

Adaptive Structuration Theory: Relevant Structures for Web Technologies

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Abstract

Adaptive structuration theory (AST) models the ways in which technology is adapted to an organisation and organisational structures adapt to the technology. AST has been developed through research involving technology applications such as group decision support systems and collaborative technology. Compared to these, Web technologies are both more common and more complex: Use of AST with the Web requires an extension to the basic AST model. This paper suggests that for relevance to website development there are not four, but eight structures that may be adapted: technology features, technology spirit, developers, task, staff, management, customers and visitors.

Keywords

adaptive structuration theory, AST, Web, structures, adaptation

INTRODUCTION

When an organisation introduces new technology, there is change. The organisation adapts to more effectively use the technology and the technology is adapted as more is learnt of its potential uses. The way in which these adaptations occur is the subject of research into AST, or Adaptive Structuration Theory. This paper extends our understanding of AST in the context of information systems which are based on Web technologies.

Research by Majchrzak et al (Majchrzak, Rice, Malhotra, King, & Ba, 2000) improved upon existing models of the adaptation process. Very briefly, the Majchrzak AST model indicates that any of the recognised structures may be adapted and that adaptations are a result of sporadic and discontinuous misalignments between the structures. The Majchrzak paper provides a considerable advance for AST. However, as with earlier papers in the area, it is restricted in the scope of technologies to which it may be applied.

The Majchrzak research was based on structural adaptations in a situation where the central technology was a CT, or collaborative technology. Other technologies studied in AST research have included GDSS (group decision support systems), hospital scanners and Lotus Notes (a commercial CT application). These technologies may be valuable tools in the appropriate situations. For researchers they have the advantage that they may be closely constrained in both application and accessibility.

A website, on the other hand, is barely constrained at all, in either potential applications or in its universal accessibility. Development of a website is also a common challenge in very many organisations. Is it possible to use the current model of the structural adaptation process in order to understand website development? Can AST be successfully extended from technologies such as CT and GDSS to the technology of the Web?

Using the Majchrzak model as a starting point, this paper examines the central aspect of AST: which structures must be considered when applying AST to Web technologies. The paper finds that the nature and impact of the Web are significantly different to that of technologies such as CT and GDSS. To match the broader impact of Web technologies, a broader set of structures must be considered. Rather than the four structures of earlier models, AST for the Web must consider adaptive structuration of twice that number of affected structures.

LITERATURE REVIEW

Organisations Adapting to Technology

A decade ago, Nagasundaram & Bostrom wrote: "Radical and discontinuous change is the order of the day in the 1990s." They saw that corporations, large and small, were using methods such as TQM (total quality management) and BPR (business process redesign) in an attempt to create new organisational forms that would enable success. To stay ahead in the highly competitive market environment, organisations needed a steady stream of new products and new services. (Nagasundaram & Bostrom, 1994/1995)

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In 1988 Leonard-Barton wrote: "New production technologies are known to be competitive weapons, but their implementation is at least as challenging a managerial problem as their invention." Further, "The initial implementation stage is particularly crucial. ... It is argued that technology transfer requires continuous, ongoing dedication to the process of change and the conscious management of mutual adaptation because the technology will never exactly fit the user environment." (Leonard-Barton, 1988)

In 1988 the issue for Leonard-Barton was new production technology. In the new century it is Web technologies that are affecting all organisational processes: from production, through marketing and sales, to long-term customer support and service.

In the field of GDSS (group decision support systems) the factor of "organisational" change appears to have caught early researchers by surprise.

"A recent trend in the [GDSS] literature has been the attempt to understand the process of [GDSS] use. This trend follows on the heels of early [GDSS] research efforts that sought to understand the effects of [GDSS] use primarily through the outcomes of such use. This early approach resulted in conflicting research results, as the influence of the process of [GDSS] use was often not considered." There was a resultant shift in focus, from direct study of the GDSS technology, to study of the use of the technology by members of a social system. (Gopal, Bostrom, & Chin, 1992-1993)

That is, researchers began to look at the changes in organisational interactions as the GDSS technology was introduced: The introduction of new technology had an impact on the surrounding sociotechnical environment.

Development of Adaptive Structuration Theory (AST)

Organisational outcomes, successful or otherwise, are not simply a result of the use of new technology. The outcomes are affected by the way in which the organisation adopts and adapts the structures of the technology and by the way in which the organisation adapts its own structures in response to the technology. This adaptive structuration influences the impact and the success of the new technology.

AST proposes a reciprocal and iterative relationship between technology and the context in which it is used (Chudoba, 1999). That is, the technology affects the organisational structures and the organisational structures affect the technology. Different organisations may adapt in different ways in order to use the same technology; the technology itself may be changed to suit the organisation in which it is being used.

Scott et al described AST as being based on Giddens' Structuration Theory (Giddens, 1984). That earlier theory focuses on the practices that occur within social systems. AST narrows the focus to structures associated with technology and, more recently, information technologies. AST models the interactions between information technologies, social structures and human activities. (Scott, Quinn, Timmerman, & Garrett, 1998)

In 1993 Contractor and Seibold wrote of the rejection of technological determinism in favour of an emergent perspective: "To date, only adaptive structuration theory (AST) offers the promise of satisfying two requirements for explanation based on an emergent perspective: recursivity and unique effects." (Contractor & Seibold, 1993) In 1997 Chin, Gopal and Salisbury wrote that, "Adaptive Structuration Theory (AST) is rapidly becoming an influential theoretical perspective in research on advanced information technologies." (Chin, Gopal, & Salisbury, 1997)

In 1994, DeSanctis & Poole wrote that, "Adaptive Structuration Theory (AST) is rapidly becoming an important theoretical paradigm for comprehending the impacts of advanced information technologies." (DeSanctis & Poole, 1994) In 2002 that statement was considered sufficiently current to be quoted in a research article (Salisbury, Chin, Gopal, & Newsted, 2002).

AST "has provided a useful framework for describing how group communication technologies are used in both expected and unexpected ways. These unexpected usages may have positive or negative outcomes." (Scott et al., 1998)

In 2000, AST was still a relevant subject for research. Kim, for example, wrote: "A number of leading theories connected with social interaction in computer-mediated communication are investigated. It is suggested that further research is undertaken into the 'adaptive structuration' theory." (Kim, 2000)

Again in 2000, Majchrzak et al reported (Majchrzak et al., 2000) on a study of a virtual work team using a CT (collaborative technology) application throughout a ten month project. As the project progressed, the team was seen to adapt each of four structures: work group, organisation, technology spirit and technology features. Four research questions were addressed, two of the more relevant questions and results are outlined below.

"(1) Can the workgroup adapt any or all structures, or does it primarily try to adapt to the technology's initial spirit?" Over the course of the project, the workgroup adapted all structures: organisational, group, technology

spirit and technology features. The research found that each area had been changed therefore each area was, indeed, malleable.

"(2) Do pre-existing structures constrain the workgroup's adaptation process, even when these structures are malleable?" All three structural areas were found to be malleable, structures in each area were changed. No area was absolutely constraining, although the organisational environment did eventually revert back to its pre-existing structure. Further, the changes were found to be a result of discrepant events: adaptations were made when existing structures failed to satisfy task requirements.

Majchrzak et al studied four structures that were adapting in an environment where CT technology was in regular use. The four structures were found to be mutually adaptive. In an environment where the central technologies are those used in a new website, will this AST model still apply? An initial and vital question is: What structures are subject to adaptation in response to the introduction of new Web technologies?

Structures Subject to Adaptation: Existing Model

Structures are the rules and resources used to generate and support a system. A system, in this sense, is a social group or organisation that acts in such a way that there are observable and consistent patterns of inter-personal relations. A structure has two parts. First is the spirit, or generally accepted objectives and attitudes promoted by the structure. The second part consists of the specific structural features that implement the spirit promoted by the structure or the system. (Gopal et al., 1992-1993)

Scott et al describes the structural features of a technology as the rules, resources, and capabilities a system can provide (Scott et al., 1998). The spirit of the technology is the general intent with regard to values and goals underlying a given set of structural features (DeSanctis & Poole, 1994; Poole & DeSanctis, 1990). The spirit reflects designers' intentions, users' interpretations, and other stakeholders' perceptions of how the technology is to be used. Either the spirit or the features, or both, may be adapted.

The "features" of technology are the more visible aspects of the technology structure. Features are the actual processes and operations, the things that can be done with and by the technology. Poole & DeSanctis describes the "spirit" as, "the 'official line' which the technology presents to people regarding how to act when using the system, how to interpret its features, and how to fill in gaps in procedure which are not explicitly specified" (p.126). In other words, the spirit is the underlying purpose of the technology. It could also be seen as being the intent of the website owners.

Previous research appears to consider "spirit" only in terms of technology: The spirit of the other structures is not formally discussed. This is clearly seen in the Majchrzak et al paper which forms the basis of the extension to the model. Changes to, for example, the spirit of a work group would have an impact on organisational theory. AST, however, is primarily concerned with technology. In this paper I will maintain the "convention" of dealing with spirit only with respect to technology.

The work by Majchrzak et al studied changes within three "structural areas": technology, work group and organisational environment. The technology structure was considered as two parts, features and spirit. A further structure, task, was said to be fixed for the duration of the study and so was not examined. These structures were drawn from earlier work by DeSanctis and Poole (DeSanctis & Poole, 1994) cited in (Majchrzak et al., 2000).

An important point to note is, that different structures were adapted in different ways. Also, the task structure was considered to be fixed but it influenced adaptations in other structures. There are several affected structures, it is important to identify which structures are relevant.

This paper will now show that implementation of Web technologies will require consideration of a wider range of potentially adapting structures.

AST AND THE WEB

AST (adaptive structuration theory) has been tested and developed on GDSS and CT applications. GDSS and CT are technologies with clearly defined objectives: They are specifically aimed at changing inter-personal communication in order to improve communication or to support decision-making processes. They are specialised tools, useful in certain situations. The virtual team studied by Majchrzak et al had a defined objective, a limited life, and it operated within a known, if unique, corporate environment.

The Web is a set of generalised technologies. It may be adopted and adapted for a wide variety of purposes. As with CT, an underlying objective is improved communication, however, the Web provides a wide range of communication options. Communication may be, for example, B2B (business to business) or B2C (business to consumer). Web technology also supports communication between individuals, between computers, within an organisation, within a virtual organisation or across and outside all formal organisational boundaries.

CT is an application, the Web is an enabling set of infrastructure and technologies. Even if the technologies are restricted to creation of a website, there is an almost limitless range of possible applications. Yet organisations are selecting amongst all of these possible applications, and implementing organisational websites. This is not a trivial task. Anticipating the organisational structures subject to adaptations related to website development will improve the overall success of that development.

Web-based Case Study

Web-related structures will be explained, in this paper, in terms of a particular case study, an organisation which will be the subject of further research. It is a small organisation with clear objectives. Its current operations are strongly based on provision of physical services at a fixed location. It is developing a website, although the purpose and method of operation of the website are still not clear: Development will involve adaptation of Web technology structures, it may also lead to adaptation of the structures of the organisation itself.

"The Club" provides a meeting place for business people:

"[The Club] is the leading business and professional persons' Club in [the City]. We offer the privacy and warm ambience that only a private Club can provide. The Club is a place to build long-term friendships and business relationships founded on high ethical standards. We provide a slightly conservative Club culture, modern but with a respect for traditional values. We are a Club of non-political character, for the interaction, enjoyment, entertainment and comfort of our Members and their guests. We encourage Membership from metropolitan and country areas throughout [the State]." (from the Club's Web page, October 2002)

This is a traditional "community" with a fixed physical focus and a common purpose. The physical focus is the Club-owned premises in the city centre, which provide the main benefits for members. The premises include a restaurant, cafe, meeting and function rooms, squash courts and a gym. The "members" of the Club are equivalent to "customers" of other forms of commercial organisation.

The Club provides a neatly bounded environment for initial development of the model for AST (adaptive structuration theory). This paper provides the groundwork, by examining one aspect of the AST model: the structures which may need to be considered. Subsequent research will study other organisations in order to strengthen or modify the current model.

Redefining "CT-Model" Structures

The Club is implementing a website that will affect communication between the organisation and its members; The site may also affect communication between the Club and its potential members, and between individuals and groups within the Club organisation. The structural areas become more complex than those examined by the Majchrzak et al study:

- Technology: The technology being considered is the Web. The Club is implementing Web technology that will improve communications. It is not yet clear how communications will be improved, nor with whom.
- The "task" is, in this case study, the operation of the Club. This is a very general definition of the task but, as with the Majchrzak et al case, it does not vary. Or rather, the new website performs one part of the broad task of Club operations. At present the website appears to be a minor activity, with little impact on the operational task. Yet this may change as the Club explores Web applications. For completeness, task structures must be included in the extended AST model.
- The "work group" is the management and operational groups within the Club, that is, the committee and Club staff. These are the people responsible for operational matters, they manage and perform the operational tasks. They will also be using and supporting the website as it develops. I will refer to them as the "staff" group.
- The "organisation" is, in this situation, the Club Executive Committee. In the Majchrzak et al situation, "organisation" represents the controlling environment in which the work group operates. The controlling environment for the Club is its committee; Employees report to the committee. So the Club committee has a dual role, as both work group and controlling organisation. I will refer to them as "management". The key difference between staff and management is that the former are "doing" and the latter are "deciding".

Table 1 summarises the changes described so far. The "current model" is that used by Majchrzak et al.

Table 1 Name changes for the new model

Current model	Web case study	New model
Technology (CT or GDSS)	Web technologies, organisational website	Technology
Task (considered as being fixed)	Club operations including website operations	Task
Work group (virtual team)	Club committee and staff involved in website development	Staff
Organisation (one "owner" of the virtual team)	Club committee, responsible for overall Web development decisions	Management

When the technology is CT, technology adaptations are driven by the requirements of the virtual team that is using the CT. The team has its task direction, yet each member of the team is also responsible to one or more managers in the controlling organisation. (Virtual team members are drawn from several organisations. Majchrzak et al describes the structural adaptations of only one of those organisations.) The team has been formed to create a new product, the product will be used by the controlling organisation.

When the technology is the Club website, technology adaptations are driven by the requirements of the Club committee. The committee sets its own task direction, it is also responsible for overall Club management. The committee is managing the creation of a new website which will provide an improved means of communication between the committee, other Club members and potential Club members. As described above, the committee is both work group (staff) and organisation (management) in this application of AST.

Technology Structures

There are numerous features available using Web technologies. Broadly speaking, the features may be summarised as being various means of communication. The broad range of features is matched by an equally broad range of possible spirit.

Historically, the spirit of the Web could be, to enable and improve communication between independent researchers. For a business, the spirit could reflect an intent to market the organisation, to improve communication from business to consumer. For a student, the Web spirit could involve gaining access to various otherwise unavailable sources of information. For a casual Web surfer, the spirit could include entertainment, discussion and keeping in touch with friends. What do these aspects of spirit have in common?

The spirit of the Web is determined by the person or organisation using the Web. Each Web developer has an intent, a purpose, which will be supported by features selected for inclusion in the website. Each Web user may selectively access the Web in order to match the technology spirit required by that Web user. If the spirit offered by a website matches the spirit required by a user then that user will be encouraged to use that website.

The technology spirit of the website may reflect the underlying reasons for the user using the Web or it may support overall requirements of website users. Korgaonkar and Wolin, for example, identified several factors that determined whether or not a website would be used (Korgaonkar & Wolin, 1999). Web users may be seeking social escapism, information, socialisation, or economic benefits. They may require transaction security, transaction privacy, privacy of personal information, and interactive control. Although this paper will not discuss that research, this brief statement does indicate the variety of "spirits" that may be looked for by Web users.

A website may be developed by business managers who are not familiar with the technology, working with developers who are not familiar with the business. (A later section discusses the role of the developer as being a separate structure.) Because of the way in which development takes place, the website may reflect both the intent of the site owners and the understanding, or misunderstanding, of that intent by the developers. There may

be features that exist only to suit developer intentions, that are transparent or simply accepted by the website owners.

So the spirit of a website may reflect the site owner intent as implemented by the developer.

For the Club, the intended spirit involves improved communication between the Club and its members and others. The intent is to provide an alternative means of providing information, a means that is effective and efficient. In the initial stages of development, the communication is largely one-way, out from the Club. There is no intent to replace existing, paper- and voice-based communications. The intent is to provide one more means of communication.

As Club website development progresses, it is possible that a key structural adaptation will be made to the spirit of the technology: The Club may extend its vision of the Web, its intended spirit of the Web technologies, from one-way communication to a multi-way, community-style extension of the purpose of the Club. At present, however, the intended spirit is relatively restricted.

This paper is extending the Majchrzak et al model of AST. The Majchrzak model used just one "technology" structure but with two subcategories. For Web technology in particular, the two aspects of technology are sufficiently distinct to be treated as two, separate structures:

- technology features: for the Club this is various forms of communication via an organisational website
- technology spirit: alternative, efficient and effective means of communication

Beyond the Organisation

There is a further complication in the application of AST to development of an organisational website: Every Web surfer is a potential user of the Web technology. Technology that is being adapted for use by Club committee and members will be available for use by non-members, including potential Club customers. Where the CT team used communication technology to support its development of a totally separate product, the Club task includes development of the communication product itself, the website.

Club committee members, employees and members will be encouraged to use the site. Any Web surfer may have access to the Club website. Structural adaptations of the Web technology may suit the Club committee, employees, members, potential Club members, and any Web surfer who accesses the site. Use of the site may then result in adaptations of the structures of any of those groups: committee, employees, members, potential members and other Web surfers.

Due to the public nature of the Web, we have two new groups to consider for our AST analysis: Web users who are members and those who are not members of the Club. Club members who may gain membership-related benefits through use of the Club website may be willing to adapt, in order to gain those benefits. The adaptations will affect their interactions and communications with the Club itself. Non-members and potential members may also adapt, in different ways to members. A key adaptation of interest to the Club will be if non-members choose to become members.

In other organisations these groups are equivalent to the organisation's "customers" and website "visitors". So there are two new structures to be considered:

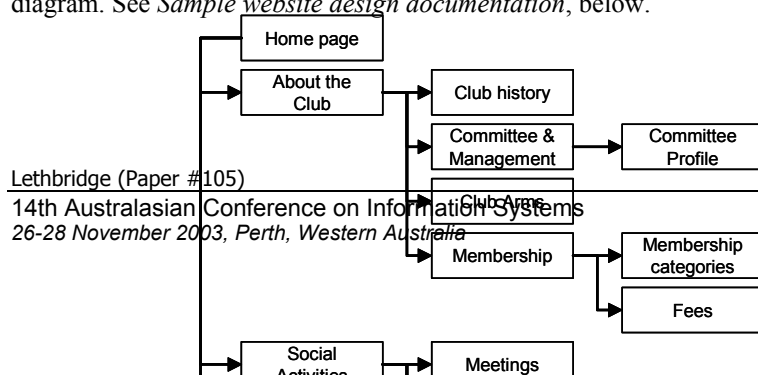
- customers: members of the Club, customers of the organisation
- visitors: Web surfers including potential Club members or potential customers

Web Site Developers

There is one more area in which the Majchrzak et al study was less complex than development of an organisational website: Consideration of the people who do the technology development and implementation.

The virtual team of Majchrzak et al used a CT technology that already existed but that was adapted by the developer on request from the team. In an ideal situation, this is the way in which all technology applications are developed. In practice, a more complex situation may exist.

In the example of the Club, initial website development was done by an external organisation, selected by competitive tender. The Club agreed to the overall website design on the basis of a simple, textual block diagram. See *Sample website design documentation*, below.



It is very difficult to visualise a finished website from the block diagram. (It is interesting to note that the block diagram itself included simple errors which could have lead to later misunderstandings.) Features such as colour, content and interactivity were not defined in the initial design: That is, development itself involved a deliberate process of adaptive structuration. Features were subsequently implemented by the developers for approval or comment by the Club management. Management depended on the developers to provide good examples and then to adapt according to management suggestions. From this simple beginning, development of the Club website has already been through several distinct phases.

In the first phase, the successful tender organisation developed a prototype website. The Club management team were responsible for working with the developers. The developers worked to a price, with a clear customer-supplier relationship. In the second phase, a Club member (myself) voluntarily acted as the key "customer representative". I took on single-point responsibility for most decisions relating to the developing website. A live website was implemented by the developer.

Third, I took on the role of developer. Again, my work was as a volunteer and a Club member. Using my representative "authority" as a Club member, I made major changes to the structure of the site, and minor changes to style and content. This stage of development was limited by the developer's (my) range of expertise.

The fourth distinct development phase was to pass responsibility back to a Web development company. This company has "professional" development expertise but the work is being done in exchange for membership of the Club. There is strong technical expertise but an unclear customer-supplier relationship.

Each of these four phases demonstrates a distinct change in the developer structure. The first two changed the interface between management and developer, the final two were completely new developers. In each situation there is a different mechanism for suggesting and agreeing changes to the organisational website. This simple example indicates that, for website development, the developer must be considered as a separate and important structure:

- developers: doing the "technical" implementation of the technology

SUMMARY

Our current knowledge of AST (adaptive structuration theory) is based on situations where the central technology was collaborative technology (CT), group decision support systems (GDSS) and other, clearly defined applications. Many organisations may use these technologies, but use of the Web is potentially universal. Adaptation and confirmation of AST in a Web-based situation will be a valuable contribution to the theory. This paper extends the adaptive structuration theory to include structures relevant to the Web.

The "current" model, as summarised and presented in Majchrzak et al, considers three structures: technology, group and organisation. A fourth structure, task, is assumed to be constant. The extended model considers eight structures:

- technology features: that which may be done with an organisational website
- technology spirit: the intent of the website owners, as implemented by the developers
- developers: those responsible for technology design and implementation
- task: operations of the organisation, particularly those areas affected by the website
- staff: those within the organisation who support and use the website
- management: responsible for ultimate decisions regarding the website
- customers: outside the organisation, using the website for its intended, customer-support purpose

- visitors: outside the organisation, using the website but not as customers

The extra structural areas reflect the increased visibility and accessibility of the Web, compared to the relative restrictions of the technology applications in earlier studies. The earlier model of AST is not suitable for application to Web technologies.

This paper has expanded one part of the AST model in order to apply it to and understand the more complex situation of the implementation of an organisational website. Parallel and future research will study and adapt other aspects of the AST model.

REFERENCES

- Chin, W. W., Gopal, A., & Salisbury, W. D. (1997). Advancing the theory of adaptive structuration: The development of a scale to measure faithfulness of appropriation. *Information Systems Research*, 8(4), 342-367.
- Chudoba, K. M. (1999). Appropriations and patterns in the use of group support systems. *Database for Advances in Information Systems*, 30(3/4), 131-148.
- Contractor, & Seibold. (1993). Theoretical frameworks for the study of structuring processes in group decision support systems: adaptive structuration theory and self-organizing systems theory. *Human Communication Research*, 19(4), 528(36).
- DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science*, 5(2), 121-148.
- Giddens, A. (1984). *The constitution of society*. Berkeley: University of California Press.
- Gopal, A., Bostrom, R. P., & Chin, W. W. (1992-1993). Applying adaptive structuration theory to investigate the process of group support systems use. *Journal of Management Information Systems*, 9(3), 45-.
- Kim, J.-Y. (2000). Social interaction in computer-mediated communication. (Social Informatics). *Bulletin of the American Society for Information Science*, 26(3), 15(3).
- Korgaonkar, P. K., & Wolin, L. D. (1999). A multivariate analysis of Web usage. *Journal of Advertising Research*, 39(2), 53-68.
- Leonard-Barton, D. (1988). Implementation as Mutual Adaptation of Technology and Organization. *Research Policy*, 17(5), 251-268.
- Majchrzak, A., Rice, R. E., Malhotra, A., King, N., & Ba, S. (2000). Technology adaptation: The case of a computer-supported inter-organizational virtual team. *MIS Quarterly*, 24(4), 569-600.
- Nagasundaram, M., & Bostrom, R. P. (1994/1995). The structuring of creative processes using GSS: A framework for research. *Journal of Management Information Systems*, 11(3), 87-.
- Poole, M. S., & DeSanctis, G. (1990). Understanding the Use of Group Decision Support Systems: The Theory of Adaptive Structuration. In J. Fulk & C. Steinfield (Eds.), *Organizations and Communication Technology* (pp. 173-193). Newbury Park, CA: Sage.
- Salisbury, D., Chin, W. W., Gopal, A., & Newsted, P. R. (2002). Research report: Better theory through measurement--developing a scale to capture consensus on appropriation. *Information Systems Research*, 13(1), 91-103.
- Scott, C. R., Quinn, L., Timmerman, C. E., & Garrett, D. M. (1998). Ironic uses of group communication technology: Evidence from meeting transcripts and interviews with group decision support system users. *Communication Quarterly*, 46(3), 353-374.

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