours, this comes to 1.7 processes per hour.

Product

Completeness. The only observational notes on completion had to do with the technique which seemed to be very effective: all the users together— as a group— scanned three lists as they described the "future" process. It served as an excellent stimuli for catching all the extra details. The litany of complaints that comes out about the current system is effective in getting users to define in great detail what they want in the future, as they scan the problem list.

Effectiveness

Innovation and creativity. This was a session that lent itself to creativity and innovation. The facilitator allowed the participants to present and document any pie-in-the-sky idea that had to do with technology. The facilitator said that he was aware of the utopian nature of some of the requirements and that those items were to be filtered later, not now.
Observations were made about a subjective category called "critical thinking" (CT) from each participant. It seems that tracking these items of CT over a timeline show that they come in spurts—where several people reinforced each other—as a result of some stimuli. After the spurt there would be longer periods of more mundane discussion. Unfortunately, careful tracking of CT would require video-taping.

Questionnaire results indicate a fairly high level of assessment on the creativity index by the users, although not the highest of all sessions. This is a bit surprising; perhaps the fourth day of sessions, which was measured here, was beginning to numb them.

Equality of participation, influence. Observations indicate that one user—the most senior person present—dominated (This observation is largely supported by the questionnaire measures of INFLUENCE1 thru INFLUENCE3). She dominated in particular during dictation to the facilitator, which was done frequently. Others would look at her to seek approval when they spoke. But this participant was unique in that she tried to involve the others by asking for their opinions and frequently asking hypothetical questions of the group. The speaking table shows that of 68 notations, the users had the floor 70% of the time.

Conflict and consensus. Observations indicated that the senior user/manager dominated in discussions and, not surprisingly, in resolving issues that arose. The observations indicate that most issues were resolved and that they were resolved by "consensus." In a post-session interview the user manager indicated that she never pulls rank, and referring to a question about one of the arguments/discussions, "She and I vehemently argue over points, when it stalemates we just drop it." Given the demeanor of this manager—bubbly is the best way to describe her—this is plausible. The tables indicate that several people naturally played the role of clarifier, e.g., they would ask what-if questions "So what about case D?"

Questionnaire results show that all three measures of conflict rank low, with the index
of contentiousness ranking lowest of all sessions. There were many disagreements during the session and therefore the results here are perhaps indicative of a constructive mood of handling disagreements, as well as good working relationships among the participants and with the facilitator.

* Satisfaction * The session ranked amongst the highest in most measures of satisfaction.

* IS-User relations and bonding. * There were no IS staff in the meeting. Both non-users were neutral facilitation staff. In spite of that, the users indicated an adequate feeling on the bonding index, feeling, apparently that their conversations with the facilitator and the scribe— in their capacity as systems people— were satisfying.

* Expectations. * Questionnaire results indicate the highest level of expectations as measured by the expectations index. There is no clear reason why this was the case.

* Structure, agenda, discipline and the JAD index. * My observations indicate a very high level of process structure: the facilitator was in charge and walked the group through a very well-defined set of steps. Questionnaire results verify this, scoring by far the highest level on assessment of structure.

The user/manager had an interesting response on the question of structure. She said that the session was "too unstructured and not structured enough." It was too structured when the facilitator should have pulled more people into the process. She also suggested that there be a "little JAD booklet" like a driver's manual. She felt surprised by some of the steps.

Documentation discipline was high as there was a full-time scribe.

Meeting time utilization was high. It was a no-nonsense session that was very lengthy. There was very little overhead, as this was the fourth day of a week-long set of sessions. Notes indicate that less than 2% of the day was spent on overhead activities. Questionnaire results support this, showing that the assessment of wasted time was the
lowest of all sessions in the study.

Analyzing the meeting along the two dimensions of structure: Task structure was high as there was a systems analysis diagramming syntax that was developed from a generic base (roughly Yourdon) and tailored specifically to the TUSD needs. Process structure was also very high, as facilitator and discipline were strong.

This session got the highest ratings on the JAD index and did not do poorly in any category.

*User mental models.* Questionnaire results suggest that the mental models improved as a result of the session, as measured by MMB relative to the mental model index. Both are in the mid-range of scores.

**Other variables:**

*Session objectives and success of the session.* The interviewee indicated that there were no objectives for the week long session.

*Planning, preparation and follow-up.* The interviewee said that the participants did not prepare and that they didn’t know what to prepare for.

### A.5 McDonnell Douglas Helicopter (MCD JAD)

This JAD session was for the MAV (Material at Vendor) subsystem of the cost accounting module. This project is part of a renewal process for the cost accounting system that takes place every several years, in patches. This latest effort on MAV and a few associated modules seems to be at the urging of DOD contract regulations. There were several JAD sessions, of a few hours each, in the weeks prior to the session observed. This is a limited-objective project that puts in changes and patches to an existing low-profile system. Few end-users were involved. No new technology was being being used.
The participants were two key users from the department plus two knowledgeable staff from IS. The facilitator was the lead analyst on the project who was trained in-house in JAD and had no prior experience.

**Session mood.** Very business-like. No tangents and idle chatter.

**Efficiency.**

The types of measurable output: almost the entire meeting addressed alternatives for one aspect of design. This type of review was too uneven to use these figures for comparative purposes. In follow-up interviews, the project manager discussed the entire project, which was the first to use JAD. He has estimated the project at 1042 person-hours and was pleased that about half-way through it, he was about 15% ahead of schedule. He did relay some grumblings about the time required for these sessions.

**Product**

**Completeness.** In this session, observations indicate a very fine level of detail in the session discussions. In the post-session interview the facilitator felt that the level of detail was "just right." To ensure completeness, the participants were to go through a few simulations in the next JAD in order to run through some test cases. One of the written comments stated that some objectives were unclear, leading to confusion about what level of detail was desired. The questionnaire results rank this session as the highest in assessment of completeness.

**Effectiveness**

**Innovation and creativity.** Alternatives were carefully discussed and dissected, but creativity was difficult to assess. The participants did not rank the session high on the creativity index.

**Equality of participation, influence.** The observations indicate that there was an even spread of participation and the speaking tables support this. Of 28 notations, the
facilitator had 31%, the IS person had another 31%, and the users had 38%, of which more than half were accounted for by the user manager (there were two users). Written comments suggest that the user/manager had the most influence.

The participants rated themselves best of all sessions on INFLUENCE2, regarding the equality of participation. All agreed that resolutions were always decided as a team.

Conflict and consensus. Interviews indicate that the main user antagonist, wasn’t there for this session and thus it was quite peaceful. Conflicts were subdued. There was a lot of good discussion about alternatives. The principal user was very good at looking for approval and consensus, e.g., looking around and asking “right?” There was a bit of confusion on resolution, though: One of the written comments stated that it was not clear what was indeed resolved and what was needed to follow-up.

The issues list was handled in record time: 5 minutes for 6 issues, with only one set aside for later. Five minutes is astounding. But on convergence for the main topic of the session, there was no resolution; there was too much clarification.

The participants ranked themselves among the lowest on CONFLICT1, the lowest on the contentiousness scale and among the worst on CONFLICT2– for getting all the items resolved.

Satisfaction The participants gave the session ratings which place them in the mid-range of satisfaction scores, ranging from 3.67 to 4.0.

IS-User relations and bonding. The questionnaire ratings place this session in the middle of all sessions on the bonding index.

Structure, agenda, discipline and the JAD index. Analyzing the meeting along the two dimensions of structure: while task structure was weak, the process structure was strong. There was a very carefully prepared agenda and guide for the meeting which was adhered to throughout.
Participants ranked the session as being highly structured: the questionnaire score was 3.33, second highest of all sessions. In the post-session interview, the facilitator indicated that the session was “fairly tightly structured.” However, observations indicate a confusing structure in the main part of the session: most of the time was spent discussing the alternatives. None were posed as “this is alternative 1,” or “this is alternative 2.” This confusion was not just a problem for this author: just minutes before the end of the discussion, one of the principal discussants said, “Maybe I’m still lost.”

Meeting time utilization was good. The meeting was conducted in a business-like atmosphere with little wasted time.

Documentation was not in public view. The facilitator took some selective notes in his notebook, without revealing what merited his comments. At the same time, the facilitator said that documentation is the principal aspect that he learned from JAD. He indicated that they now have several pages of open issues and they have documentation to look back on.

List-making discipline was ambiguous. The meeting handout included an open issues list which was an important part of the meeting. The facilitator stressed that he doesn’t like to “walk through lists one at a time like others do.”

The session did not fare well in the JAD index because of list-making, use of basic tools and documentation. The session was rated high in group discipline and in problemsolving attitude.

Other variables:

Session objectives and success of the session. The facilitator indicated that he wanted to highlight open issues and to converge on (one of the two) alternatives. Later he said that the objectives were met and that all points on the agenda were covered.
The facilitator rated the meeting as an 8 out of 10. He listed the strengths as: going through all the issues; drawing out the information from the users; commit to follow-up; emphasize the correctness of the reports rather than just on the "new look" (integrity). The weakness, in his words, was in poor presentation of the alternatives.

*Planning, preparation and follow-up.* The JAD memo and the report mock-up by the user liaison indicated a great deal of planning and preparation.

### A.6 IBM DBA (IBM-DB E-JAD)

The IBM DBA E-JAD session was conducted at the space-station-like RAD (Requirements and Design) Center in Irving, Texas. The RAD Center is one of 35 or so IBM Decision Support Centers (DSCs) which use GroupSystems software. The session lasted four and half days, although I did not attend the last day and did not include it in the study. The Business Systems Division at IBM was mandated by management to develop a methodology for data administration that would be common across sites and across systems and platforms. The output of the session would lead to a process, a methodology, and not an application per se. The stated objective of the session was to define and document the data methodology, which included a list of 11 items of output, such as definition of a repository, DFDs for each process, etc. The 10 participants came from IBM installations all over the country and most were Data Base Administrators (DBAs) or held similar positions. Most had many years of experience in their position and in IS. Thus, this session was unusual in that the participants were not really users in the traditional sense.

Facilitation was conducted by a very experienced IBM JAD facilitator who also had several months experience on GroupSystems. She shared the leadership role with the lead analyst of this project, who helped in planning the agenda and running a few of the tasks.
Several GroupSystems tools were used. A CASE tool was also used, rather unsuccessfully, for one of the tasks.

Session mood. The atmosphere became very casual as the week progressed. The dress code was casual for the whole week ("loosey goosey" as the facilitator called it). By the third day, the participants were typing to the tunes of the rock band AeroSmith. The participants "trashed" the facilitator's office in a prank reminiscent of fraternity parties. The participants yelled war-like chants when a popular decision of some kind was made. Doughnuts and coffee and candy and bagels were consumed non-stop. It is hard to determine what effect this unusual mood had on productivity. The participants were very highly educated, highly motivated people who had respect for the staff.

Efficiency

There were two types of measurable output: the first is the text in TC that was synthesized by the lead analyst into 35 deliverables, which have an average of 8 steps per deliverable, which equal 280 processes on the Knowledgeware CASE environment. This is the number that is used in Table 5.2.

Second is the number of lines of text on Topic Commenter (TC). Five tasks were conducted on TC, which were the major products of the session. The lines of text on them were 825, 740, 525, 570, 450, 575 in chronological order, totaling 3685. The 3685 lines of text were done in (net) 4.75 hours, which means 776 lines per hour (see Table A.1). For the processes per hour: the gross hours computation is more appropriate since the processes are the overall output of the session: 280 processes over 32 hours comes to 8.8 processes per hour.

Product

Completeness. The interviews indicate some confusion on this construct. The facilitator said that there was too much detail, but the lead analyst said that output was not
Table A.1: Output quantities on predominant GroupSystems tool

<table>
<thead>
<tr>
<th>Session</th>
<th>GroupSystems tool</th>
<th>Lines of text per hour on GroupSystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM-DB E-JAD</td>
<td>TC</td>
<td>776</td>
</tr>
<tr>
<td>IBM-L E-JAD</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>IBM-MPI E-JAD</td>
<td>IO</td>
<td>342</td>
</tr>
<tr>
<td>GFC-MR E-JAD</td>
<td>TC</td>
<td>757</td>
</tr>
<tr>
<td>ARMY-TRAV E-JAD</td>
<td>PE/EA</td>
<td>145</td>
</tr>
<tr>
<td>ARMY-MAS E-JAD</td>
<td>PE</td>
<td>210</td>
</tr>
</tbody>
</table>

complete and that he did not expect it to be complete to begin with.

The observational assessments indicate that the overwhelming impression of the session is that much work remains to be done by the lead analyst after the meeting is over. The textual comments in the questionnaire support this observation: “We have done a lot of work with no real deliverable;” “[the lead/analyst] will have to take all our output and make sense of it;” “no visible finished product;” “quite a bit of follow-up.”

Effectiveness

*Innovation and creativity.* Several divergent tools were used in this session, such as PF and EBS. Broad topics were discussed in each of these. Observations indicate an openness to new ideas, however, one of the comments in the questionnaire indicate that the participant “would have been more satisfied if they were asked to be more creative.” Questionnaire results indicate that the users rated this session among the highest of all sessions on the creativity index.

*Equality of participation, influence.* Observations indicate that the participants were evenly split between those that were very talkative and those that almost never spoke up. This did not stem, as in other sessions observed, from an uneven spread of knowledge (although there were 1-2 participants who were somewhat less experienced). The comments in the questionnaire and the interviews indicate that there was a strong perception of equality of participation. Questionnaire results support these observations.
Conflict and consensus. The observations indicate that conflicts lists were mostly intellectual in nature (e.g., about whether to use the object-oriented paradigm), with the domain being intellectual rather than political; there were no turf wars. Later in the week there may have been some groupthink because of fatigue. On the other hand, there was one participant who was consistently argumentative. The facilitator indicated that she was annoyed at him. A comment in the questionnaire called some of the arguments trivial although another said that disagreements were constructive. The comments in the questionnaire indicate that the participants appreciated the contribution of GroupSystems for eliminating personality conflicts and reducing personal attacks. The facilitator lamented after the session that she didn’t do “group consensus.” It is very likely that she is referring to the mountain of text that the group created on GroupSystems which was left to be synthesized after the meeting with the inherent disagreements resolved.

The questionnaire results do not show a strong feeling about conflict one way or the other relative to other sessions.

Satisfaction. The questionnaire shows that the participants gave among the highest ratings to facilitation. They rated GroupSystems 3.5, the lowest of all E-JAD sessions. The agenda, which seemed to be more problematic in all qualitative data, did only slightly worse, 3.3, while the overall rating was 3.7. Overall they were only lukewarm about the whole session.

IS-User relations and bonding. This was inapplicable here because of the type of participants.

GroupSystems tools used and fit with task. Seventeen activities were assessed for fit in the questionnaire; of these four were traditional tools (although in this room nothing is traditional), and one CASE tool which falls in neither category. The GroupSystems tools were rated slightly higher than the traditional tools (4.14 compared to 3.9). In addition, there were clear trends by day. On days 1-2, the fit rating was low and it
increased markedly on the third day, when everyone seemed to think that the session became productive. The most successful tool by far was TC and the least was PF.

**Expectations.** Comments indicate some skepticism about the systems outcome. One commenter thought that the methodology (the output of the session) would not be adhered to. Another thought that the new methodology would be good. The questionnaire index of expectations ranks this session roughly in the middle in terms of expectations.

**Structure, agenda, discipline and the JAD index.** The lead analyst said that with a group of this caliber, one can't get too structured. This was verified by the questionnaire results, which indicate the lowest level of structure of all sessions (in a three-way tie).

Documentation discipline was taken care of largely by the GroupSystems tool TC.

Meeting time utilization: The net number of hours worked decreased during the course of the week. Overhead was not high: 30 minutes were spent up front in introductions and then a few minutes every day to explain agendas and discuss what restaurant to have lunch at. However, there was general acknowledgment (including the interviews) that the first two days of the session were wasted--including the unsuccessful attempt to use CASE during the session. Not surprisingly, the questionnaire results rank this session as the worst of all in terms of wasted time.

The length of time spent on each discrete step went down as the week progressed, from just over an hour on average on Monday to around 30 minutes by Thursday. Yet the feeling was that the quality of the work went up. In other words, each step took less time (in minutes) as the week progressed. Why? I suspect that the boundaries became well defined and that the initial problems with decomposition disappeared, leaving room for more productive tasks.

Analyzing the meeting along the two dimensions of structure: Task structure was weak. The only aspect of task structure used was not related to GroupSystems: the
implicit knowledge of decomposition logic that was used to define the deliverables. Process structure was strong, although the discipline seemed to be lacking. The facilitator was in control. There were well-defined tasks such as brainstorming on whiteboards or on EBS.

There was general dissatisfaction with the original agenda, which was tossed and replaced with a new one. This is a complaint that came up numerous times from all participants and from the facilitator.

The session was rated well on the JAD index in general and specifically on facilitation, the tools and the environment. The session was rated relatively poorly on goals (because they were not attainable) and with list-making, which was covered to some extent by the facilitator’s assistant.

*User Mental models.* This session had the highest increase in the mental model of the system as ranked by the users in the questionnaire (from 2.70 to 3.44). Given the length of the session, it should only be compared to other long sessions in this study.

*Other variables:*

*Session objectives and success of the session.* The session objectives were vaguely defined, unattainable, or at the very least not attained. Team-building was never initially stated (to me) as an objective of the session but was stated by both interviewees in post-session interviews as an objective. This was a case of an inadvertent by-product that everyone embraces as “planned.” At one point early Monday, the lead analyst said that the objective of the output was “to sell to management.” This never came up again.

*Planning, preparation and follow-up.* Preparation requirements of the participants were minimal and most did less than that. The facilitator had difficulties, by her own account, with meeting with the lead analyst/user and thus prepared an agenda that the facilitator was unhappy with.
A great deal of follow-up was needed for the session. The lead analyst estimated that it would take him a few weeks’ work to transfer all the text to Knowledgeware, which is what he had defined as his deliverable.

A.7 IBM-Leasing (IBM-L E-JAD)

This session was actually a series of E-JAD meetings conducted at IBM’s Decision Support Center in Bethesda using GroupSystems. The questionnaire data used in this study was given after 10 half-day sessions that took place over the course of 1.5 months. This session was the only one in this study that was not directly observed by the author.

The meetings dealt with a business re-engineering task. Leasing, one of IBM’s central support functions for its Marketing and Sales group, was chosen to be re-engineered. Leasing is a mammoth application that supports about one thousand branch offices per day and has major batch requirements every night. Hence this was not the design of a system per se, but rather of a set of organizational processes. The participants were not IS staff, with one exception. There were nine core people, with 10-11 showing up for each meeting and 17 participants in all involved at the various sessions. The participants scored highest of all sessions on the question which asked whether there was always a person in the session who knew the answers to the questions.

The GroupSystems facilitation was conducted by a UA facilitator with support of three other doctoral students who were involved in supporting the experimental tools.

Several experimental GroupSystems tools and approaches were used here, including Enterprise Analyzer (EA) and EnterpriseMatrix, a derivation of GroupMatrix.

Efficiency Measurable output are the 64 processes defined, which are at various levels of detail. These were done during only part of the sessions, over 17 hours.

Product
Completeness. Questionnaire ratings (Table A.4) show that these sessions ranked highest of all E-JAD sessions and second highest of all sessions.

Effectiveness

Innovation and creativity. Questionnaire results indicate high ratings for creativity, though not highest of all E-JAD sessions on creativity (Table A.8).

Equality of participation and influence. This session ranked well in the participants perception of equality. It came in best on perception of team resolution (INFLUENCE1) and of perception of each person’s contribution to the process (INFLUENCE3).

Conflict and consensus. Questionnaire results show that on the contentiousness index the session was rated in the middle of sessions. The interesting finding has to do with the other two measures of conflict. Although the participants were amongst the highest in ranking themselves as disagreeing with suggestions made by others, they rated the session among the best in terms of resolving disagreements in the sessions.

Satisfaction. The participants rated the 5 dimensions of satisfaction between 3.5 and 4.0, in the mid-range of scores of all sessions. This site rated worst on satisfaction with the facilitation.

Expectations. Questionnaire results show that expectations are highest among all E-JAD sessions.

Structure, agenda, discipline and the JAD index. Questionnaire results put this session in the middle in terms of its level of structure. The session was rated in the middle in terms of wasted time.

Other variables:

Session objectives and success of the session. The outputs of the session were two: brainstorming on how to change the process and a model of the enterprise needs.
A.8 IBM Master Product Inventory (IBM-MPI E-JAD)

The IBM-MPI was conducted at the Bethesda offices of IBM at the Decision Support Center using GroupSystems. The session was a day-long meeting. Master Product Inventory (MPI) is a subsystem that supports machines that are in the sales cycle. MPI is one of several subsystems that marketing personnel in the branches access during the sales cycle.

The stated objective of the session was modest: to get ideas from the users for "business justification." Another participant, who was instrumental in the session and was from the usability group, indicated that they wanted comments from the users on improving the screens. In practice these two goals coincided quite a bit.

The 9 users came from branches all over the US. They were all staff people with responsibilities that were largely administrative. There were two IS staff present who have full-time responsibility for MPI. In addition a user manager/liaison was present. The questionnaire indicates that none of them had been to JAD sessions before, although this group ranked the highest of all groups in average years of experience in their functional areas.

Facilitation was conducted by an experienced DSC facilitator. Only two GroupSystems tools were used but they were used repeatedly.

Session mood. Considering that most of the participants did not know each other before the meeting, little was done to warm them up: no coffee and donuts, no planned socializing. Assessment at the session indicates that the group had no spirit, told no jokes, were passive and timid.

Efficiency.

Measurable output was the 11 screens reviewed in 7.25 hours gross. Additionally,
during the 2:08 hours time on IO, 53 ideas were submitted on IO with 342 lines of text appended to them. All this comes to 1.5 screens per hour. The IO usage came to 161 lines per hour.

**Product**

Completeness. Since the objectives of the session were so limited, the interview answer was predictable: the lead analyst said, in post-session interview, that nothing was missing. The user manager said, though, that some creativity was missing. The observational assessment was that some more discussion should have been allocated for some items particularly after the vote. One of the participants commented that they were not addressing the larger problems in the system and its use. She mentioned MDQ (Market Driven Quality), a current IBM buzzword that focuses on quality goals.

Effectiveness

Innovation and creativity. The session did not lend itself to a great deal of creativity since it had to do with screen reviews. In eleven IO activities, only 53 ideas were submitted, an average of less five per screen, or less than one per person per screen. This is not a sign of unbound creativity even in a conservative estimate. The analyst sitting next to me did not see many new items on the lists which she hadn't seen before. In the post-session interview, the user manager said that she thought that some creativity was missing— that she got better responses in one-on-one interviews with the users when they did a site visit at a user site the month before. In other words, she perceived that something in the session was not conducive to creativity.

Questionnaire results point to a high level on the creativity index, tied for second place among the E-JAD sessions. Apparently the users perceived a higher level of creativity than did the manager or myself.

Equality of participation, influence. Observations and interviews indicate a very
uneven spread of expertise in the group, which led to an observed uneven spread of participation. Some of the participants spent their time reading others' comments on GroupSystems rather than participating by entering information. During verbal parts of the session, a few participants were very active, while other were never heard from. Only three were listed in the speaking tables. The speaking tables indicate that of 68 notations, GroupSystems had 57% of the time, IS staff 15%, the facilitator 10%, while the users verbally had the floor only 15% of the time. Presumably this indicates a good spread of participation since GroupSystems equalizes participation. Indeed, the questionnaire supported this observation. The participants rated themselves near the top in their perceptions of equality of influence.

Conflict and consensus. Most of the session revolved around the tools. No observations could be made about computer conflicts on the tools. Consensus, however could be measured: the concordance on the votes taken was generally low. Five votes were taken with the range of concordance\(^1\) from 0.11 to 0.74 with an average of 0.40. In reality some of these votes were not about real alternatives, they were about items which were "pie-in-the-sky." Additionally, as the post-session interview indicated, the ultimate resolution falls on the users' senior manager who was not even present. No attempt was made to bring the users to convergence on their rankings.

The participants rated the session medium to low on the three conflict measures coming in lowest of all sessions on one of the measures. This supports the observations that little attempt was made to draw out the conflicts, or resolve them in the sessions.

Some "issues" were raised verbally by the users, although they were not tracked. At least once, the user/manager squelched one of these issues by simply tabling it as "an issue." In post-session interview, she indicated that she "liked to work behind the scenes."

\(^1\)Kendall's coefficient of concordance is a measure of agreement with the maximum being 1.00 and the minimum being 0. The rule of thumb is that there is good agreement above 0.60.
Satisfaction. Satisfaction level was very high, ranging from 4.0 to 4.5, the highest of all sessions. It is not altogether clear why this session ranked highest on satisfaction.

IS-User relations and bonding. Interviews indicate a culture of distance from the users that prevailed in the meeting. The IS staff sat separately and ran the session. Some bonding was created at lunch and in a few hall conversations. The questionnaire results support these observations pointing to some positive feeling on the bonding index—putting this session in the middle on this measure.

Structure, agenda, discipline and the JAD index. Interviewees seemed to think it was “right” in terms of level of structure. Both key people were glad that it loosened up at the end with some the open questions and comments. Observational assessments indicate that the session could have used a bit more verbal discussion after each vote.

The questionnaire results indicate this session in the mid-range of sessions on this measure, with the average of 2.5 pointing more towards the “loose” end of the spectrum.

Documentation was largely taken care of by GroupSystems. In the verbal discussion, at the end of the session, private notes were taken without coordination or display.

Meeting time utilization: Observations indicate that with the format used, several participants had nothing to do during the use of IO because they had nothing to contribute. On a different note, there was overhead time required by the tools: training time (21 minutes) and idle time while the facilitator was operating GroupSystems (no estimate). These were not major problems though, and the questionnaire results support this assessment—rating the session tied for first in terms of least wasted time.

Agenda: The agenda was set and adhered to. The progression of tasks was good. The clarity of the task plus the tools enforced the pace.

The structure of most of the session was fairly rigid. The participants went through the following sequence 11 times: brief introduction to screen (3 minutes on average);
IO on that screen (11 minutes on average); and then vote and rank.

Analyzing the meeting along the two dimensions of structure: There was virtually no task structure. Process structure was strong: the agenda was well-defined. The tools were the central focus of the session with the facilitator in control.

The session was rated about average on the JAD index, particularly on facilitation, group discipline, agenda and goals and was rated somewhat poorly on list-making and choosing the right participants.

User Mental models. The participants indicated a good level on the mental model indices both before and after the session.

Other variables:

Session objectives and success of the session. As stated above, the objective was modest. The key interviewees rated it an 8 and 9 on a scale of ten. One was concerned with lack of response of some participants, and the other with lack of time for open dialogue.

Planning, preparation and follow-up. The planning was well done: the users received handouts with cover letters plus mock-ups of all planned screens that were to be discussed in the session. The lead analyst estimates that it will take 5-9 months to implement the suggestions that are deemed important and doable.

A.9 Greyhound Financial Corp.– Management Reporting (GFC-MR E-JAD)

The E-JAD on Management Reporting was conducted in the electronic meeting room in Scottsdale, AZ, using GroupSystems. This session included the CEO and the top two levels of management at GFC. Hence this session is atypical of the others in terms of the organizational level of its participants. The task was to define requirements for the
management reporting subsystem. The session was slated for a half day in the morning, followed by a lunch buffet.

The GroupSystems facilitation was conducted by a UA facilitator, while functional facilitation was split between the MIS Director and the lead analyst on the project. None of the facilitators had experience with JAD.

*Session mood.* This was an informal get-together of the managers and executives of the firm. Food and drinks were abundant at all times, as were hall conversations. Perhaps the happy-go-lucky mood was too much and accounted for a certain lax mood among many of the managers, who were ordered to the session by the CEO.

**Efficiency**

Measurable output were outputs from the GroupSystems tools: The participants produced 500 lines of text in 135 paragraphs on TC for 11 topics in 40 minutes of work. This works out to 757 lines of text per hour.

**Product**

*Completeness.* The principal user, in the post session interview, said that the output was 80% complete, with the remaining percentage absent because of lack of closure. The observational assessment was that although the objectives and instructions were clearly stated, they were not communicated well to the users and that the users were not pushed. As a result, they did not produce at the maximum that they could. This was not borne out by the questionnaire which showed the participants' assessment of completeness (3.25) to be about on par with the rest of the sessions, although there was a high degree of variance in their answers (An S.D. of 1.24 for 13 who answered the question).

**Effectiveness**

*Innovation and creativity.* This was a session that *did* lend itself to creativity and
innovation— the session with the most senior participants in this study. The one 40-minute period of discussion was essentially a very high-level brainstorming in which the CEO spoke most often. The reason for this discussion was probably the stimuli that came just before it— the presentation of a sophisticated EIS.

On the other hand, the EBS sessions were relatively unsuccessful in eliciting creativity, lasting only 6, 9 and 4 minutes. Some of the comments were sophomoric. It seems that after fostering a creative mood, the switch to EBS may not have been successful. The number of item submissions was 69, 64 and 23, respectively, with the length of comments becoming very short over time and the number of purposely silly items increasing over time. Compare this with a typical EBS session of 20 participants which lasts 30 minutes and generates 1000 lines of comments (approx. 300 items).\(^2\)

The lead analyst took the output and filtered out what she called “new requirements.” She noted that EBS “did not provide many feasible new requirements.” 17% of all EBS comments were categorized as new. This is the figure before consolidation. Examination of the output reveals that perhaps a third (i.e., 6%) would remain after eliminating redundancies. The analyst saw the TC output as more successful: after consolidating the items, some 8% of were defined as new requirements by the analyst.

The questionnaire creativity index for this session was the lowest of all sessions in the study (although the variance was the highest of all sessions). This supports some of the qualitative observations.

\textit{Equality of participation, influence}. Most of the session took place on the GroupSystems tools, but there was one short period of discussion. Observations indicate that the active discussants were the CEO (the most senior person there), and two user/managers. Most of the other 20-odd people did not contribute. This changed during the electronic

\(^2\)private conversation with AR Dennis.
tasks. The participants ranked themselves fairly high on equality of contribution, although, as a whole, they thought that their individual contributions were insignificant (INFLUENCE3).

The lead analyst indicated that one of her main reasons for conducting an E-JAD was that the tools benefit the group because the CEO has an overpowering personality.

**Conflict and consensus.** Observations do not show conflict: most of the session was on the GroupSystems tools. A post-session interview with the principal user indicates that he recognized that there were items for which there was no closure and he saw this as a drawback. There was text from the tools that “someone will have to take back to the office and mull over.” Curiously, the Director of MIS indicated in pre-session interviews that there was little need for closure in this session (and hence there was little use for ranking, or voting). Questionnaire results support the interviewee observation: this session ranked highest on the contentiousness index and highest on the ranking of disagreements being set aside without resolution (CONFLICT2), as well as among the highest on the third conflict measure (CONFLICT1). There were apparently a great deal of hidden disagreements in the text of GroupSystems which did not surface verbally and were not addressed– or brought to “closure.”

**Satisfaction** was adequate ranging from 3.67 to 4.21. Surprisingly, the highest rating was given to the facilitator who was really a minor part of the session.

**IS-user relations and bonding.** Although interviews indicate that IS has good relations with some users and poor relations with others, it wasn’t clear how this session affected relations.

**Expectations.** Expectations were fairly high in the questionnaire index, scoring a 4.11 out of 5.00.

**Structure, agenda, discipline and the JAD index.** The session was highly structured
in that every task was carefully defined in the agenda and adhered to. The executive interviewed thought that the structure was "just right." The questionnaire results rank this session as the second highest of all sessions in terms of structure, which supports the qualitative findings.

Documentation discipline was handled by the GroupSystems tools, except for verbal discussions which were not captured.

Time utilization was mixed. The net work time was low because of frequent breaks and a low attention span of the participants. In an interview, one of the senior executives thought the meeting utilized the managers' time fully. Questionnaire results put this session in the mid-range of participant's perception of wasted time.

Analyzing the meeting along the two dimensions of structure: Task structure was non-existent, while process structure was strong in that specific models were used: brainstorming and implicit decomposition through TC.

This session was rated high on the JAD index—doing well in: agenda setting, in selecting the appropriate participants, and support of top management. It was rated relatively poorly on the dimensions of facilitation and on the problem-solving atmosphere.

*GroupSystems tools used and fit with task.* Observations in the session and a reading of the output shows that the EBS tasks were not successful, with comments being very brief and sometimes silly. The three EBS tasks were unusually short in time.

Interestingly, the users rated the fit of the EBS task slightly higher than that of the TC task. Also noteworthy is that one IS professional who sat down with the users to fill out the questionnaire rated both the tools as a (perfect) 5.0 while the users rated them on average below 4.0—this difference in opinions is greater than 80% of the cases of IS-user comparisons.

*User mental models.* This session had the greatest fall in the user mental models as
rated by MMB relative to the mental model index (from 3.26 to 2.75). Why? Probably because of the flood of information with no clear resolution to any of it.

Other variables

Session objectives and success of the session. The objectives were clearly defined in the session memo, but not clearly articulated and motivated in the session itself. The executive interviewed said that the text that he saw did not follow the stated objectives.

The lead analyst stated the criterion for success very clearly in the pre-session interview: that there be "new" items in the text which the analysts had not heard of previously. Midways through the session, she saw quite a lot of new information, by her account. The participants felt differently: in hallway conversation some of the users said that there was very little that was new in the output. The executive interviewed didn't think the session was completely successful because closure was not reached. Perhaps they were all right: the users have seen all this before somewhere, but for IS this was new. The post-session filtering and analysis of GroupSystems output (both EBS and TC) indicated that both provided new requirements not previously known to the analysts (between six and eight percent of the items were new).

Planning, preparation and follow-up. Planning and preparation seemed to have been done well with the two key IS staff coming to a planning meeting with the facilitator and this author. The memo sent out for the session was well-prepared.

A.10 ARMY-TRAVISS E-JAD

The Army TRAVISS E-JAD session was conducted at the University of Arizona electronic meeting room. The session lasted four and half days. TRAVISS will be an application that will support the installation training and visual aids activities; hence it is a large record-keeping and inventory system. The DSS aspects of the system are minor.
The stated objective of the session was to complete the "Functional Description" (i.e., the requirements document). The unusual aspect of this session— as in the other Army project— is the division of much of the activities into small groups. Nineteen hours, or more than half of the work time, were given over to four small groups of four to five participants each.

The 21 users came from many Army installations. Less than half had in-depth expertise on the application at hand. Yet the questionnaire results indicate a high level of experience in their respective functional areas. Some of the participants were actually IS staff at the different installations who were supporting the current version of TRAVISS. Yet they were invited in as users. One comment in the questionnaire indicates the sentiment: "there were no actual users here." The participants recognized that the right people were not at the session, scoring the worst rating of all sessions on this measure.

Facilitation was conducted by one of the UA facilitators with considerable experience. He had worked with Army sessions of this kind several times before and had established a good rapport with the functional leader (lead analyst) from the Department of the Army.

Three experimental GroupSystems tools were used in this session (described under the heading tools). The group coordinators were willing to try any new tool or technique.

Session mood. The mood was one of warfare between two camps of four participants each from two competing organizations within the Army. Each one of these had developed their own version of TRAVISS over the years and both advocated their respective approaches. There was also a philosophic difference between a mainframe-centered approach and a micro-centered approach. The mood was further characterized by the very frequent comings and goings of the many participants who were smokers and who would walk out and chat on the balcony. This was very disruptive. There were several participants who did very little work— this was evident to others. The participants as a
whole recognized that many of them should not have been invited because of their lack of knowledge.

Efficiency.

Measurable output in the session was the size of the requirements document that was being created. The growth of the document in kilobytes is shown in Figure A.1 and indicates the document more than doubled in size over the course of the session. Much of the work, though, involved rewriting existing text (no estimate is available for the breakdown of effort on change versus additions). The number of medium- and low-level processes were 90 by the end of the session, with a growth of 80 processes (through decomposition) during the session. The other identifiable output was the number of sections in the EA database tool shown in Figure A.2. These more than doubled from their original level over the course of the session.

The hours worked on the document are computed as gross hours (4.5 days in 8-hour day units) less some non-related units of time (in this case the introduction, the issues and the closing, which total 10 hours). So the hours devoted to the document are 26 hours. The growth of the document of 165 Kbytes yields 6346 Kbytes of data per/hour which is approximately 145 lines of text per hour. One of the analysts noted that the session was successful at speeding up the entire documentation process.

Product

Completeness. Post-session interviews indicated that session output was not complete. One of the users indicated that the output is only 50% complete because two topics were missing: financials and communications. One of the analysts said that the output was not complete because treatment of a certain section was not done, and system data and data elements were not complete. This analyst took the objective of the session as stated and expected all six sections of the document to be complete with the exception of wordsmithing. Another analyst lamented the lack of graphics tools in the session, seeing
that as the major missing component. A textual comment supports this: “The group never came to grips with the overall picture of the required functions.” Another said, “I am fairly confident that this area needs a lot of work.” Two analysts follow-up on the document—spending about four and ten days respectively on finalizing the document. One of the analysts said that she spent some of the time synthesizing/consolidating the decomposed descriptions of the users.

The questionnaire data also showed concern with completeness. While the users rated the session as 2.93 on this measure, the four IS personnel, who presumably had a better feel for exactly what completeness means, rated the session as 2.5 on the scale—a fairly low score.

The textual comments of the questionnaire, as well as the interviews, suggest that there was also concern about the level of detail. One user said that the detail was sufficient except for wordsmithing, while one analyst said that the detail was insufficient because of lack of user understanding.

There are several reasons for the performance on completeness. From a managerial perspective there was no one who was truly in charge of results. The lead analyst was concerned with achieving the deadline, not with the content. From a procedural perspective, the Army was using the traditional approach of the very segregated waterfall model. The FD document is to be put out for a bid and the contractors will need to deal with the omissions in later stages. Additionally, mention was made several times that these contractors were to build a rapid prototype, and in the process discover the missing requirements and the errors. In summary, the entire set of incentives related to this project weakened any drive for completeness.

Effectiveness

_Innovation and creativity._ The main (unstated) goal was completeness, not creativity.
The group was asked to write a dry specifications document from a “strawman.” Questionnaire results show that the participants did feel the session helped them be creative (3.61), though this was on the lower end of the scale relative to other sessions.

Equality of participation, influence. Observations, interviews and textual comments on the questionnaire indicate a very uneven spread of expertise in the group, which led to an observed uneven spread of participation and influence (and this is supported by the questionnaire results). Comments on the questionnaire indicate that the proponents of the various competing systems had much greater influence than the neutral participants. Observations were made on the half day treatment of issues (which occurred on Day 4), which was done in the large group format. Here participation was also skewed. Though 16 of 21 participants made at least one comment (of the issues observed), four of the users were very active in both the discussion and the resolution of the issues. One participant helped resolve 13 of the 26 issues noted as resolved. Two other participants were also very active in issue resolution. Interestingly, the IS staff played a relatively minor role in both the discussions and the resolutions. As in the other E-JAD sessions, equality of contribution with GroupSystems could not be monitored.

Conflict and consensus. This was by far the most contentious session observed, with several of the participants in two clear camps, or what the Army called “system proponents.” One non-camp participant called the meeting “vicious.” During small group work, some of the potential conflicts were mitigated by splitting the four proponents of each camp into the four small groups so that no coalitions could form. The small groups were told to solve issues by consensus. In general, this was successful. Questionnaire results were extremely surprising, relative to other sessions. This one did not rank highest on any of the three conflict measures, although it was near the high end on all. Perhaps the participants had, by the end of the week, taken for granted their disagreements.

The half day allocated to issue surfacing and resolution was viewed positively (e.g.,
"the results were more useful"). The issues were handled very quickly. Of the 41 issues tracked, the average handling of each issue was 3.4 minutes with only three that lasted for ten minutes or more of discussion.

There were a few cases of "electronic duels" noted. Because of the nature of the tools, where the last entry stays, with no read/write controls, individuals and teams made change decisions without consulting the other party. Occasionally, the other party would see their work changed and change it back. Such duels were minimized, however, because the document sections were allocated by the facilitator.

Satisfaction. Written and verbal comments indicate a general satisfaction with Group-Systems and with the environment, but there was a low satisfaction level with the process, the organization, matching tools to achieve goals and the overall approach. One participant commented: "the problem was not the tools but the process itself."

Satisfaction ranged from 3.36 to 4.43, with the lowest of the marks given to the agenda and the output of the session. The facilitator received the highest level of satisfaction. The IS personnel were much less satisfied—scoring 0.36 to 0.96 less than the users on the five measures of satisfaction with the session.

IS-User relations and bonding. During a week-long session in which both sides rolled up their sleeves and worked together in the same room for many hours in the day and then socialized with each other in the evening, there were many opportunities for creating bonds and trust. Observations suggest that this was particularly useful to the analysts who had a chance to learn from the users. One of the analysts noted that the team-building worked well.

Questionnaire results rank this session in the mid-range on the BONDING index relative to the other sessions in the study. Interestingly, the IS personnel ranked their relationships with the users much higher in the Bonding index: 4.00 as compared to the users’ 3.22.
GroupSystems tools used and fit with task. Traditional GroupSystems tools (IO, EBS, VO) were used for only a small part of the session, and only for what was, in fact a minor part of the product.

Three prototype tools were used in the session: a) Enterprise Analyzer (EA), a database tool designed to support textual process descriptions. The tool was modified slightly from its previous use for this session. The FD flat file was chunked up and imported into EA. The basic structure was: ProcessNo (key), Name, Description. A custom menu served as the user interface; b) The ProtoEditor (PE) was created ad-hoc by one of the UA doctoral students. It allowed multi-user access to a textual document. It worked well, but had limited editing capabilities. One of the analysts was most enthusiastic about this, as it allowed her group to get into momentum on their work; c) EnterpriseMatrix is a modification of the GroupMatrix (GM) and has been used in a number of previous sessions.

The lead analyst discouraged decomposition in the planning and the facilitator asked the participants not to decompose lower than the third level of decomposition. Yet, there was a great deal of decomposition in this meeting. On the day of working on the EA database, approximately 50 new processes were created.

Expectations. Questionnaire results place this session among the lowest on the expectations question index. This is not surprising given the problems in the session.

Structure, agenda, discipline and the JAD index. As in other categories this variable was dominated by guerrilla warfare. Analyzing the meeting along the two dimensions of structure: The process structure was weak because of a lack of a clear agenda. The agenda was changed frequently, surprising some participants. The facilitator was well-respected, but maintained weak control. The natural agenda imposed by the GroupSystems tools did not exist because much of the session revolved around self-managed small groups. The task structure was virtually non-existent because no framework or
model was introduced during most of the session. The questionnaire results indicate a medium assessment of structure (2.69).

Written comments indicate some dissatisfaction with the agenda— that it was unclear and not strictly followed. There were many ad hoc changes throughout the week. Questionnaire results indicated this session was among the lowest in terms of satisfaction with the agenda.

Documentation discipline was taken care of by GroupSystems. The verbal parts of the sessions, though, were largely uncaptured, except for the issues discussion, which was partially captured by the facilitator. Verbal discussion discipline was difficult because of the contentiousness.

This session was rated worst of all sessions on the JAD index. The session was rated poorly, as discussed elsewhere, in the criteria of group discipline, problem-solving atmosphere and choosing the appropriate participants all of which are weighted heavily.

Meeting time utilization. At various points, there were many people not working. Net work during the 4.5 day session was 30 hours. Of this, almost three hours was overhead, while small group work was erratic with group discipline poor. The participants rated wasted time on the questionnaire in the middle of the range of all sessions: unanimously giving it a 4.0. The IS personnel were a lot more critical, rating the session as a 3.0 on the time-util scale. That means that on average they felt that 21-40% of the session was wasted.

_user mental models_. The users had a good set of mental models of the system both before and after the session.

Other variables:

Session objectives and success of the session. The objective of the meeting was very clearly stated: to complete the "FD." Furthermore the document had to conform to DOD
standard 7530A, a standard specifically created for writing requirements documents. But this was still ambiguous (what degree of detail does the FD need to be?, should it be complete at the end of the week, or after the analysts toil over it some more? There were no clear answers), and open to criticism (One of the analysts stated that the objectives were wrong to begin with). Additionally, one of the analysts indicated that the objective was not communicated properly to the users.

Three interviewees responded about the degree of success (on a scale of 1 to 10) of the meeting: one user rated the meeting a 7 because the right people were not there. One analyst rated it a 7 because of “unpreparedness.” Two analysts interviewed both rated it a 4; the first blamed poor planning while the other complained that the FD is not complete.

Planning, preparation and follow-up. The weakest part of the planning process was the composition of the group, which as discussed, was inappropriate. Furthermore, some the participants did not bring all the reference materials. The major planning session took place the afternoon before the session began. The main decision-makers were the facilitator and the lead analyst. One of the participants summed up the meeting with the 6Ps; “Prior planning prevents piss poor performance.” Some of the textual comments also mentioned the weak planning.

Follow-up: The textual output of the session was taken by the the analysts on diskette back to their home offices. The analysts spent the next week reformatting the text back into WordPerfect format. None of the user participants were tasked with follow-up.

A.11 ARMY-MASCHACT E-JAD

The Army MASCHACT (Master Schedule of Activities) E-JAD session was conducted at the University of Arizona electronic meeting room. The session lasted three days.
MASCHACT will be an application that will support events and resource scheduling inside Army installations and across installations, hence it is a sophisticated calendaring system. The stated objective of the session was to complete the “Functional Description” (i.e., the requirements document). As in the previous Army session one month before, the participants were split into small groups: 12 hours of the session were spent in small group work, which represents more than half of the net working time.

The 7 users came from several Army installations. As in the previous session, there were some problems with selecting appropriate users. Knowledge was also skewed. The participants in this group came in last of all sessions on the measure of years of experience in their current functions.

Facilitation was conducted by the same UA facilitator as the previous session. The functional leader (lead analyst) from the Department of the Army was also the same as last time. This time, though, one of the consultants with training in a JAD-like technique called FAST co-facilitated the session.

Another unusual twist in this project is that some, but not all, users were taken to a consulting company in Denver the week prior to the UA session, where they were steered through a rapid prototyping methodology of development. In other words, in the E-JAD session covered, they were being asked to backtrack in the SDLC.

Session mood. In contrast to the previous session, the mood was friendly and business-like.

Efficiency

Measurable output in the session was the size of the requirements document that was being created. The growth of the document in kilobytes is shown in Figure A.3 and indicates the document almost doubled in size over the course of the session. Much of the work, though, involved rewriting existing text (no estimate is available for the
breakdown of effort on change versus additions). The number of pages grew from 38 at the start to 91 by the end of the session—this is more than double. The number of medium- and low-level processes was 37 at the end of the session. The number of processes actually decreased as empty process shells previously defined as strawmen were consolidated.

The hours worked on the document are computed as gross hours (3 days in 8-hour day units), less some non-related units of time (in this case the introduction, the issues and the closing, which total 7:20). So the hours devoted to the document are 16.66 hours. The growth of the document of 53 pages of text yields 3.2 pages per hour which is approximately 210 lines of text per hour.

Product

Completeness. In post-session interviews, one user indicated that not all issues were resolved. His assessment of completeness was 85% because there were some decisions that the participants simply couldn’t resolve. Another analyst said that the output was 65% complete at the end of the session and 85% with a few more days of her time. Written comments also question completeness: one attributed it to lack of all knowledgeable participants being present, while another essentially said the approach should have been different.

There were some differences regarding perception of the level of detail achieved. The principal user interviewed thought that for his needs, the level of detail was just right, while an analyst said that the level of detail was not enough to fulfill the most detailed section. Questionnaire results ranked this session as the lowest of all sessions on this measure. This is a bit surprising, considering that the previous Army session probably fared no better.

Some of the completeness issues are common to the previous Army session. Please see discussion there regarding managerial perspectives.
Effectiveness:

Innovation and creativity. The main (unstated) goal of the session was completeness, not creativity. The group was asked to write a dry specifications document from a strawman. There was one comment in the questionnaire that praised the ability to brainstorm on GroupSystems. This session was rated the highest of all sessions on the creativity index of the questionnaire, far ahead of the other E-JAD sessions. This is somewhat surprising given the qualitative observations of this and other sessions on the construct of creativity. Perhaps it was the GroupSystems tools which created the perception of creativity.

Equality of participation, influence. Observations indicate that there were some vocal and dominating people which probably stemmed from an uneven spread of expertise. One of the principal users concurred with the observation in the interview. He also suggested that rank played a role in equality and influence. (There were was one Colonel and one Lt. Colonel and the rest were lower ranked). Two comments in the questionnaire spoke of uneven influence during the session, the first because of experience and the second because some participants had been to the rapid prototyping session, while some had not. The three measures of equality of influence were not conclusive, although INFLUENCE1 indicates that the respondents perceived their resolutions to be team resolutions and scored best on that measure relative to other sessions in the study.

Of the 12 notations that were made in the speaking table, 60% were those of either one of the two facilitators, while the other 40% were one of two officers. One user interviewed suggested that only some of the users “really care about this system” (which they will have to deal with), while others are only indirectly invested in its success. Another participant, though, pointed out that no one felt stifled in the session.

Conflict and consensus. As opposed to the other Army session only a few weeks before, this one was amicable. On the last day of the session there was one half day
devoted to issue discovery, discussion and resolution (as in the previous session) using
the IO tool. Both post-session interviews referred to this activity and commented that it
was useful and that it went well. The user interviewee liked the IO feature of anonymity
because it "lowers the cost of expressing oneself." In fact, the fit question gave this
activity a perfect 5.0— the highest ranking of all tasks in all sessions.

Observations indicate that one of the thorniest issues in the session was scope. This
was an area in which problems came up again and again. The facilitator resolved these
questions in favor of a limited scope, although he did not have full authority to do so.
Questionnaire results for all three conflict measures were at the middle of the range
relative to other sessions, generally pointing to a low level of conflict.

Satisfaction. Observations and interviews indicate a good level of satisfaction with
the session in all respects. Questionnaire results in this area were unusual. The partici-
pants gave very high rankings on satisfaction with the agenda, with GroupSystems and
with facilitation. On all three of these the results are the highest of all sessions. On
the other hand, satisfaction with the output was the lowest of all sessions (although the
variance is largest), and the overall satisfaction is the second lowest. This type of result
is difficult to explain. It may indicate that the lessons learned from past sessions have
begun to come to fruition by combining traditional JAD techniques (through outside
facilitation) in the E-JAD environment. On the other hand, the participants still sensed
that their work was not done.

IS-User relations and bonding. Some of the users had been working together since
the prototyping session of the previous week and this created familiarity. The participants
rated the session high on the bonding index— highest of all E-JAD sessions.

Expectations. This session scored lowest on the questionnaire expectations index.

Structure, agenda, discipline and the JAD index. There were no significant complaints
about structure. Some interview comments mentioned some weaknesses: e.g., the fall
in productivity on the day in which there was only small group work. Questionnaire results rated the session in the middle of all the sessions with a 2.80 average on the structure measure.

The session was rated about average on the JAD index. The weaknesses lay in choosing the appropriate participants and support of management, which are closely related. Another area of weakness is the JAD techniques of lists and total documentation, neither of which were executed fully in this session.

Meeting time utilization: The interviews indicated good use of time. Some exceptions noted included waiting for the tool to be fixed; the last few hours of the last day in which participants worked at a slow pace; and unnecessary tasks (e.g., CSFs). Questionnaire results rank this session as second best of all sessions in terms of perception of time well used.

GroupSystems tools used and fit with task. Tool use almost replicated the previous Army session. Much of the work was done on a much improved ProtoEditor, an experimental tool, which is a multi-user editor on a Pascal platform that allows for version control, locking, and several levels of security. It is very easy to use, but it is not a full word processor. It also broke once, requiring the participants to wait. One of analysts commented that, on the whole, she would have preferred working directly in WordPerfect because it saves her conversion work.

Whereas in the previous session, the participants decomposed frequently, this time there was a technical constraint on introducing a new section (e.g., a new process) in the ProtoEditor. This did not constrain the participants though, who continued to decompose in small groups, but kept the new sub-processes in the same text file.

User Mental models. Somewhat surprisingly this session scored the highest on both MMB and on the mental model index measure, which means that they thought they have a very good picture of the future system both before and after the session. Perhaps
some of this had to do with the prototyping session that some participants went through a week before.

Other variables

Session objectives and success of the session. General consensus among the participants was that the objectives were clearly stated and that they were met during the session.

In the interviews, the participants were asked to rank the success of the session on a scale of one to ten. One of the users rated it an 8 because part of the functionality that he needs for the FD was determined to be out of scope. One of the analysts rated it 7 because they were two days behind schedule.

Planning, preparation and follow-up. Observations show that in the planning meeting (the day before the session), the agenda changed significantly from the draft. This may reflect a lack of adequate planning.

Follow-up: two of the participants stayed an extra two days and worked full-time on converting and augmenting the FD output into a word processor format.
Figure A.1: TRAVISS Session: Growth in document size
Figure A.2: TRAVISS Session: Growth in document sections
Figure A.3: MASCHACT Session: Growth in document size
Table A.2: Survey data by session. Question 4. Number of years in the department. 1= none, 2= 1 to 2 years, 3= 3 to 5 years.

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Table A.3: Survey data by session. Expectations Index. 5=highest

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Table A.2: Survey data by session. Question 4. Number of years in the department. 1= none, 2= 1 to 2 years, 3= 3 to 5 years.
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Table A.4: Survey data by session. Question 7: Completeness. 5=highest.

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Table A.5: Survey data by session. Question 8: Mental model before the session began (MMB). 5=highest.
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Table A.6: Survey data by session. Mental Model Index: 5=highest

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Table A.7: Survey data by session. Bonding Index: 5=highest
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<td>.63</td>
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<td>.41</td>
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<td>0</td>
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Table A.8: Survey data by session. Creativity Index. 5=highest

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<td>.75</td>
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<td>.71</td>
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Table A.9: Survey data by session. Question 27: Structure. 5=highest
### Table A.10: Survey data by session. Question 20: Satisfaction overall (SATALL).

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<td>.67</td>
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5=highest

### Table A.11: Survey data by session. Question 21: Satisfaction with output (SATOUT).

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<td>4.00</td>
<td>.00</td>
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<td>3.70</td>
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<tr>
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</tr>
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<td>1</td>
<td>3.60</td>
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<td>3.78</td>
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5=highest
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<th>Mean</th>
<th>Standard Deviation</th>
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<td></td>
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Table A.13: Survey data by session. Question 23: Satisfaction with Agenda (SATAG). 5=highest.
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<td>MCD T-JAD</td>
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<td>3.67</td>
<td>.58</td>
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<td>.84</td>
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Table A.14: Survey data by session. Question 24: Satisfaction with Facilitation (SATF). 5=highest.

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Table A.15: Survey data by session. Contentiousness Index: 5=highest.
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<td>2.60</td>
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</table>

Table A.16: Survey data by session. Question 30: I personally disagreed with [items] that the group came up with (CONFLICT1). 5=all the time.

<table>
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<td>2.00</td>
<td>.63</td>
</tr>
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<td>.00</td>
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Table A.17: Survey data by session. Question 31: Disagreements were resolved? (CONFLICT2). 5=never.
### Table A.18: Survey data by session. Question 32: Resolution (INFLUENCE1). 1=Team, 2=1 to 2 dominate.

<table>
<thead>
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<td>IBM-DB E-JAD</td>
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<td>1.20</td>
<td>.45</td>
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<tr>
<td>IBM-MPI E-JAD</td>
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<td>1</td>
<td>1.20</td>
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### Table A.19: Survey data by session. Question 33: Did everyone contribute equally? (INFLUENCE2). 5=very unequal

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<th>Standard Deviation</th>
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<td>3.13</td>
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<tr>
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<td>3.00</td>
<td>.63</td>
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### Table A.20: Survey data by session. Question 34: My own role was (INFLUENCE3).

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Table A.21: Survey data by session. Question 35: Preparation time. 1=none.

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Table A.22: Survey data by session. Question 36: Follow-up time. 1=none.

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<td>.82</td>
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Table A.23: Survey data by session. Question 39: Percent of time wasted (TIMEUTIL). 5=zero percent, 4=1 to 20 percent.

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<td>.41</td>
</tr>
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<td>.71</td>
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APPENDIX B

GROUPSYSTEMS

This appendix covers several topics under the rubric of GroupSystems in greater detail than that addressed in the body of the manuscript: 1) History of GroupSystems 2) Description of the GroupSystems tools, 3) Cost of electronic sessions.

B.1 From Plexsys to GroupSystems to E-JAD: a history

Plexsys was the name of the University of Arizona electronic meeting system before it became known as the University of Arizona GroupSystems. The following history of Plexsys is largely abridged from Nunamaker, George, Valacich, Dennis, and Vogel (1989a).

The underlying concept for PLEXSYS had its beginning in 1965 with the development of Problem Statement Definition/Problem Statement Analyzer (PSL/PSA) as part of the ISDOS project at Case Institute of Technology. The PSL/PSA process started with the assumption that the requirements were known, or that the individual (or group) responsible for the systems building project was capable of stating the requirements. There was no emphasis on developing an organizational consensus on the “correct” set of requirements, because at the time, it was assumed that the systems analyst was in charge and would be able to satisfactorily define the systems requirements by consulting with the user. The concept of making the user responsible for requirements analysis did not develop for another ten years.
The collective wisdom of the ISDOS project at the time was to focus on methods to build a system starting with "the assumption of correct requirements." Each task of the life cycle was envisioned being automated. A team of graduate students under the direction of Professor Daniel Teichrow at Case Institute of Technology developed this conceptual approach which evolved into PSL/PSA and later, into Plexsys. Plexsys is derived from the word plexus defined as an interwoven combination of parts in a structured system. The sys is short for system. PSL/PSA was later used by over 100 organizations to document and analyze their IS requirements.

PSL/PSA is a tool used to describe systems requirements in machine readable form. The requirements are expressed in a formal language called PSL. As the PSL statements are entered into the database, PSA analyzes them for correctness, completeness, and consistency with data and information already present in the database. PSA produces a set of reports representing the combined view of many analysts. These reports describe the inputs, outputs and system flow, structure, data derivations, size, volume, and dynamics.

In the early 70s, two doctoral students at Purdue, Blosser and Konsynski, added procedural definitions to PSL to support automatic code generation from PSL/PSA. In parallel, Nunamaker, who was involved in the project that led to PSL/PSA from its inception, created an interface to SODA (systems optimization and design algorithm) from the PSL.

Nunamaker and Konsynski moved to Arizona in 1974. There, a change occurred in their thinking. During work with PSL/PSA/SODA with the US Navy, they discovered that end users had problems defining a system using a formal language. The Navy people would not write their needs in PSL, and instead, hired consultants to sit with the end users and write their requirements. These findings led to the Plexsys concept: a stage should be created before the PSL/PSA stages to assist users in determining requirements.

Nunamaker and Konsynski found that many of the groups they worked with were
steering committees of size 10-20 people. Therefore, it became clear that requirements elicitation needed a special meeting room. The meeting room would be set up with workstations to capture and store requirements, system flows, and data structures. Special tools would be needed to support this kind of meeting.

In 1985, the first computer assisted group meeting facility was opened at the University of Arizona (UA). The Plexcenter, as it was then called, is a large U shaped conference table with 16 networked PCs. The software that supported it, developed by UA students, faculty and staff was called Plexsys. The tools used at the time included: brainstorming, issue analysis, voting, stakeholder identification, and assumption surfacing. During the first 18 months of its operation it was discovered that the Plexsys system was useful for general planning activities. The domain of the system broadened. The researchers quickly realized that such a system, which is now classified as an electronic meeting system (EMS), can support much more than merely requirements elicitation. For a number of years now, GroupSystems efforts have been devoted to planning, idea generation, communication, problem-solving and negotiation sessions (Nunamaker, et al., 1991b; Dennis, et al., 1990b).

In 1987, the second facility opened at UA with 24 workstations funded with a grant from IBM. In the meantime, an electronic meeting room was set up at an IBM manufacturing plant in Owego New York using the Plexsys software. Within three years, IBM had 35 electronic meeting rooms with Plexsys software (renamed to TeamFocus by IBM in 1990). In 1989, Nunamaker started a spin-off firm called Ventana Corporation, that markets group support software in Tucson. Its product became known as GroupSystems.

B.2 Tools

A brief description is given here for each of the GroupSystems tools (also see Table B.1). Some descriptions include additional descriptions of their potential use in JAD
### Table B.1: E-JAD: tools and status

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<td>current</td>
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<tr>
<td>Vote</td>
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<td>current</td>
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<td>SA</td>
<td>current</td>
</tr>
<tr>
<td>GroupWriter</td>
<td>GW</td>
<td>current</td>
</tr>
<tr>
<td>File Reader</td>
<td>FR</td>
<td>current</td>
</tr>
<tr>
<td>Alternative Evaluator</td>
<td>AE</td>
<td>current</td>
</tr>
<tr>
<td>Enterprise Analyzer</td>
<td>EA</td>
<td>prototype</td>
</tr>
<tr>
<td>ScreenPrototyper</td>
<td>SP</td>
<td>prototype</td>
</tr>
<tr>
<td>ProtoEditor</td>
<td>PE</td>
<td>prototype</td>
</tr>
<tr>
<td>GroupEditor</td>
<td>GE</td>
<td>prototype</td>
</tr>
</tbody>
</table>

Electronic Brainstorming (EBS). EBS is perhaps the best-known tool in the GroupSystems toolbox and has been shown in television documentaries and discussed in the computer popular press frequently. Much of the GroupSystems laboratory research is conducted on this tool. EBS takes the classic concept of brainstorming (Osborn, 1957) and sets it on the computer network. EBS is an idea generation tool in which participants enter comments anonymously and then the comments are randomly shared by the other participants. Each participant adds comments to one of several files circulating in the system.

Idea Organizer (IO). IO is used to create lists, comment on list items and consolidate lists into a workable set organized by category. While consolidation is often a slow process, it is a critical part of the sequence. The random items that emerge from EBS

sessions.
are organized into bins, or categories for further work.

Voting tool (VO). This tool is used to rank or vote on a list of items by order of importance, or on a yes/no scale. The ranking tool can be used to form consensus or to highlight differences of opinion that need to be resolved.

Topic Commenter (TC) and GroupOutliner (GO). TC and GO use the index card and hierarchical file metaphors to capture textual comments. The facilitator, with the help of the participants, defines a list of topics as labels for each of the cards/files. A participant selects a card and a window opens to enter text, or to see the text entered by others.

TC and GO are used in an E-JAD session to flesh out the details of the design—to capture the “design rationale” that is so critical at later stages. The cards can be functional areas, screens, reports, interfaces, or even pseudo-code calculations. While TC is slightly easier to use, it supports only one level of information organization. GroupOutliner supports a tree hierarchy of files which is extremely useful for JAD descriptions as the group decomposes functions into finer and finer granularity.

TC and GO can support multiple opinions about an item in question. In other words, the text captures and documents disagreements. The E-JAD facilitator can make clear certain conventions, specifically, how to voice a disagreement with a previous comment.

GO’s hierarchical structure, introduces a cognitive burden on the users: they must implicitly understand the decomposition process. Participants inexperienced in decomposition cannot determine if an item of information needs to be at a root or branch file (e.g., should it be level 2.2 or should it be level 2.2.4?). The users are also often unaware of the level of detail desired by the system designers. With a large information tree GO can become disorganized. These problems can be overcome with careful instructions by
the facilitator.

**File Reader (FR).** FR is a memory resident program that provides any participant with pop-up access to a database of text files. A library of documents is stored in this tool for ad-hoc access by the users. It can be used as the complete reference point for all pertinent documents relating to the session. Thus, output from previous sessions (e.g., EBS), supporting documents, and lists of various kinds can be updated continuously by the facilitator and stored on the File Reader. FR is now part of a set of utilities called Briefcase.

The JAD technique involves numerous lists: of open issues, assumptions, problems and definitions. Issues and other lists are usually kept on flip charts during JAD sessions. In an E-JAD, lists can be maintained on an editor in separate files, updated from the scribe’s station and updated on a frequent basis by the facilitator to File Reader.

**GroupWriter (GW).** GroupWriter is a multi-user document editor. Sections of the document can be locked by the user. GW also supports multi-user annotation. The annotation feature is borrowed from the hypertext arena and is built on the “Post-it note” metaphor. Each annotation appears as a footnote marker. GW is similar to the class of software commonly referred to as “authoring systems” which has been implemented for groups of professionals who need audited revisions of text (e.g., technical writers, lawyers).

The output of the JAD methodology is often a document, e.g., a requirements document, but it is unusual for participants in JAD sessions to work on writing documents. After the session the scribe and analysts synthesize the text, lists and notes that are produced to create a formal document. Group writing activities can now be supported using a collaborative tool such as GW.

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1The previous version of this tool is called GroupEditor.
GroupMatrix (GM). GM is a two-dimensional matrix created by the facilitator and distributed to all participants. The participant sees a screen much like that of a spreadsheet. GM is used to allow a group to develop consensus on a set of relationships between elements. Participants enter a value in each cell of interest and the group averages are displayed on the public screen. Color codes are used to show consensus and disagreements. GM is conceptually similar to some packages associated with Enterprise Modeling that appeared in the market recently. (Arando, 1991). Many of these tools are anchored around the matrix metaphor. The matrix metaphor has been used successfully for years by IBM as part of the BSP methodology.

GM can be used in E-JAD to establish relationships between data elements and processes, or between data elements and functions, etc. The matrix can also be used in E-JAD to group data elements into functional groups.

B.3 The economics of electronic meetings

Some of the cost calculations of Chapter 5, are based on actual costs incurred in electronic meeting rooms. The daily charge for a session: at the University of Arizona $1200 to $2000/day; at Ventana Corporation $1200/day; at IBM, for an outside customer, $7000/day. Session charges usually include the cost of facilitation and other miscellaneous support. IBM charges $45000 a year internally for supporting a Decision Support Center running GroupSystems. This does not include local direct costs.
PARTICIPATORY DESIGN

The spectrum in Figure 1.3 positions the JAD approach in the middle of the user involvement spectrum. There are stronger forms of user involvement that fall under the rubric of socio-technical systems (STS) design (Bostrom and Heinen, 1977) and its somewhat controversial cousin Participatory Design (PD) (Mumford, 1981; Greenbaum and Kyng, 1991).

STS design had some early influence on PD. STS design starts from a *Theory Y* assumption of human resources in which the individual employee is viewed as one who wants to contribute to the organization. STS design combines the social and technical requirements of the system. The social requirements include the following: job design objective, work organization objectives, individual role assumptions, responsibility assumptions, and organizational policies (Davis, 1982). STS design attempts to optimize the uniqueness of the organizations' technical requirements along with the values of the members into an environment of a high quality of work life (Bostrom and Heinen, 1977), whereas the traditional IS department adapts the social system to the technical system. Interestingly, the JAD and PD approaches of having users and designers work together is not emphasized.

The Scandinavian model of user involvement in systems design is called Participatory Design. The Scandinavian model is inherently a political one that advocates “industrial democracy” and “democratization of the workplace.” PD means that the workers (clerical, union-members) both *initiate* and *design* the computer systems they work with on a daily
basis. The workers can initiate new systems when they have unions representatives who operate within the social norms of Scandinavia; this is clearly not the case in North America. In Scandinavia there have been a number of non-trivial systems built using PD (Grudin, 1990; Ehn, et al., 1990), but examples seem limited.

The tenets of PD are (Czycswki, et al., 1990): 1) PD rejects the assumption that the goal of computerization is automation of human skills; 2) users themselves are in the best position to determine how to improve their work; 3) perceptions about technology are at least as important as technology itself; 4) computers must be viewed in context, not in isolation.

While JAD sessions are strongly structured, PD is virtually structureless since it rejects the engineering orientation that guides software development in North America. Many of the case studies that have been published about PD discuss some structure but much of it seems to be post-hoc. However, the PD approach is very creative in getting users involved in design through various techniques: storyboarding; theatre; metaphor-based design; cooperative prototyping (cf. Thorensen, 1990); mock-ups which might include cardboard cut-outs to suggest monitors. All of these use low tech props. In fact Bodeker, et al. (1990) in their workshop, emphasized that they like to use low-tech tools for design. This might be a point to reflect upon when considering the need for automation. The process though is ephemeral: it is not clear how ideas are translated into design, how prioritization is done or how other processes are conducted.

The gulf between the values that drive JAD and PD is large. At the PD-90 conference, which this author attended, the more militant proponents sneered at the American notions of "teamwork" and quality circles. They see these concepts as sorry attempts to compromise with PD which take from the employees without giving them anything in return.

It is noteworthy that the PD approach is thought to lengthen the design phase but
shorten the implementation phase. This finding is intuitively appealing, though—again—not verifiable. Contrast this claim with the typical claims of JAD which state that both the design and implementation phases are shortened. The value-added product that PD potentially offers is an even higher quality system that will be even more accepted by the user community.
APPENDIX D

JAD

This appendix is a potpourri of topics that fall under the rubric “the state of JAD” which were collected over the course of this study. They are:

1. JAD participant roles
2. JAD vendors: a brief survey
4. JAD in Israel
5. JAD and CASE: a brief discussion

D.1 JAD participant roles

The JAD roles were introduced in Chapter 1. JAD—like a play—tends to have distinct actors with well-defined roles. An understanding of the roles serves to elucidate JAD in general. This section is an amalgamation of numerous references and “cookbooks” on JAD (JAD, 1986; Guide, 1986; Wood and Silver, 1989; August, 1991).

- **Executive Sponsor.** The sponsor—a senior manager—defines the overall project purpose and direction. Decisions beyond the participants’ discretion and unresolved conflicts are taken to the sponsor. Most JAD methodologies strongly recommend that the sponsor kick-off the JAD session in order to serve as a motivating spirit.
Commitment by management is critical: The JAD prescription calls for a healthy
dose of executive awareness and commitment to the process (preferably both user
managers and IS managers, but especially the former). If this commitment is
non-existent or even lukewarm, then the output of the session will suffer.

- Users. Users are at the heart of the entire approach. They are the ultimate
owners of the systems, the people who will use these systems on a day-to-day
basis. The most knowledgeable users about the use of the system should be at
the session(s). Two rules of thumb are cited in the JAD sources (cf. Wood and
Silver, 1989): All areas of expertise related to the domain of the session must be
represented—there should never be a situation where an issue cannot be resolved
because there is lack of authority or expertise in the room. Second, the users that
attend the session should be those that the organization can least afford to have
away from the day-to-day operations and management. As the maxim goes: “If
you can’t afford to lose her for three days then that’s the person we want.”

There are significant philosophical differences about the desirable level of JAD
participants. The traditional JAD approach, as well as other methodologies, seems
to focus on middle managers—particularly those managers vested with some re-
sponsibility for the project. At the other extreme is the Participatory Design (PD)
school which calls for the low-level users, the operational staff (see Appendix C).

Whether one believes in the socio-technical/PD approach to JAD sessions or not, it
seems from several sessions which I have observed, that the low-level employees
are all too frequently overlooked as attendees. Frequently the meeting room is
filled with middle level managers and supervisors who are not able to go into the
detail of day-to-day operations (e.g., what 17 fields are needed to fill out form
A345).

The two rules of thumb described above are regularly violated in many cases
because of organizational constraints. It is difficult and often costly to bring
together everyone who really should be in the session. It is also difficult to anticipate a priori who are the experts required to support discussions. Both of these aspects are dependent on the abilities of facilitators to demand the right people and the executive sponsor, in turn, to pressure them to attend.

- **IS Personnel.** The IS staff, analysts, project managers, database personnel, and technical experts are often assigned to the project by the time the first JAD session is scheduled. There are considerable differences of opinion about whether they should participate in the JAD sessions. The IBM JAD approach suggests not to involve them in the session per se, for they will intimidate the users and shoot down good ideas. At most, some IS people can be allowed in the session but relegated to the status of an *observer*, one not allowed to speak.

Many of the newer approaches, though, emphasize the cooperative nature of development between IS and users—and the need to work as teams. In this scenario, IS personnel are involved in JAD sessions (cf. Martin, 1990c, 1990g; Tiger teams in PRI, 1990).

- **Facilitator/Session Leader.** The session is led by a neutral facilitator who, ideally, is trained in leading such meetings; and, in addition, is a member of neither the IS team nor the users. The facilitator should have training in group dynamics (or an instinctive flair), and in systems development methodologies. Today, training needs to include automated tools such as CASE. The facilitator is responsible for overseeing all activities and all details of the session: the agenda, the discussion, and documentation of the session results.

- **Scribe.** The scribe captures the proceedings of the session. The scribe's notes are used as the main source for requirements documents, design documents, etc. In some sessions two scribes are used.

There are different approaches to casting the scribe. The traditional approach in JAD is to use a secretary who can type/write quickly. There are problems with
this: ideally both application knowledge and system knowledge are needed to capture the essence of discussions as well as design decisions. Hence, in many cases junior analysts are given the role of scribe.

- Observers. Observers are passive participants with an interest in the meeting. According to the “group dynamics” rules, they are not allowed to participate. In some meeting rooms the observers can watch the session on video.

D.2 JAD Vendors

This section summarizes some of the offerings in the market in the area of JAD “methodology.” The information was gleaned from marketing literature and from FASC (1990).

One way to categorize these vendors is to distinguish between Information-driven (e.g., “The method”) versus process-driven (e.g., IBM traditional JAD); which correspond roughly to: information engineering versus software engineering, respectively.

The convention used in the summary below is firmname, [product name].

- Andersen Consulting, [CSTaR]. No information available.
- APLAN, [Odyssey]. (APLAN, 1990). This is a structured systems development technology which uses a JAD -like structured workshop as its core. Odyssey has software similar to GroupSystems’ EBS functions: in particular, a chauffeured version of brainstorming. An additional tool is one which “assembles hundreds of pages of documentation into a coherent report that is fully cross-referenced.”
- ATLIS/Performance Resource Inc (PRI), [The Method]. (PRI, 1990). The JAD session is part of an overall information engineering methodology. The Method fuses the three components: JAD, CASE and information engineering. JAD is termed Next Generation JAD. The firm differentiates it from the first generation IBM JAD as shown in Table D.1.
First Generation JAD | Next Generation JAD
--- | ---
Focus on process | Focus on data and process
Transaction oriented | Transaction and MIS/DSS
User participants | Tiger Teams of users and IS
Scribe | Design analyst
Word Processing | CASE
Application Level only | Enterprise Business Area,
applications levels
functional testing
new terminology
engineering approach to exercises

Table D.1: The generations of JAD (from ATLIS/PRI)

PRI runs an annual JAD/CASE users’ conference in which attendees share experiences of JAD and “The Method” techniques and share success stories.

- **Boeing Computer Services, [Consensus].** (Boeing Computer Services, 1990).
  This is an adaptation of the technique used by Boeing to design the 747 aircraft. It is not restricted to a particular industry or function. The focus in Consensus is on a “consensus team” of users, developers, experts, an arbitrator and facilitators. BCS has run hundreds of sessions using their methodology both inside Boeing and in other companies. They mention that CASE tools are used in the sessions where applicable.

This is a generic structured methodology that is not limited to a specific design technique (e.g., Entity Relationship) or a particular CASE tool. The methodology supports 3 major areas: planning, systems development, and management support (e.g., problem resolution). The workshop format includes the following steps: brainstorming, analyzing and organizing information, authoring, verifying (including resolution of conflicts and the publishing of minority opinions). The workshops are long and intense. Boeing prefers to have two facilitators running the sessions. The technology used: Vu-graphs, flip charts and CASE tool projections.
• Computer and Engineering Consultants [Rapid Analysis]. (Computer and Engineering Consultants, 1990). RA is structured around the “workshop” for requirements analysis. It uses IEW (a CASE tool) plus proprietary software. An interesting feature is the business area analysis sizing service to determine project size and number of Rapid sessions needed.

• D. Appleton Co. (DACOM), [RAP (Requirements Analysis Planning)]. (Appleton, 1990). The JAD-like sessions are called Team Management Techniques. They use the IDEF modeling technique popular in DOD development efforts. The consultants from DACOM play a very active role, and do not just facilitate. DACOM also specializes in conforming with CALS, a military standard for requirements tracking, which affects the rigor of requirements tracking. DACOM uses CASE-like tools called ModelPro for (data modeling on a PC), and IDEF/Leverage for the mainframe. They emphasize that their approach is data-driven.

• Digital Equipment Corporation (Europe), [TOPS and RAMS]. DEC Europe has developed two user-centered design session methodologies that it actively markets in Europe: TOPS and RAMS (see Tsafir and Monheit, 1990; DEC marketing literature; 1990). Both techniques heavily emphasize wall charting. TOPS uses a number of colorful wall charts and flip charts prepared from kits. Users roam around the room filling in wall charts. Currently, Mac-based software is being developed to support the graphics and charts used in sessions. These latter techniques were developed at DEC Israel.

• JAtec Design Systems, [4RAM]. was formed by the IBM initiator of JAD. The company has several trademarks and registered copyrights in the JAD area.

• M.G. Rush, [FAST]. If there is anyone who can be defined as somewhat of a folk hero in the JAD field it is probably this man, who has run his own one-man consulting firm for years and has been extremely successful. The FAST technique defines the “business system” first. Sessions with users are held throughout the
life cycle as necessary, e.g., for plans, structured analysis, transaction systems, DSS, test plans, and prototypes.

- **Software Productivity Services, Sweden.** (SPS, 1990). SPS conducts JAD-like sessions which they term “intensive sessions.”

- **The Strategic Advantage.** (Strategic Advantage, 1990). JAD-like sessions are one of the cornerstones of the firm’s methodology. They emphasize the impartiality of the facilitator. TSA has run dozens of sessions using their methodology.

- **Technology Transfer Institute.** This national mass-market IS seminar organizer runs 3-day seminars on JAD on a regular basis ($995).

- **WISDM.** Emphasizes the facilitated meeting management aspects and strategic planning with an understanding of the external environment. No automation tools are mentioned in their literature.

### D.3 JAD in Israel

JAD is a process-oriented approach and thus is greatly affected by culture and organizational norms.

Data for this chapter was collected from interviews conducted in Israel in December, 1990 and January, 1991. Discussions were conducted with managers and executives in key organizations in Israel: IBM-Israel, DEC-Israel, Israel Power Company (the monopoly energy provider), Israel Aircraft Industries (one of the largest firms in the country), Rafael (a defense firm), and El Al airlines.

In general, JAD-like methodologies are rare in Israel. Several factors are present which—relative to the environment in the US— inhibit acceptance of JAD in Israel:

- a culture of doing rather than planning.
• informal organizational communications patterns and informal work methods.
• reluctance to change old methods and procedures.
• high degree of politization in organizations.

All of these factors are present as obstacles in US organizations, but appear to be stronger in Israel.

IBM-Israel conducts JAD-like sessions for organizational strategy and IS-level strategy using elements of well known models such as the Porter model (see Lahmi, 1990). The use of the term JAD itself is non-existent. The sessions are not highly structured.

DEC-Israel seems to be somewhat of a leader within DEC-Europe in the introduction of novel JAD-like approaches called RAMS and TOPS (see Tsafrir and Monheit, 1990). These include colorful Mac-based software and numerous tables and boxes. The emphasis is on creative wall-charting techniques that seem more developed than the standard IBM JAD techniques. The sessions are deemed so successful that they are used as a marketing lever by the DEC sales force in Israel.

In general, in other firms, user involvement is operationalized in traditional IS approaches: committees and specifically, joint IS-user committees and teams. This is generally similar to the state of many US firms.

An interesting linguistic observation was noted which hints at the politization of IS-user relations: During interviews, a Hebrew word that frequently cropped up in describing work with the users and the relationship between users and IS was: mool, as in “one works mool the accounting department. Mool translates loosely into “opposite,” “opposing,” or “against.” Contrast this with the American concept of working with the accounting department.
D.4 JAD in Arizona

During the course of searching for organizations that would cooperate in the field research, this author made several hundred telephone calls within Arizona and spoke to staff at almost all the large organizations in the state—both private sector and public sector.

These conversations resulted in a by-product: the state of JAD in the state of Arizona. In general, most organizations do not use JAD-like techniques to develop systems, although almost all of the managers, that I ended up speaking with, were aware of JAD. Several organizations were moving towards using JAD during 1990-91. Several were eager to introduce JAD and saw my phone call as an opportunity. JAD was often erroneously lopped together with CASE as a tool that...“yes we are looking at...” JAD seems to be introduced in concert with other modern techniques and technologies, primarily CASE and other IE approaches. This was apparent in two out of the four Arizona organizations in this study.

I discovered that the interpretations of JAD were very loose. Some organizations referred to a meeting with users as a JAD, although there was almost no use of any of the techniques of JAD. In one set of meetings I attended there was essentially no process leader in what was called a “JAD.” This was a common misunderstanding: one manager told me that they “naturally” implement the JAD techniques, which is entirely possible, but probably indicates that he does not really know what JAD is.

IBM is active in supporting JAD sessions in the state, particularly with the large organizations in the state. However, at least two organizations voiced concern about the cost of JAD support from IBM as an inhibitor to implementing JAD.

The results of the informal survey are presented in Table D.2. Notes about the table: the numbers here are interpretations from careful telephone notes. The numbers are not
Table D.2: Status of JAD in major Arizona organizations: informal survey

A few conclusions can be drawn from the data represented in the table: use of JAD-like methods is surprisingly low— even after a decade of exposure. Second, the organizations that tend to be highly politicized and thus can profit most from JAD— namely public sector organizations— have underutilized the approach.

D.5 JAD and CASE

CASE tools have made their way into organizations since the mid 1980s. Today, many organizations use CASE in some form in development projects. Some professionals realize that this powerful tool can be used advantageously in JAD sessions. Today many JAD sessions are conducted today with a variety of tools: graphic tools for depicting DFDs, ER diagrams, state transitions and other diagramming techniques, screen painters.

Several case studies have appeared recently that discuss the “hows” of combining the technology and the methodology. For example, Kern (1989) introduces the notion of A-JAD (Automatic-JAD), which is JAD with a CASE tool on a front screen projector.
A lengthier involvement of CASE in JAD sessions is described in Semich (1990) which describes how to structure such sessions. At least one IBM group is experimenting with JAD and CASE (Bates, 1990).

Researchers realize that CASE is—among other things—technology to support group work. Henderson and Cooprider (1990) define 98 features of CASE, 10 of which are in areas called cooperative functionality, which cover JAD and teamwork. However, CASE is not, at present, an ideal tool for JAD sessions: “the problem that CASE is attacking is team-oriented (Bochenski, 1990). CASE is not built as a team software, although some progress is being made.

Tools in the CASE domain support a limited number of JAD tasks specifically. For example, Index Technology’s Excelerator 1.9 has a feature which supports “open issues” which is likely to have resulted from customer requests to support JAD capabilities.
Two very similar E-JAD experiments were conducted with student subjects using GroupSystems. Each experiment had a size of one (n=1) and thus was statistically inconclusive. The two experiments are designated here as Study 1 and Study 2 (chronologically).

Objective: The objective of the study was to study an E-JAD session in a controlled fashion and determine which was the best tool for an E-JAD task. A secondary objective was to investigate experimental issues in an E-JAD setting.

Hypotheses. There were two hypotheses:

H1: Given that structure is an important factor in the success of JAD, then the more structured the GroupSystems tool, the better the output quality.

H2: When comparing traditional JAD to E-JAD, the latter is expected to perform better— in a fixed allotment of time— because the subjects can only have one conversation at a time in a traditional JAD session, as opposed to multiple "conversations" in the electronic versions.

Treatments. Study 1 had three treatments while Study 2 had only two. Three treatments were given in Study 1: a manual JAD with a facilitator (traditional JAD style) and two automated treatments: the first using Electronic Brainstorming (EBS) and the second using GroupOutliner (GO) with a pre-defined structure. Only the two automated
treatments were given in Study 2.

There was only n = 1 in each treatment. Each group had 50 minutes to perform their task.

In accordance with H1, the GroupOutliner (GO) team was expected to outperform the EBS team because a) GO lends itself to more organized thinking b) the GO structure was pre-assigned by the author (who knew the "solution"), c) as compared to the EBS, one can focus on a topic and get it done in depth, rather than jumping around, d) less redundancy takes place, as compared to EBS.

The dependent variable was "completeness" as measured against a master list of requirements abridged from the IBM case (JAD, 1986). There were 46 items on the master list of requirements (which were not in themselves complete, but were representative of a comprehensive system).

Task Subjects were assigned roles as "users" and given positions in a fictitious hotel. They were asked to list requirements for a hotel reservation system. The subjects received a three-page background description they read in advance and referred to during the treatment. The task was taken from an IBM training manual distributed in IBM JAD workshops, and was modified somewhat by the author.

Brief job descriptions were given to the subjects: Regional manager, Hotel Manager, Food and Banquet Manager, Service and Reservations Manager, Accounting Manager, Room and Housekeeping Manager, and a few Front desk clerks.

Subjects were senior MIS students in an MIS project management course. They were assigned into groups. Each participant was assigned a task in the hotel. A fraction of their grade was to be determined by their performance in the exercise. No major differences
Table E.1: Results of pilot controlled experiments in E-JAD

<table>
<thead>
<tr>
<th></th>
<th>Study1 Manual</th>
<th>Study1 EBS</th>
<th>Study1 GroupOutliner</th>
<th>Study2 EBS</th>
<th>Study2 GroupOutliner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements of Master List (46 total).</td>
<td>13</td>
<td>35</td>
<td>27</td>
<td>30</td>
<td>26</td>
</tr>
<tr>
<td>Pages of output</td>
<td>6 handwritten</td>
<td>13 typed</td>
<td>9.5 typed</td>
<td>13 typed</td>
<td>13.5 typed</td>
</tr>
<tr>
<td>Number of distinct items</td>
<td>98</td>
<td>209</td>
<td>113</td>
<td>186</td>
<td>143</td>
</tr>
<tr>
<td>Num Participants</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

were found between prior hotel exposure/experience of the groups as measured by a background pre-test.

Results were somewhat surprising: In both Study1 and Study2 the EBS teams outperformed the GO teams as measured by the numbers of requirements that met the master list. The Manual team in Study1, as expected, performed the worst. See Table E.1 for the results.

Discussion The GroupOutliner tool is better organized, allows users to focus and offers no distractions. In short, there was every reason to believe that the GO teams would outperform EBS. In addition, had this been a real group the GO team’s output could actually be made into some requirements documents that make sense. The EBS output is disorganized and would be much harder to synthesize. So what happened? Random group differences? Probably not, based on pre-test and observations of the students work, as well as post-experiment discussions. A few weak explanations can be offered here:

Effort: there was no qualitative difference in the way the groups went about the task. The GO teams typed in less text, so their level of effort may have been less than the
EBS team.

Fit of tool to task: The EBS tool encourages a "shot-gun" approach: by writing more, shorter items, the EBS subjects ended up hitting more of the requirements on the master list. The EBS format also encouraged the subjects to stay at a higher level which helped them still further to score "hits" that the GO team missed by going into more detail. The 46 items on the master list ("the correct list") are a bit quirky. They represent a cross-section of requirements, but they have some areas they focus on and some they basically ignore. Hence the shot-gun approach may work better.

Differences in treatment between Study1 and Study2 The same case was used, the same tools were used, the same hierarchy was used for GroupOutliner, the same amount of time (50 minutes) was used, and the same master list was used.

There are a few minor (in my mind) points changed in Study2 compared to Study1:

• The number of participants on one Study2 team was only eight, as opposed to all other teams of nine. The eight-person team won anyway. But this is easily overcome by a handicap.

• While the Study1 teams was given a lecture about JAD prior to the exercise, the Study2 teams had no prior lecture in JAD.

• Differences in the tools. In Study2 GroupOutliner made use of the automatic name tagger. All subjects filled out their (real) name plus their job description. This is a nice feature: it puts comments in context and removes anonymity from the tool. Hence, unlike the Study1 treatments, one of the groups did not have anonymity. No differences could be determined from casual observations: all subjects typed a lot in both cases.
Master Questionnaire

This is the master version of the questionnaire as it is analyzed in the manuscript. The order of questions here and a few keywords were changed for every site. Also note that the spaces have been condensed somewhat for printing here.

University of Arizona
Karl Eller School of Management

Welcome

This survey covers your opinions about the user design session that was conducted on XX/YY/ZZ. We would highly appreciate your input about this process.

The goal of the study is to learn how to design higher quality systems by getting the customer (the user) more closely involved with the process---through user design sessions (also known as JAD: Joint Application Design).

This survey is being conducted by the:
Department of Management Information Systems
at the
University of Arizona.
The coordinator is Erran Carmel.

Thank you for your participation.

Instructions

You will be presented with a series of questions about user design sessions. Please select the answers that most closely match your opinions. All responses will be completely confidential. The survey takes ten to fifteen minutes to complete.

Writing Comments
If you want to make comments about any question, or to explain an answer that might be misleading, you may enter comments by pressing the <F1> key. Your comments will be saved with your answer.

Quitting Early

You may quit the survey at any time by pressing the <ESC> key. Your previous answers will still be kept, but you cannot begin over: It will corrupt the data. Just return the diskette.

1
Select the numbered answer that best describes your feeling about the following statement:
   I've participated in user design sessions before.
   1. Yes
   2. No
   0. Not sure

2
Select the numbered answer that best describes your feeling about the following statement:
   I've participated in designing systems before.
   1. Yes
   2. No
   0. Not sure

3
My experience with programming, designing, testing software systems (in years):
   1. none
   2. 1-2 years
   3. 3-5 years
   4. 6-10 years
   5. 11 or more years.

4
The number of years that I have been in this department / functional area:
   1. none
   2. 1-2 years
   3. 3-5 years
   4. 6-10 years
   5. 11 or more years.

5
Complete the following sentence:
   I expect that the new "TheSystem" will be a _____
   1. disaster
   2. poor system
   3. adequate system
4. good system
5. dream system

6
Complete the following sentence:
I believe that relative to the current way of doing things, the new "TheSystem" will be _______
1. much worse
2. a bit worse
3. about the same
4. better
5. much better

7
Complete the following sentence:
I think that...
the requirements that we created are _______
1. very INcomplete!
2. incomplete
3. adequate
4. complete
5. very complete!
0. Don't know / Not applicable

8
Before the sessions began...
I had ______ of what the new system will be like.
1. No idea whatsoever
2. thought through 1-2 ideas
3. some ideas
4. a fair idea
5. a very clear picture
0. Don't know / Not applicable

9
Complete the following sentence:
Now that the sessions are over...
I have a ______ what the new system will be like.
1. VERY vague feeling for
2. vague feeling for
3. adequate picture of
4. clear picture of
5. VERY clear picture of
0. Don’t know / Not applicable

10
Complete the following sentence:
At this point.....
My understanding of the business area is ______
1. nil
2. fragmented
3. adequate / fair
4. good
5. excellent
0. Don't know / Not applicable

11
Select the numbered answer that best describes your feeling about the following statement:
I can explain TheSystem to a co-worker.
1. not at all
2. a few points
3. adequately
4. except for a few points
5. completely / very well
0. Not applicable

12
Select the numbered answer that best describes your feeling about the following:
I can draw a detailed diagram of TheSystem and how it will operate.
1. not at all
2. a few points
3. adequately
4. except for a few points
5. completely / very well
0. Not applicable

13
My role in this project is best described as a:
1. User / Customer / Business Expert
2. IS (Information Systems) staff

14
Select the numbered answer that best describes your feeling about the following statement:
During the course of the sessions I’ve had a chance to chat with the systems people who are involved in the project:
1. not at all
2. a bit
3. some
4. a fair amount
5. a great deal
0. Don't know / Not applicable

15
Select the numbered answer that best describes your feeling about the following statement:
During the course of the sessions I’ve learned about the
process of building systems.
1. not at all
2. a bit
3. some
4. a fair amount
5. a great deal
0. Don't know / Not applicable

16
Select the numbered answer that best describes your feeling about the following statement:
During the course of the sessions I've been kept sufficiently apprised about TheSystem and its development plans.
1. not at all
2. a bit
3. some
4. a fair amount
5. a great deal
0. Don't know / Not applicable

17
Select the numbered answer that best describes your feeling about the following statement:
During the course of the sessions I've grown to trust the systems people.
1. not at all
2. a bit
3. some
4. a fair amount
5. very much
0. Don't know / Not applicable

18
Select the numbered answer that best describes your feeling about the following statement:
During the course of the sessions I've had a chance to chat with the users.
1. not at all
2. a bit
3. some
4. a fair amount
5. a great deal
0. Don't know / Not applicable

19
Select the numbered answer that best describes your feeling about the following statement:
During the course of the sessions I've grown to trust the
users.

1. not at all
2. a bit
3. some
4. a fair amount
5. very much
0. Don’t know / Not applicable

20
Complete the following sentence:
My level of satisfaction with the entire process that took place in this session is best described as ______
1. Very dissatisfied!
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very satisfied!
0. Don’t know / Not Applicable

21
Complete the following sentence:
My overall level of satisfaction with the way GroupSystem was used is best described as ______
1. Very dissatisfied
2. Somewhat dissatisfied
3. Neutral
4. Satisfied
5. Very satisfied!
0. Don’t know / Not Applicable

22
Complete the following sentence:
My level of satisfaction with the OUTPUT OF THE SESSION that I’ve helped create is best described as ______
1. Very dissatisfied!
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very satisfied!
0. Don’t know / Not Applicable

23
Complete the following sentence:
My level of satisfaction with the session AGENDA is best described as ______
1. Very dissatisfied!
2. Dissatisfied
3. Neutral
4. Satisfied
Complete the following sentence:

My level of satisfaction with the FACILITATION is best described as ________
1. Very dissatisfied!
2. Dissatisfied
3. Neutral
4. Satisfied
5. Very satisfied!
0. Don’t know / Not Applicable

Agree or Disagree?

The process that we went through in the session helped ME to come up with ideas on important issues.
1. Disagree strongly!
2. Disagree
3. Neutral
4. Agree
5. Agree Strongly!
0. Don’t know / Not Applicable

Agree or Disagree?

The process that we went through in the session helped the GROUP to come up with ideas on important issues.
1. Disagree strongly!
2. Disagree
3. Neutral
4. Agree
5. Agree Strongly!

Complete the following sentence:

At the beginning of the session the meeting discipline and meeting agenda was ________
1. very loose
2. loose
3. tight on some aspects, loose on others
4. tight
5. very tight
0. Don’t know / Not Applicable

Agree or Disagree?

The participants already had disagreements on policy and design for TheSystem BEFORE the session began.
29
Agree or Disagree?

New disagreements on policy and TheSystem design resulted from the discussions in the session.

1. Disagree strongly!
2. Disagree
3. Neutral
4. Agree
5. Agree Strongly!

30
Select the numbered answer that best describes your feeling about the following statement:

During the course of the sessions, I personally disagreed with the suggestions/requirements that the rest of the group came up with.

1. Never
2. Almost never
3. Occasionally
4. Frequently
5. All the time
0. Not Applicable / Don't know

31
Complete the following sentence:

During the session the disagreements were _______

1. All resolved
2. Mostly resolved
3. Resolved in about half the cases
4. Mostly set aside with no resolution
5. All set aside with no resolution
0. Don't Know

32
Were the disagreements resolved as a team, or did one or two people strongly influence the situation?

1. Team resolution
2. One/Two strong influences
0. Not sure / Don't know

33
Did everyone contribute the same amount to the session?

1. Very equal
2. Equal
3. somewhat equal
4. unequal
5. Very unequal
0. Don’t know

34
Complete the following sentence:
My own role in defining requirements was
1. nil
2. a minor contribution
3. about equal to the others
4. a major contribution
5. the most important of all participants
0. Not Applicable / Don’t know

35
Preparation time:
The total time I spent prior to this session to prepare for it:
1. none
2. less than 2 hours
3. 2-8 hours
4. between 1 and 2 days
5. between 2 and 5 days
6. between 5 and 10 days
7. more than 10 days
0 Not applicable / Don’t know

36
Follow-up time:
The total time that I anticipate spending after this session to follow up on tasks that came up in the course of this session:
1. none
2. less than 2 hours
3. 2-8 hours
4. between 1 and 2 days
5. between 2 and 5 days
6. between 5 and 10 days
7. more than 10 days
0 Not applicable / Don’t know

37
Select the numbered answer that best describes your feeling about the following statement:
During the session there were questions that came up about TheSystem which the group could not answer.
1. none
2. a few
3. some
4. a fair amount
5. a great many
0. Don’t know / Not applicable

38
Agree or disagree?
All relevant and important decision-makers were present in order to carry out the objective of the session.
1. Disagree strongly!
2. Disagree
3. Neutral
4. Agree
5. Agree Strongly!
0. Don’t know / Not applicable

39
About what percent of the session time was wasted due to inefficient meeting agenda?
1. 61+
2. 41-60%
3. 21-40%
4. 1-20%
5. 0 %
0 Don’t know / not applicable

40-41
Do you agree with the resolution of this issue?
ISSUE :  issuedescription1
RESOLUTION: resoldescription1
1. Disagree strongly!
2. Disagree
3. Neutral
4. Agree
5. Agree Strongly!
0. Don’t know / Not Applicable

42-58
To answer the next set of questions, keep in mind the following analogy:
Suppose that you need to pound a one-inch nail into a wooden beam.
To do this you have to choose from several tools.
You would like to choose the best one.
1. a piece of cardboard it clearly does not work
2. a hardcover book its awkward, very slow and breaks down
3. frying pan not elegant but gets the job done
4. small one-pound hammer the right tool, but not the right size
5. larger three-pound hammer the perfect tool
Using the above analogy, how well did the highlighted tool assist in doing the task?
Task 1 with tool alpha
Task 2 with tool beta
Task 3 with tool gamma
Task 4 with tool delta
Task 5 with tool epsilon

These questions were the standard free-text questions scattered throughout the text.

Please comment about the facilitator's work

Please comment on the work that the systems staff did before, during and after the session.

Comment about the role of the influential participants. How influential were each of the participants in the sessions? Did some wield a great deal of influence?

How has this experience differed from other system development efforts that you have been involved in?

[These questions are optional]

My name is:
My position is:
My department / organization is:

[new page]

------------------------------------------------------------------
This is the last screen.
I hope you enjoyed answering the survey.
------------------------------------------------------------------
The following is a complete listing of all questions and interview guides used in interviews for this study.

G.1 Demographics

- Organizational: Name, Industry, No Locations, Sales/Budget, No employees.
- Division: Name, No. Locations, Budget, No. employees.
- Project Level: No. of end users ultimately effected; Estimated cost overall; Current system size in KLOC, number of programs, FPs; Estimated new system size in KLOC, number of programs, FPs; Estimated time to implementation;

G.2 Pre Session Interview

- General: Describe system and how it fits in the organization; What stage in the SDLC is the project now? Why a JAD session now? Degree of importance of the project relative to others. e.g. is the CEO monitoring? is this a showcase? a peripheral system? Difficulties in the project to date. Who initiated the project?
- History of JAD use in the organization: Are JAD sessions unusual in your organization? How long have you used JAD? Is it mandatory? How many JADs do you do in the life cycle typically? How many of the users have been involved before in this or other projects? How about other JADs?
• This session: length, objectives, IS people involved, users involved, facilitation, tools, structure, prep by users, expected output (e.g. document, prototype).

Expectations of the session: quality, group dynamics, How would you measure the success of the session? How critical is the session to the success of the system?

Users' attitudes: users' satisfaction with the current system; users' expectations of new system success; user-IS relations; users' understanding of the system, individual users' perspectives and agendas. What issues should I be aware of that will come up?

• Other: What documents have already been created for this project? How many of the users have seen them? Ask for them!

G.3 Post-session interview

• Was the meeting a success? On a scale of 1 to 10.

• Did the meeting meet its objectives? more/even/less. Why?

• Completeness. Was the output of the meeting complete? Perfectly/Adequate/Less than adequate/distressing. Anything missing in hindsight?

• Was the level of detail: too much, just right, or not enough? Why?

• Was this meeting useful for next step?

• What time was well used? What time was wasted? How much time in percent.

• Breaking with norms: was this meeting a break with norms: for the group? for the project? for IS? for the organization?

• What automation would you use? both practical and "blue sky."

• Were all people there? Were all opinions heard?
• Go over issues/items/requirements: Did you agree with the resolution? How did you like it? Was this what you understood by the final resolution? Were there issues that disappeared and shouldn’t have?

• Structure. Was the meeting: too structured; just right, or not enough? Why? Did the “structuredness” vary over time? Was that good?
APPENDIX H

THE DESIGN PROBLEM: COGNITION IN SYSTEMS DEVELOPMENT

The cognitive issues of SD are inherent in the first of the problems defined in Chapter 1: the systems analysis problem. Asking users to help build a system imposes upon the users a set of cognitive challenges that trained IS professionals have been struggling with for years. The problem-solving areas encountered include decomposition, synthesis, specifying relationships and interactions, and defining structures of data, defining boundary conditions and constraints (Atwood and Jeffries, 1980; Jeffries, et al., 1981; Malhotra, et al., 1980; Bradley, 1986). Essentially the group encounters the same difficult cognitive problems that an individual encounters—problems which, by and large, have no easy solutions.

To alleviate this problem many JAD facilitators spend time training users in systems analysis and information engineering methodologies which serve to structure the problem areas and ease the cognitive burden. This is a hot area of debate. Is it worthwhile to train users in systems analysis at high cost? Can we get this information using more conventional means? Some studies have been conducted along these lines. For example, Jarvenpaa and Machesky (1986) used novice student subjects who, as they stated, are like end users. They studied the behavior of the subjects learning data analysis skills. In accordance with their hypotheses, they found that learning to use a logical data technique was more successful (on all dependent variable measures) than using a relational data technique.

Decomposition is a cognitive task that the IS community does not know how to
manage well for individuals, let alone groups. Do we allow the users to decompose by themselves without hand-holding? Henderson (1987) argues that the key difference between systems development team work and other decision-making processes is that the problem-solving process involves decomposition—implying that decomposition is an unusual task. Findings from his study suggest that "we don't have tools for groups" which allow them to decompose and distribute tasks to subteams and individuals.

Several of the eleven sessions observed in this dissertation involved decomposition tasks performed by the users. Although no data was collected specifically about decomposition, these tasks seemed particularly problematic in both T-JAD and E-JAD. The two Army E-JAD sessions asked the users to freely decompose their domains using the EA and PE tools. In follow-up interviews, one of the analysts indicated that she ended up combining decomposed processes that the participants created. Further research in E-JAD needs to investigate the benefits of technological support for decomposition tasks.
APPENDIX I

THE JAD INDEX

Consider the problem of comparing JAD sessions, electronic or otherwise. With so many factors contributing and interacting, how does one do it?

One approach is described in this appendix. A list of 13 criteria were compiled which together form a complete set of factors that determine a “good” JAD session. The list was compiled from the set of JAD guidebooks (Wood and Silver 1989, FASC 1990, IBM 1986, August 1991), and with the help of two knowledgeable researchers. Once the criteria are weighted by relative importance, a rating can be given to each JAD session. This was the goal that led to the development of the JAD index.

The 13 criteria are presented here exactly as they appeared in the survey:

• Group Dynamics.

  FACILITATION is defined as encompassing all activities and personal character of the session leader. Pertinent factors are: Is the facilitator in control? Does s/he have the ability to summarize? How are her leadership skills?

  GROUP DISCIPLINE is defined as the sense of order and purpose that the participants have. Pertinent factors are: Is the group discipline self-imposed or imposed from the outside? Is the group getting out of hand?

  PROBLEM SOLVING ATMOSPHERE is defined as the group sense of discovering and resolving issues. Pertinent factors are: is the group too critical/adversarial or is it lazy/unmotivated?
DURATION OF MEETING/SESSIONS is defined subjectively as being the "right" length of the session: not too long or too short.

- Structure.

GOALS OF SESSION are defined as an objective, or mission. Pertinent factors: Are the goals clearly stated up-front and adhered to?

AGENDA is defined as structure of the meeting. Pertinent factors are: Is the agenda set in advance? Is it adhered to?

LIST MAKING is defined as consistently documenting a variety of items in lists. Typical lists are issues, assumptions, constraints, problems.

- Environment and support.

MEETING ROOM is defined as the setting for the session. Pertinent factors are: Is it comfortable for long sessions? Is it in a location with no distractions?

DOCUMENTATION is defined as capturing discussions of the session. Pertinent factors are: Is there a scribe and/or other sources to capture dialogue. Is the scribe capturing everything?

TOOLS-CONVENTIONAL is defined as a set of session aids that have been used traditionally. Pertinent tools are: overhead projector, computer screen projection, flip charts, whiteboard, blackboard, handouts.

TOOLS-ADVANCED is defined as a set of session aids that have not been used traditionally. Pertinent tools are: specialized software, CASE, prototypers, groupware.

- Organizational issues.

SUPPORT OF MANAGEMENT is defined as involvement and support from both user and IS top management for the process that surrounds the session.

APPROPRIATE PARTICIPANTS is defined as including all decision-makers and the best information sources. Pertinent factors are: Are there deadwoods in the room?
Methodology  A list of JAD professionals/experts was compiled on a convenience basis. The JAD professionals are people that I have dealt with regarding JAD, with knowledge and experience in the JAD methodology. Many of these are facilitators from sessions in the study itself. 15 letters were sent out with the criteria list and a cover letter requesting the professional’s input. Nine surveys were returned and all were judged usable.

The weights shown in Table I.1 and Figure I.1 are computed as simple averages of the nine respondents. No statistical tests were performed on this small sample size. All of the respondents filled out details of their JAD experience on the survey. Additionally, I knew most of them from prior contact. With all that background in mind, the group was divided up into “very experienced” (four respondents) and “other—” (five respondents) and their results as groups differed only slightly (This is shown in the last two columns of Table I.1). The respondents varied in training: a few were trained by IBM, others in other JAD-like techniques such as FAST.

Observations  The most important factor, according to the experts, has to do with an activity that is conducted outside the JAD meeting room: getting the right participants into the room in the first place.

The second interesting finding is that “tools” (Conventional and Advanced) make up less than 10% of the weight of the JAD session. Facilitation skills seem to matter most. As one facilitator wrote back in a letter attached to the survey: “...a good facilitator can lead a group to its objectives using crayons in a garage.”

The weights were used in compiling Table 5.8.
<table>
<thead>
<tr>
<th>JAD criteria</th>
<th>Overall</th>
<th>Very Experienced</th>
<th>Other Experienced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitation</td>
<td>12.67</td>
<td>14.50</td>
<td>11.20</td>
</tr>
<tr>
<td>Group discipline</td>
<td>6.56</td>
<td>6.00</td>
<td>7.00</td>
</tr>
<tr>
<td>Problem solving atmosphere</td>
<td>7.78</td>
<td>7.50</td>
<td>8.00</td>
</tr>
<tr>
<td>Duration of meeting</td>
<td>3.89</td>
<td>3.25</td>
<td>4.40</td>
</tr>
<tr>
<td>Goals of session</td>
<td>11.33</td>
<td>11.50</td>
<td>11.20</td>
</tr>
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<td>Agenda</td>
<td>7.22</td>
<td>7.25</td>
<td>7.20</td>
</tr>
<tr>
<td>List making</td>
<td>4.56</td>
<td>4.25</td>
<td>4.80</td>
</tr>
<tr>
<td>Meeting room</td>
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<td>3.00</td>
<td>4.40</td>
</tr>
<tr>
<td>Documentation</td>
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<td>7.50</td>
<td>9.60</td>
</tr>
<tr>
<td>Tools- conventional</td>
<td>4.56</td>
<td>4.25</td>
<td>4.80</td>
</tr>
<tr>
<td>Tools- advanced</td>
<td>5.00</td>
<td>6.25</td>
<td>4.00</td>
</tr>
<tr>
<td>Support of management</td>
<td>10.33</td>
<td>9.75</td>
<td>10.80</td>
</tr>
<tr>
<td>Appropriate participants</td>
<td>13.67</td>
<td>15.00</td>
<td>12.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Table I.1: The JAD index weights
Figure I.1: The JAD index: bar chart of weights
REFERENCES


Engineering.


[76] Gallupe, R.B. and McKeen, J.D. (1988). Beyond computer-mediated communication: an experimental study into the use of a group decision support system


