Applying Social Psychological Theory To The Problems Of Group Work

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1. Motivation

In the work arena, groups are a major mechanism for organizations to tackle problems that are too large or complex for individuals to solve alone. For example, modern software packages, like Microsoft's Excel[tm], consist of million of lines of computer code, while a good programmer typically writes a few thousand lines of code a year (Somerville, 2001; see Boehm et al, 1995, for more precise estimates of productivity in software engineering). To construct these massive applications, companies bring together individuals with skill in such disparate topics as interviewing, requirements analysis, software architecture, algorithms, databases, programming, graphic design, user interfaces, evaluation, and the application domain. Very few people are polymaths, with skills in each of these areas. Thus, both the scale and the scope involved in building large software applications demand group effort of some sort.

The sub-field of Human-Computer Interaction known as Computer Supported Cooperative Work (CSCW) attempts to build tools to help groups of people to more effectively accomplish their work, as well as their learning and play. It also examines how groups incorporate these tools into their routines and the impact that various technologies have on group processes and outcomes. Computer Supported Cooperative Work, as a sub-field, grew out of dissatisfaction with the individualistic emphasis in early research in Human-Computer Interaction, with its overwhelming concern with single individuals using computers to perform routine tasks. This individualistic emphasis contrasts with the everyday observation that much paid work is done by interdependent individuals who collaborate (or compete) on ill-structured tasks.

We try to create technology to support groups for two primary reasons—to support distributed groups and to make traditional, collocated groups more effective. First, we want to get the benefit of groups in settings and for tasks where they had not previously been practical. Distributed work has existed since at least the days of the Hudson Bay Company (O'Leary, Orlikowski, & Yates, 2002). However, the large numbers of interdependent teams whose members are located in different locations is a modern phenomenon, brought about by consolidation, acquisition, and globalization in corporations and enabled by improvements in telecommunication and computing technology. For example, engineering teams building modern aircraft have designers in multiple locations around the world. (Argyres, 1999). Teams building large telecommunications software systems have members in North American, Europe and Asia. Large consulting firms are likely to draw upon experts drawn from multiple offices scattered around the globe to get advice. These are not isolated examples. A recent study of a large telecommunication corporation showed that about 50% of the project teams in this company were composed of members who were located in different cities (Cummings, 2001). Distributed groups are typically not as effective as ones whose members are collocated (Cramton, 2001). One goal of CSCW research has been to develop technology that would allow distributed teams to work as if they were collocated.

A second goal of CSCW systems is to help both collocated and distributed teams perform better than they would otherwise. As already mentioned, the reasons for creating groups to do work is that they can accomplish tasks beyond the scope of individuals. Across many tasks, groups do perform better than the individuals who belong to them. Yet combining individuals into groups often leads to poorer performance than one would expect if the combination were "frictionless." For example, people work less hard in teams than they do when working individually (Karau & Williams, 1993). They fail to take advantage of the unique knowledge and skills they bring to the group and reach decisions without exploring many of the relevant alternatives (Larson, 1996). They have difficulty coordinating their contributions (Diehl & Stroebe, 1987). Finally, the very diversity for which they were formed often leads to dissatisfaction and conflict (Williams, 1998). Steiner (1972) coined the term "processes loss" to describe the decline in performance from some theoretical maxim which groups typically show. But CSCW systems can be designed to ameliorate some of these process losses.

The contention of the current chapter is that both of these goals require deep knowledge of the factors that make groups effective or that undermine them. This knowledge, for example, can help us understand what makes distributed teams perform more poorly than collocated ones and what is needed to support them (Cramton, 2001; Kraut, Fussell, Brennan, & Siegel, 2002; Olson & Olson, 2000). It will also suggest remedial actions to take to overcome known inefficiencies in groups. The next section provides an introduction to the field of Computer Supported Cooperative work. The remainder of the chapter will provide an introduction to the relevant social psychological literature. We will then show how social psychology theory can help explain and solve a well-understood problem—the failure of brainstorming groups to deliver more or better ideas than what is known as a "nominal group," that is, a non-interacting collection of individuals.

2. An overview of CSCW research

Figure 1 is a conceptual map of the CSCW area, showing the variety of research issues it addresses, differing in approach, focus, and scope. The prototypical CSCW research project (the center in Figure 1) examines small groups interacting with computer or telecommunication applications. CSCW researchers differ in their approach. Some researchers build systems to support small group work; they typically come from the engineering-oriented disciplines of computer science and electrical engineering, which put great value on the engineering and building of systems and applications (e.g.,

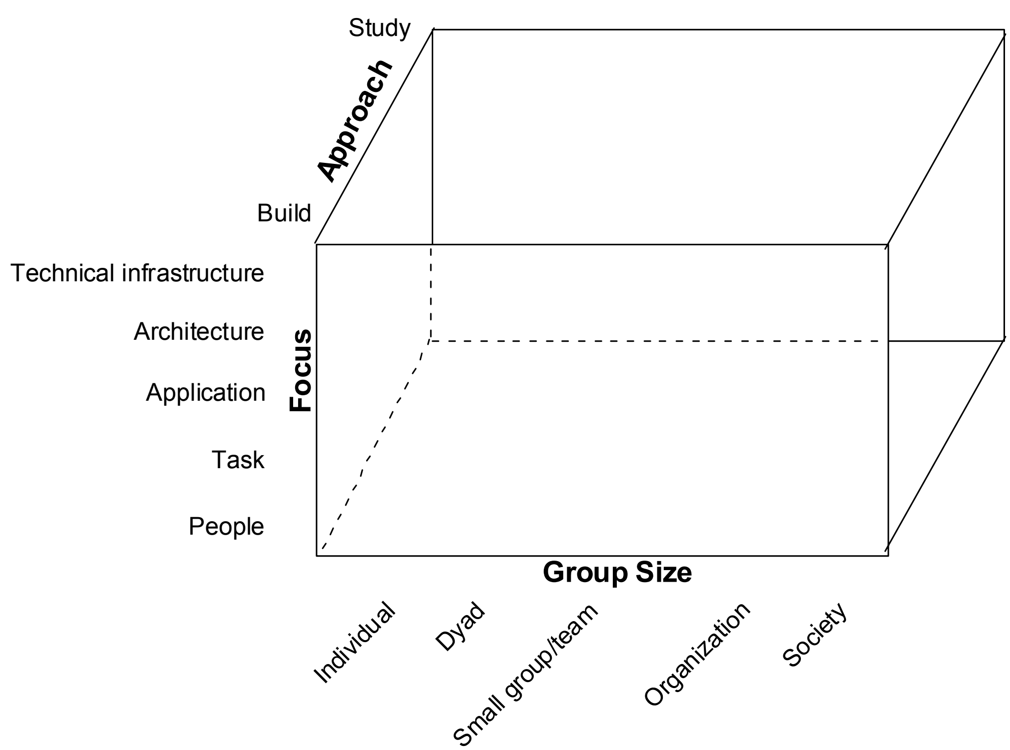


Figure 1: Variations in CSCW research.

Ackerman, 1992). Others come from the social science disciplines of psychology, sociology, anthropology, and communication studies. These disciplines typically value the ability to describe a social phenomenon empirically and to identify the causal mechanisms that influence it. Their CSCW research often describes how applications were used and the consequences of their use (Orlikowski, 2000).

There is variation around the modal research in terms of the focus and group size they are concerned with. The modal research is concerned with small groups interacting with an application. Further away from this core, on the engineering side, research topics range from the software architectures, which are necessary to support CSCW applications (e.g., Dewan, 2000), to the enabling software and telecommunications infrastructures. On the social science side are applied, empirical studies of groups performing tasks (e.g., (Olson, Olson, Carter, & Storrosten, 1992) (Hughes, King, Rodden, and Andersen, 1994; Suchman, 1987) and more basic empirical research on the behavior of groups (Clark, 1992; McGrath, 1993). These empirical studies often provide fundamental knowledge and can serve to set requirements for the CWCW applications to support group work. CSCW research also varies in the size of the social collective it considers. The typical size or scope of the social collective treated in most CSCW research is small groups or teams of between three and a dozen people. However, the scope can range from dyads (Clark and Brennan, 1990; Monk, this volume) to organizations (Burton, this volume), to communities (Preece, 2000) and beyond.

3. Scientific foundations

Since the turn of the 20th century (Ross, 1908) and especially since World War II, the field of social psychology has developed a rich theoretical base for understanding and predicting group behavior. The goal of this chapter is to provide a brief introduction to the nature of groups and to give the reader a taste of social psychological theories about group behavior and how they can contribute to the design of collaborative systems. I use the term "social psychological theories" advisedly. There is no unified theory in modern American social psychology with pretensions of explaining all of social behavior. Rather, the intellectual style has been to build and test a large number of medium-level theories, each attempting to account for an interesting social phenomenon in a limited domain.

However, unlike theories in cognitive psychology, this theoretical base has been inadequately mined in the HCI and CSCW literatures.

This chapter will only scratch the surface of the literature on groups in social psychological and organizational behavior research. Our overview will start with McGrath's classic review of the small group laboratory literature up to the mid-1980s. Even though the empirical review is dated, McGrath provides an excellent framework for thinking about research on groups. More recent texts and handbooks in social psychology provide citations to the current literature (Aronson, 1999; Baron, Byrne, 1999; Gilbert, Fiske, Lindzey, 1998; Hogg, & Tinsdale, 2001).

Input-Process-Output Models of Group Functioning

There is substantial agreement among social psychologists about the classes of factors that influence group outcomes. Among the most useful frameworks for thinking about groups and their effectiveness are the input-process-output models summarized by Steiner (1972), Hackman (1983) and McGrath, 1984). Figure 2 illustrates the basic features of an input-process-output model. These models hold that the success of a group (its outcomes) depends upon inputs or resources which the group has to work with (e.g., the skill of its members and the task they have been assigned) and the interaction among

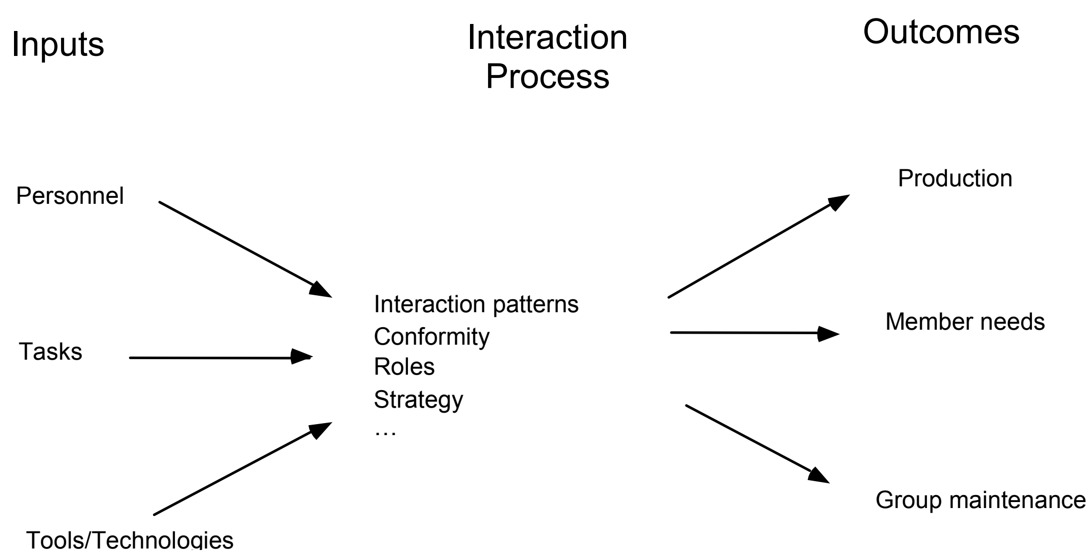


Figure 2: Elements of an Input-Process-Output Model of Groups

team members (e.g., smooth communication; competition). We begin this discussion by considering the outcomes or success criteria for a group, because understanding them highlights relevant inputs and interaction.

Outcomes

Production outcomes. Input-process-output models emphasize that the outputs of a work group are multidimensional. Often when lay people think of work groups they judge their success in terms of production—task outcomes that are acceptable to those who receive or review them, produced as efficiently and effectively as possible. For example, one might judge a software engineering team based upon the quality and quantity of the software it produces, a factory team based upon the number of cars it assembles, a team of scientists based upon the importance of the theories they develop or empirical observations they collect, or a design team based upon the new product ideas they have. By the production criterion, groups are successful if they meet their production goals, and useful technologies are those that help them do so more efficiently or in new configurations. By these criteria, the success of groups is analogous to the success of individual work—more efficient or effective production.

The experimental literature shows that groups on average perform better than the average of their members or than a member selected at random. For example, they produce more and better ideas than a single individual when brainstorming, or solve problems more accurately than the typical person in the group (Gigone, & Hastie, 1997; Hill, 1982). Groups do better than individuals through two basic mechanisms—aggregation and synergy. First and most simply, the different individuals who make up a group bring unique resources to it. They bring energy, and differences in knowledge, skills, and attitudes that are often essential for accomplishing some task. As we indicated in the case of software engineering, the large size of software projects and the range of knowledge and skills they require means that no single individual could construct a large software project individually. Second, and more difficult to explain, is synergy. Synergy is the increase in effectiveness that comes about through joint action or cooperation. It is the result of groups building upon the resources that its members contribute and going beyond them. It is, for example, the creative solution that occurs when members with different points of view or different backgrounds try to solve a problem and achieve a solution that goes beyond what any of the members knew before they got together. To make this concrete, consider IDEO, one of the most successful new product design firms in the United States. When trying to develop a new design for some product, such as a shopper-friendly, child-safe grocery cart that resists theft, it routinely mixes biologists, engineers, historians, and designers together on its design teams (Kelly & Littman, 2001). To generate this synergy, it creates a physical environment and work process to bring together ideas from different disciplines in new and creative ways (Hargadon & Sutton, 1997). For example, it maintains archives of toys and gadgets, has an organizational structure that downplays status differences among managers and employees, evaluates employees based on helpfulness to others as well as creativity, and emphasizes brainstorming meetings as a way to shape ideas.

Group maintenance and member support. Besides production, groups also need to have the capability to work together in the future (group maintenance) and to support the needs of individuals within the group (member support) to be successful (Hackman, 1987). Consider a scientific team putting together a research proposal to a granting agency. Their proposal convinces the reviewers and the granting agency, and they receive a grant for $800,000. By a production criterion the group was successful, because it produced a high quality proposal acceptable to the reviewers. However, the team also needs to maintain itself as a group to be successful. For example, if the process of writing the proposal was so filled with conflict that the team was unwilling to work together once they received their funding, that group would not be successful by the group maintenance criterion. Similarly they would need to recruit graduate students, convince department heads to grant them space, and perform a host of other activities to maintain themselves as a group.

In addition to production and group maintenance, successful teams also support their members. For example, we would consider the scientific team more successful if working together made members more satisfied with their work, helped them meet personal career goals, or enabled them to them learned from each other.

Relationships among outcomes. These outcomes of groups do not change in lockstep. In many real world groups, for example, productivity and job satisfaction, a component of member support, are only weakly correlated (Judge, Thoresen, Bono, & Patton, 2001; Oliver, Harman, Hoover, Hayes, & Pandhi, 1999). Interventions designed to improve one of these outcomes may have a debilitating effect on another. For example, in a classic experiment, Levitt (1951) demonstrated that increasing structure in group communication by having all messages flow through a single coordinator can improve the efficiency when the group performs simple distributed problem-solving tasks. However, the same intervention also harms members' satisfaction with the group. Similarly, Connelly and Valacich (1990) have shown that having a skeptic in a brainstorming group causes the group to generate more ideas of higher quality. Again, however, this intervention decreases members' satisfaction with the group.

Inputs.

According to Input-Process-Output models, both inputs to the group and the processes group members use when working together influence whether groups will be effective in achieving their production goals, meeting members' needs, and maintaining themselves over time. By influencing the group process, inputs have both direct and indirect effects on group effectiveness. Inputs include such resources as personnel, task, tools and time.

Personnel. Obviously groups composed of more highly-qualified people—having appropriate knowledge, skills, and motivation—will on average be more effective than groups with less highly-qualified members. Work groups that are functionally diverse have a larger stock of ideas to draw upon, and differences in assumptions that allow them to generate more creative solutions. As we have seen in the case of IDEO, new product development teams with members who have expertise in a wide variety of disciplines have the potential to be highly creative, bringing together old ideas in new ways (Hargadon & Sutton, 1997).

However, diversity can be a mixed blessing. McGrath's (1984) and Martins' reviews (1996) demonstrate that functional diversity, demographic diversity, variation of length of time with an organization can lead to crippling frustration and conflict within a group. It is difficult for individuals from divergent backgrounds to share a common enough language to communicate efficiently (Isaacs & Clark, 1987). In addition, they are likely to have different values and beliefs about what is important (Pelled, 1999). Language and differences among visual designers, engineers, and marketing personnel on a new product team, for example, may cause them to talk past each other rather than being a source of synergy. They may all desire elegance of design, but for the designer this means a visually appealing one, for the engineer it is a solution that efficiently solves a problem, and for the marketer it is one that appeal to consumers' tastes.

Task. As mentioned previously, on average groups do better than their individual members on many tasks. But the extent to which they exceed the capabilities of individuals and the processes by which they achieve this success depend upon the characteristics of that task. McGrath (1984) has developed an influential taxonomy of the tasks that comprise group work. (See Figure 3). The taxonomy was originally developed to describe the artificial tasks that characterize laboratory experiments on group behavior. In the real world, any group is likely to engage in most of these tasks to varying degrees.

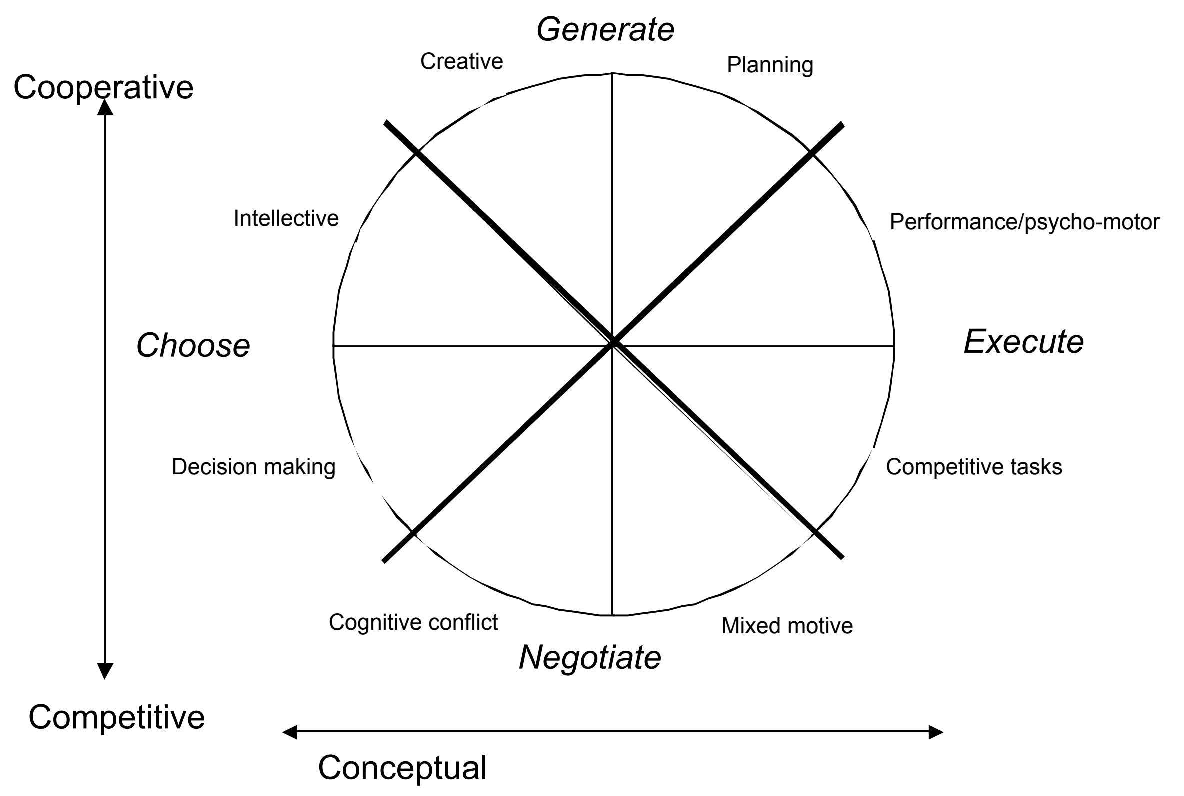


Figure 3: Taxonomy of group task(adapted from McGrath (1984))

Despite this limitation, the taxonomy is useful for highlighting how even small changes in task definition are likely to influence group effectiveness.

The upper left-hand quadrant of McGrath's circumplex consists of cooperative cognitive tasks. Among these, McGrath distinguishes among **generative tasks**, such as brainstorming, where groups develop new ideas; **intellective tasks**, in which groups answer math or other problems with correct answers; and more open-ended **problem-solving tasks**. A typical brainstorming task asks groups of individuals to identify new uses for a fork or to solve a problem on a college campus of an imbalance between the supply of parking places and demand for them. In these brainstorming tasks, groups produce more good ideas than does any single individual (Gigone & Hastie, 1997; Hill, 1982). The primary mechanism seems to be mere aggregation, in which multiple people, even if they are not interacting, are likely to generate more unique good ideas than any single one of them. However, synergy can also play a role, since in interacting groups one person's ideas may spark variations from others (Paulus, Larey, & Dzindolet, 2000).

In one subset of intellective tasks, including anagrams and Eureka problems, the

B B A A R R	go it it it it	we**lie**ight
I'M you	my own heart a person	long do
knee light light	XQQME	search and

Figure 4. Examples of Eureka puzzles.

Answers, left to right top to bottom: Parallel bars, Go for it, Lie in weight, I'm bigger than you, A person after my own heart, Long over due, Neon lights, Excuse me, Search high and low solution can be easily verified once generated. For example, consider the brainteasers in Figure 4. On these tasks, groups tend to be as good as the best person in them on any trial (Gigone & Hastie, 1997; Hill, 1982). These tasks follow a "truth wins" rule. Once any person in the group solves the problem and communicates the answer to the group, the group accepts it. Again, aggregation is the key, because a collection of individuals is more likely to contain at least one individual who can figure out the correct answer than is any one of them selected at random. Finally, ambiguous problem-solving tasks are those with multiple acceptable solutions or where the correct answer cannot be easily verified. These include world knowledge problems (e.g.., the morbidity rate for black males) or difficult math problems. In these tasks, groups tend to be as good as the second best person in them in any trial and seem to follow a "trust-supported" heuristic. Interaction in the group allows the group to pool information and to fix errors though a process of both aggregation and synergy. For example, when a group is trying to estimate one morbidity rate, one person may be knowledgeable about health risk and death, while others may contribute knowledge of accidents and violence.

Technologies. The focus in much of the research in CSCW is on building technology that helps both conventional and distributed groups to be more effective. The social science tradition considers technology broadly to include both the ways in which groups and tasks are structured and the artifacts they use. Thus, for example, the assembly line in an auto plant uses the technology of the division of labor, which breaks down a large task into a sequence of subtasks performed by specialized workers and the technology of conveyor belts, to move components from one station to another. To give another example in the CSCW domain, researchers have developed technologies to reduce interruptions among team members. They include scheduling conventions, which distinguish between quiet times, when communication is discouraged, and interaction times, when communication within the group (Perlow, 1999) is permitted. They also include sophisticated filtering algorithms, which permit electronic communication only when a recipient isn't busy (Horvitz, Jacobs, & Hovel, 1999).

Just as groups should be more effective if they have more qualified personnel, it is obvious that they would also be more effective if they had appropriate technology to support their activities. Technology can be as simple as the office arrangements and the physical proximity that permits members of a group to communicate frequently and interactively. Most organizations collocate individuals who need to work together precisely to take advantage of physical proximity. When group members cannot be collocated because of the nature of the task, the availability of relevant staff, competition, or other factors, teams must use telecommunication—literally, communications at a distance. These telecommunication technologies include telephones, video teleconferencing systems, electronic mail, instant messaging, shared computer file systems, databases, and screens sharing software. These technologies are not as effective as physical proximity for communication. Groups are less likely to form among people who are geographically separated. If distributed groups are formed, they have more difficulty in setting direction, in coordinating their work, and in forming successful working relationships than do teams whose members are collocated (Cramton, 2001; Kraut et al., 2002; Olson & Olson, 2000).

Technology for groups goes beyond simple communication facilities. For example, the distributed teams of engineers who design modern aircraft use sophisticated software tools that combine communications, databases, computer-aided design, and simulation (Argyes, 1999). The engineers can use three-dimensional digital software to see parts as solid images and then simulate the assembly of those parts on the screen, easily correcting misalignments and other fit or interference problems among parts that need to interoperate and were designed by other engineers.

The traditional view in group research is that inputs such as people, tasks, and technology have a dual impact on group effectiveness. They can influence outcomes directly, and they can influence outcomes by changing the way that group members interact with each other. For example, groups are generally better able to complete a well-defined task, because it is easier for them to figure out and evaluate solutions against clear criteria. This is an example of a direct effect of task on performance. In contrast, having a well-defined task may make it easier for groups to establish a clear division of labor, in which each member knows his or her responsibilities and how subtasks will be integrated. In this sense, the task is influencing group effectiveness by changing the group interaction and reducing coordination costs.

Interaction Processes

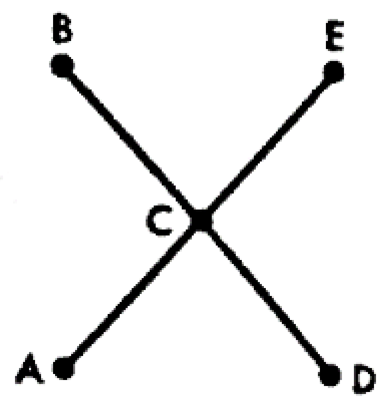
The way that group members interact with each other can directly influence group outcomes and can mediate the impact of inputs to the group. Factors such as the following can all influence groups' outcomes in terms of production, maintenance, and member support: communication, conflict, conformity, socialization, leadership, status, and in-group-out-group differentiation. For example, group members are strongly influenced by the beliefs, attitudes, and behaviors of those around them (Asch, 1955; Sherif & Sherif, 1969, Chapter 11). Some consequences of the conformity pressures in groups are that over time, diversity in a group tends to decline (Latane & Bourgeois, 2001), that group members perceive more homogeneity in the group than actually exists (Latane & L'Herrou, 1996), that members feel comfortable with the perceived homogeneity of the group, which helps group maintenance (Williams, 1998), and that groups sometimes fail to sufficiently explore options (Janis, 1972). Given the range of interaction processes in groups, the influences on them, and their consequences, this chapter cannot adequately review the relevant literature. We focus here on communication, perhaps the most important component of group interaction. One can characterize group communication in terms of its volume, its structure, its content, and its interactive features.

A large literature in social psychology and organizational science shows that for tasks involving interdependence and uncertainty, team members must have a substantial amount of interpersonal communication to be successful (Thompson, 1967; Van de Ven, 1976). For example, without swift communication including feedback, pairs have difficulty constructing simple objects (Chapanis, 1972; Krauss, Garlock, Bricker, & McMahon, 1977). Pairs who can communicate are less likely to devolve into self-destructive behavior in prison dilemma settings (Macy, 1991). Pelz and Andrews (1966), in their classic study of scientists in organizations, show the importance of within-team communication for success, and these findings have been replicated often. In a recent study, Cummings (2001) showed that teams in a multi-national corporation were evaluated more highly when the members communicated more with each other.

Conversely, Kiesler, Wholey and Carley (1994) showed that novice software engineering teams failed when they didn't communicate enough.

However, even communication is not an unalloyed good. Communication takes time away from individual production (Perlow, 1999). Organizational contingency theorists hold that no one way of behaving in a group or organization is appropriate for all groups, and that the technology needed to support a group varies greatly with the tasks that typically confront the group. They emphasize uncertainty as a key feature of tasks that determine whether a particular technology will be appropriate (Galbraith, 1977; Lawrence & Lorsch, 1970).

Consistent with organizational contingency theory, a basic finding from both laboratory experiments and field studies in organizations is that the right combination of volume, structure, content and interactivity in group communication depends upon the task. For example, in classic experiments Leavitt (1951) demonstrated that in a simple distributed problem-solving task, having all messages flow through a communication coordinator increased efficiency. In this task, groups of five were required to identify a unique card among a set that had previously been distributed to them. Here having a wheel communication structure (Figure 5a), in which all messages were given to person C, who in turn passed them on to their destination, was more efficient than the fully connected graph in Figure 5b, where each group member could directly connect with every other one. However, in a more complex task, in which the group needed to solve a more difficult problem, the fully connected graph was superior to the wheel (Shaw, 1964).



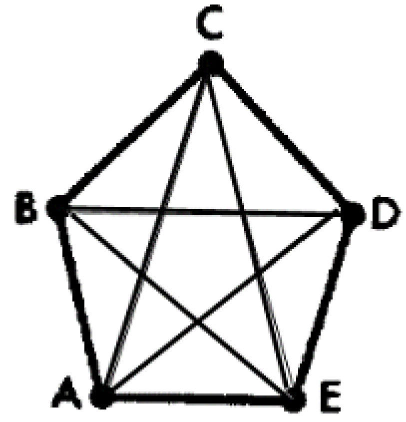


Figure 5a: Wheel structure	Figure 5b: Fully-connected structure

Field studies of teams in organizational settings show similar results. Tushman's research on research and development labs (Argote, 1982; Katz, 1979; Tushman, 1979) compared teams performing tasks differing in uncertainty: for example, teams doing relatively certain service work (e.g., maintaining laboratory equipment), teams doing a more uncertain and complex basic research. When service teams were organized hierarchically, with a supervisor central to both communication and coordination, they were more successful than when they were organized in a self-managed way, with less supervision and more peer-to-peer communication. In contrast, basic research teams were more successful when they engaged in more peer-to-peer communication and had a diminished role for the supervisor. (See Argote (1982) for similar results among hospitals emergency room crews dealing with either routine or more unusual cases.)

These results have implications for communication tools and technologies to support group work. In groups performing relatively certain tasks in stable environments, the current generation of CSCW, which does not easily support highly interactive communication among multiple individuals, may suffice. At one extreme are highly routinized tasks conducted in a stable environment, such as those done by the staff in a fast food restaurant. In this environment, communication among workers assembling an order of burgers, fries and a shake can be highly ritualized. The counter clerk can enter the order on the keypad of the cash register, which then updates a queue on a video screen behind the counter. By glancing at the list on screen, the fryer and griller know how much food to cook, and the assembler can grab fries and the burger from the staging area and pour a shake, without any direct communication with other team members. More extensive, direct communication among them is unnecessary and is likely to interfere with their ability to keep up with demand during peak meal times. In contrast, technologies that restrict communication would be less acceptable in environments where the risk is more uncertain. For example, communication among research scientists collaborating on a project or members of a hospital emergency room must be more direct and interactive. (Argote, 1982; Katz, 1979; Tushman, 1979). Teams might need to be collocated to work effectively, and distributed teams might need to meet frequently. Uncertainty can increase because of interdependence among team members, tight time constraints, or greater variability, among other factors (e.g., Kraut & Streeter, 1995).

Process losses

Even though groups typically perform better than an average member, for many tasks groups do worse than the theoretical maximum one would expect, given the resources members bring to the group. Steiner (1976) terms this the general problem of "process loss," in which the mere fact of being in a group degrades performance from what the members could be theoretically capable of producing. Consider the intellective problems tasks described previously: The basic finding was that groups perform as well as their second best member, and that an individual's answer on one of these tasks is accepted only if a second member supports it. This means that in many groups, at least one group member had a better answer than the answers the group as a whole agreed upon.

Analogous phenomena occur in real-world groups as well. One might expect, for example, that teams with greater diversity should outperform more homogeneous teams, because the diverse teams can bring a richer, non-redundant set of resources to bear on problems. Yet, despite these expectations, reviews of the research literature show that functional and demographic diversity in work groups have mixed effects (Williams, 1998). They only occasionally lead to production benefits and frequently lead to dissatisfaction with the group and turnover in membership.

Processes losses come about through two distinct processes: coordination problems and motivation problems.

Coordination problems: Groups are inherently different from individuals performing the same task because of the need to coordinate. Whenever the work of individuals is interdependent, they must coordinate to achieve success (Van de Ven, Delbecq & Koenig, 1976). This process of coordination takes effort, which could otherwise directed toward production. Indeed, Malone and Crowston (1994), among others, define coordination as the extra activities people must do when working in concert to accomplish some goal, over and above what they would need to do to accomplish the goal individually. Coordination consists of broad alignment of goals, as when a management team sets a direction with implications for marketing and engineering. It also consists of detailed alignment of behavior, as when a coxswain shouts “stroke” to coordinate the behavior of a rowing crew. When coordination is high, a unit of individual work will translate into more team output. Conversely, when coordination is low, the same quality and quantity of individual work will result in less group output.

A wide variety of distinct mechanisms leads to process losses because of coordination problems. Table 2 provides a sampling of these mechanisms. Several of

Coordination problem	**Definition**
Coordination effort	Time and effect invested in coordination deducts times and effect from production and group maintenance
Misaligned goals	Value differences or political differences among group members prevent them from pursuing common goals
Misaligned communication	Individuals have difficulty communicating with each other because of differences in assumption, vocabulary, location, and other impediments to achieving common ground.
Conformity pressures	Individuals are less likely to express personal beliefs and ideas because of social influences, such as imitation or evaluation apprehension
Synchronization problems	Output offered by one individual in a group do not meet the inputs need by another, because they are of the wrong form or arrive at the wrong time
Production blocking	Scare resources, such as time in a meeting or production tools, can’t be simultaneously used, and some group members remain idle while others work.

Table 2: Examples of coordination problems

these mechanisms partly account for the failure of functional diversity in groups to result in the expected gains in creativity and production. For example, people with different functional backgrounds often have different vocabularies, standard operating procedures, values and goals. Differences in these factors make it more difficult for them to coordinate. Experimental research shows that group productivity is hurt when people have incompatible, personal goals (Mintz, 1951). On April 14, 1994, two US Air Force F-15 jets shot down two US Army helicopters in Iraq's no-fly zone. Differences among Army and Air Force pilots in vocabulary, standard operating procedures, and values were partly responsible for this accident (Snook, 2000). For example, the Army's value of flexibility and the Air Force's value of precision in planning led to different standard operating procedures, in which the Army helicopters received their flight routes just moments before a flight, while the Air Force had detailed flight plans in place 24 hours before their flights. Thus the jets didn't expect to see friendly aircraft in the area, and fired on them. These problems were compounded by a number of others.

Motivational problems. In addition to the coordination problems in having to align, schedule and integrate individual efforts, working in a group also influences the motivations of the group members. Sometimes being in a group enhances individual motivation and other times it undercuts it. Groups, for example, establish norms about how hard members should work. "Rate-boosters" and "slackers" are terms for people who expend more or less effort, respectively, in relationship to an implicit group norm. Group members tend to pressure those who deviate from the group norm to get them to conform. Whether the group norm is to work hard or slack off often depends upon history, on explicit goals that are set for the group (Locke, Latham, & Erez, 1988), and upon whether group members directly participated in the goal-setting or whether it was imposed upon them (Coch & French, 1948). For example, members generally conform more closely to production goals if they had a hand in setting them.

Sometime merely being in the presence of another is sufficient to change motivation. Social facilitation is one of the oldest phenomena identified in social psychology. Trippet's 1898 experiments on pacing and competition examined the consequences of the mere presence of others on upon an individual's behavior (Triplett, 1898). Zajonc (1965) reviewed evidence to show that merely being in the presence of another seems to increase individual arousal across many species, including humans. A basic principle of behavioral theory is that increased arousal makes the most dominant response (i.e., the one most poised for being emitted) in a situation even more dominant. Findings that animals eat more in the presence of others and that people laugh more when watching a comedy in the presence of others are consistent with this proposition. The implication is that the presence of other people will facilitate performance when a task is well-learned, but will degrade performance with new tasks. For example, all else being equal, compared to working alone, people working in a group should have more difficulty learning a complex new task, but should perform better executing well-learned tasks.

Social loafing

Social loafing is another phenomenon in which group membership degrades individual motivation. The basic empirical phenomenon is that individuals typically work less hard when they are part of a group than when they are working on their own. The issue here isn't the mere presence of others. Rather, social loafing occurs when people think that the outcomes of their efforts are being pooled with the efforts of other group members. The phenomenon was first identified by Ringelmann (cited in Kravitz & Martin, 1986). When volunteers pulled on a rope connected to a strain gage, as the number of volunteers increased, the force they exerted declined from the amount one would expect by adding up the volunteers' efforts when they worked individually. Ingham, Levinger, Graves and Peckham (1974) demonstrated that the effect was the result of decreased effort and not failures of coordination, by comparing blindfolded volunteers who believed that they were pulling alone to those who thought that they were jointly pulling on the rope. By the time of Karau and Williams' review (1993), researchers had demonstrated the phenomenon in over 80 experiments in both laboratory and field settings, using a wide variety of tasks, including physical ones (e.g., rope pulling, swimming) and cognitive ones (e.g., brainstorming, evaluating poems, keeping vigilance).

Although social loafing is a robust phenomenon, the extent to which being in a group leads to social loafing varies with the nature of the task and the nature of the group.

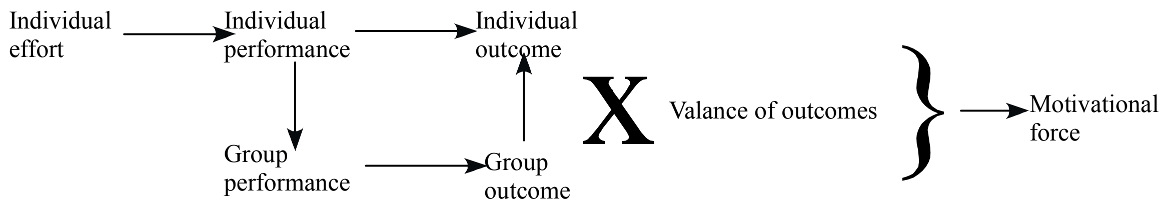


Figure 6: A collective effort of social loafing (from Karau and Williams, 1993).

In particular, an individual will engage in less social loafing if the individual is working in an attractive group, if the task is personally satisfying or engaging, if the individual thinks other members will perform poorly, if the individual thinks his or her own contribution is unique, if the individual's own output is visible to other group members, or if the individual is a woman, was raised in an Asian culture, or is a child.

Karau and Williams (1994) developed an integrated theory of social loafing, which accounts well for prior research. This is illustrated in Figure 6. The basic assumption is that people will work harder (greater motivational force) if they think their effort will lead to some performance that will help them to achieve some valued outcome. This relationship is easy to see when individuals are performing alone. One might expect a runner to race harder if he thinks his effort will increase his chances of winning and if he values winning. Performing in a relay race complicates the picture, because there is a less direct link between his effort and the chances of his team's winning, and because his evaluation of winning is likely to be influenced by his liking for the group. This model predicts that when working in a group, individuals would work harder when they think that their contributions are unique or that other members will perform poorly, because in these cases their effort is more necessary for group success. In addition, individuals should work harder if they like the group, because this increases the value of the outcome for them. In a later section, we explore the implications of this theory for design.

4. "Detailed" description: Explaining productivity loss in brainstorming teams

The performance of brainstorming teams is an excellent example of the benefits that groups bring and the way that process losses undercut their effectiveness. We have seen that on brainstorming tasks, groups produce more good ideas than any single member is likely to produce. However, a group of interacting individuals is likely to produce fewer good ideas than a "nominal" group, that is, a group of comparable individuals who work independently and pool their contributions. In this section, we consider how social psychological theories that account for process losses might apply to this phenomenon. We can use our understanding of the reasons for the process loss in this case to evaluate the likely success of the design of commercial brainstorming tools. In a subsequent section, we try to show how using Karau and Williams' theory of social loafing we might redesign other social-technical systems, like list servers or online discussion groups, where content is often undercontributed.

There are three plausible explanations for why interacting groups produce fewer ideas than collections of similar individuals working independently—social pressure, social loafing, and production blocking. Social pressure and social loafing are examples of motivational problems, while production blocking is a coordination problem. There is evidence that all three processes frequently occur in groups of many kinds, including brainstorming groups. However, production blocking seems to be the major cause of production loss in interacting brainstorming groups. In this section we consider the evidence that leads to thess conclusions and suggest how this attribution of causation has consequences for the design of group systems for brainstorming.

Social pressure. Although there are many forms of social pressure, in the case of brainstorming one might expect that individual contribution may be inhibited because of evaluation apprehension—an individual's fear that others might think badly of him or her for coming up with silly or impractical suggestions. Osborne's (19xx) directions for successful brainstorming, which emphasize the nonjudgmental contributions in the early stages of brainstorming, try to guard against this inhibitor.

Social pressure in general and evaluation apprehension in particular reduce participants' willingness to contribute ideas in a brainstorming session. This is especially the case for people who offer minority points of view or controversial ideas (McLeod, Baron, Marti, & Yoon, 1997). Diehl & Stroebe (1987) directly manipulated evaluation apprehension among individuals who were brainstorming by telling some of them that their contributions would be judged by peers or expert judges (high evaluation apprehension) or not (low evaluation apprehension). Individuals who expected judgment produced fewer ideas than those who did not, especially when the discussion topics were controversial.

To reduce evaluation apprehension, some researchers have recommended anonymity in electronic brainstorming systems (Nunamaker, Dennis, Valacich, Vogel, & George, 1991), and most commercial brainstorming systems enforce anonymity. As Dennis and Williams note in their recent review, however, evidence about the benefits of anonymity are equivocal at best (Dennis & Williams, 2002). Connolly, Jessup & Valacich (1990) examined the effects of anonymity and evaluative tone on the performance of 24 computer-supported 4-person groups. Participants in the non-anonymous groups were introduced to each other, and their ideas were identified with their names, while those in the anonymous groups were not introduced, and their contributions had no names attached. These researchers also manipulated the evaluative tone of the experiment by having confederates offer critical or supportive comments in response to others' contributions. They found a strong effect of evaluative tone, with groups containing a critical confederate generating more ideas; but only weak effects of anonymity. Research by Cooper, Gallupe, Pollard and Cadsby (1998) showed anonymity raised the productivity in electronic brainstorming groups by 10-20%. However, similar research by Dennis and Valacich (1993), Jessup, Connolly and Galegher (1990), Prentice-Dunn and Rogers (1982) and Jessup, Connolly and Tansik (1990) found little evidence that anonymous groups produced more or better ideas than ones where members were identified.

Does evaluation apprehension account for the productivity loss in brainstorming groups? To test this, one would need to show that the difference in brainstorming productivity between interacting groups and nominal groups is reduced when one controls for evaluation apprehension. Diehl and Stroebe (1987, experiment 4) conducted this test, by comparing brainstorming groups who believed their contributions would be judged by peers or experts (high-evaluation apprehension) with those who thought their contributions would not be judged (low-evaluation apprehension). They found that the high-evaluation apprehension groups produced fewer ideas than the low-evaluation apprehension ones, but only when they believed that the judgments reflected upon the individual contributor rather than the group a whole. However, regardless of the evaluation apprehension condition, nominal groups produced almost twice as many ideas as interacting groups. This pattern of results suggests that while evaluation apprehension inhibits the generation of ideas, it does not account for differences between nominal and real groups.

Social loafing. Social loafing might account for production loss in interacting brainstorming groups compared to nominal groups, because participants working in a real, interacting group might be less motivated to contribute. To test for the effects of social loafing, researchers typically compare nominal groups of co-acting individuals (i.e., groups in which individuals work in the presence of others, but believe that their outputs will not be pooled) with true groups (i.e., groups in which individuals work in each others' presence and believe that their outputs will be combined). Social loafing does reduce brainstorming effort, as it does many other outcomes. Research comparing real and nominal groups shows that social loafing reduces contribution in brainstorming tasks. For example, Diehl and Stroebe (1987, experiment 1) conducted a brainstorming experiment with two independent variables—type of session (individual versus real interacting 4-person group) and type of assessment (personal versus collective). In the personal assessment condition, participants were led to believe that their individual contributions would be tallied, while in the collective assessment condition, they were led to believe that the contributions would be pooled among all people in an experimental condition before being tallied. Collective assessment reduced contributions. Subjects in the collective assessment condition reduced their contributions by 24%, showing the effects of social loafing. However, the effects of type of assessment were much weaker than the effects of being in a 4-person group or of working individually. Subjects in the group sessions reduced their contribution by 63% compared to those in the individual sessions (i.e., what others have called nominal groups). Moreover, the productivity loss from being in an interacting group was approximately the same whether subjects thought their contributions would be evaluated individually or collectively. These results suggest that while social loafing can decrease productivity for brainstorming tasks, it cannot account for differences between nominal and interacting groups.

Production blocking. Conventional, face-to-face brainstorming groups experience some degree of production blocking, because multiple members of the group cannot talk simultaneously without drowning each other out or interrupting each other. Therefore, to determine whether production blocking accounts for productivity losses in brainstorming groups, researchers have added production blocking to conditions under which blocking would not typically occur. For example, Diehl and Stroebe (1987, experiment 5) compared five experimental conditions. To replicate traditional research, they compared interacting groups and nominal groups (isolated individuals brainstorming independently). In addition, they included three other conditions, in which subjects believed they were in groups whose members were distributed in different rooms. Red lights that glowed when other members of their distributed groups were talking regulated when they could contribute, to different degrees. In one condition (blocking, communication), they heard the other people by headphones and were told to refrain from contributing when the red light was on. In the blocking, no-communication condition, they were told to refrain from contributing when the red light was on, but could not hear the other parties. In the no-blocking, no-communication condition, the red lights glowed when others were talking, but subjects were told that they could contribute "whenever they wanted and that they need not pay any attention to the lights." Results were consistent with the production blocking explanation, showing that both blocking manipulations reduced brainstorming contribution to 50% of the level of the interacting groups, while seeing the light without the blocking instruction had no effects on brainstorming.

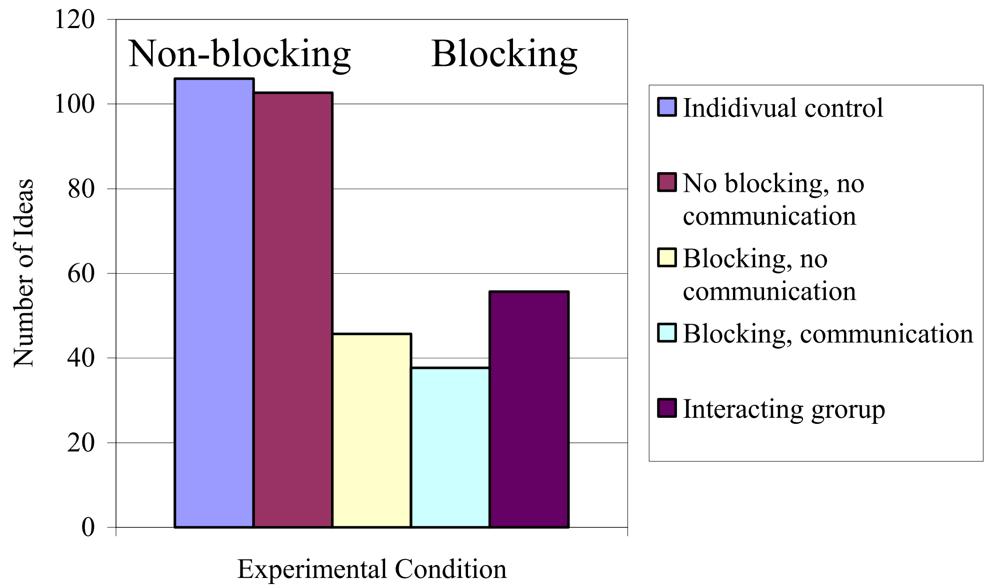


Figure 7: Brainstorming contributions (From Diehl and Stroebe, 1987, Experiment 5).

Gallupe, Cooper, Grisé and Bastianutti (1994, experiment 3) used a similar approach. They compared two electronic brainstorming systems, in which people typed their contribution. In the electronic, no-blocking condition, participants could type in parallel and enter ideas simultaneously. In the blocking condition, subjects could enter material only when a previous contributor had verbally indicated they had finished entering an idea. They compared these two electronic conditions with a conventional interacting, face-to-face brainstorming group, who spoke their contributions (face-to-face), and a face-to-face group whose members had to wait until others were finished speaking before making a contribution (face-to-face, first in). Subjects in the electronic, no-blocking condition produced about a third more non-redundant ideas than subjects in any of the other conditions, which did not differ from each other.

Together the results of this research show that evaluation apprehension, social loafing, and production blocking can all reduce production in brainstorming groups. However, production blocking seems to be the primary factor that explains why nominal groups (individuals whose contributions are pooled) typically produce more ideas than interacting groups. Electronic groups whose members interact in parallel can perform as well as or better than nominal groups. Introducing blocking into the electronic group eliminates the advantages of working independently.

Application to system design

Knowing whether social pressure, social loafing or production blocking is the primary cause of production loss in group brainstorming has implications for designing effective brainstorming tools. If social pressure and evaluation apprehension are the major culprits, one design solution is to enforce anonymity in contributions. Disguising the identity of contributors should reduce their fears that others will think poorly of them for outlandish contributions and thereby reduce inhibition. As Nunamaker, and his colleagues note (Nunamaker et al., 1991), "anonymity can affect EMS [Electronic Meeting Support] use by reducing or eliminating evaluation apprehensions and conformance pressures, as well as social cues. The reduction of evaluation apprehension and conformance pressure may encourage a more open, honest and free-wheeling discussion of key issues. (p. 55)." Based on this logic, most commercial meeting support systems, including those with electronic brain storming features, enforce anonymity. (e.g., www.GroupSystems.com).

In contrast, if social loafing is a major cause, then enforcing anonymity would be counter-productive. Both theory and Karau and Williams' (1993) empirical literature review suggest that making an individual's contributions visible decreases social loafing and encourages people to contribute. One type of positive social pressure in a group is to set a production standard. Knowing that others can observes and evaluate one's output discourages group members from slacking off, at the same time that it might discourage them from contributing outlandish or controversial ideas. Perhaps these conflicting outcomes are the reasons why anonymity does not seem to have consistent effects on the quality and quantity of performance in brainstorming sessions.

Finally, if production blocking is the major source of the problem, then manipulating anonymity is irrelevant. Production blocking occurs when simultaneous contributions overtax some scare resource, such as time or working memory. Production blocking occurs because in face-to-face settings, two people can't talk at the same time or because the act of listening to others' contributions prevents an individual from simultaneously generating new ideas. If production blocking is the major cause, then the solution is to devise procedures or technologies that allow simultaneous input. Virtually every research-oriented and commercial group decision support system has a module for electronic brainstorming and has procedures for simultaneous input. For example, the brainstorming module from www.groupsystems.com circulates a small number of lists of suggestions among the participants. Each participant initiates a list, by making a contribution. When participants submit a contribution, they are randomly given a one of the circulating lists, to which they can append another new idea or a comment on a previous one. In this arrangement, multiple participants can contribute simultaneously. They also have an opportunity to see others' contributions for the potential stimulation this might provide.

Although we have used the phenomenon of production losses in brainstorming as a vehicle to understand the application of various social psychological theories, these theories are not limited to this domain. In the section below we discuss how a theory of social loafing might be used to increase contribution rates in various online communication forums.

5. Case Study: Applying social psychology theory to the problem of under-contribution to online groups

Social loafing and online groups

One of the benefits of the Internet is its support of online groups and communities (Preece, 2000). The Internet supports computer-mediated communication among groups of individuals who may or may not have off-line relationships as well. People can communicate in near real-time, using synchronous communication services, like MUDs, chats, and instant messaging. Alternatively, they can communicate without having to be simultaneously available, using asynchronous communication services, like electronic mail distribution lists, list servers, and electronic bulletin boards. For example, http://www.lsoft.com/catalist.html and http://www.tile.net/lists/ provide listing of literally thousands electronic-mail based, electronic discussion lists, a large proportion of which are open to the public. These online groups can be recreational, as are many Dungeons and Dragons-based MUDs or movie fan-based distribution lists. They can provide technical, product or hobby information, such as distribution lists for computers and programming languages. Many, such as the numerous health-oriented chats and distributions lists, provide both social support and information for their participants. A common characteristic of online groups is their highly uneven distribution of contributions. In almost all, a small fraction of the members contribute most of the content, with the remainder acting as "lurkers" or subscribers who only read. Figure 8 shows the distribution of active participants in a sample of 39 active email-based distribution lists on a wide variety of topics (Bulter, 1999). Over 50% of the individuals subscribing to these lists posted no messages at all, and in fewer than 10% of the lists do even 50% of the subscribers contribute anything. The vast majority of messages were contributed by a small number of posters.

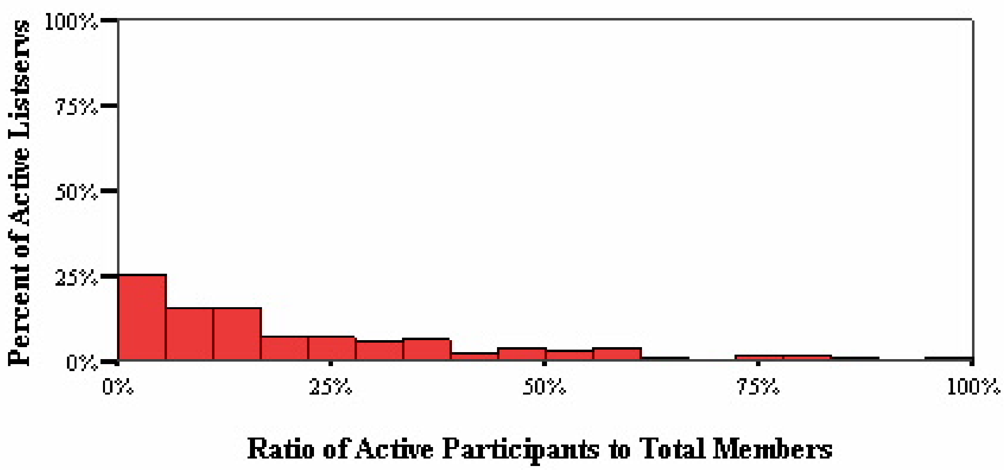


Figure 8: The distribution of the activity level of members in 39 email-based distribution lists (From Butler, 1999)

Imagine that your goal, as a sponsor of an online group for cancer support, such as OncoChat (http://www.oncochat.org/) or the breast cancer distribution list at http://www.oncochat.org/, was to increase participation rates, so that more of the subscribers contributed. In some sense the problem of low contribution rates is a social dilemma, analogous to paying taxes or donating to public television. If no one contributed to these online groups, then the social benefit that members get from them would disappear.

As an exercise, one could take Karau and William's theory of social loafing and use it as the basis for design guidelines to increase participation rates in this group. To my knowledge, no one has yet formally conducted such an exercise or built an online group based on these guidelines. Existing online groups are consistent with these guidelines to varying degrees. The proposal sketched in this chapter is admittedly speculative and should be treated as a set of testable hypotheses rather than established fact. Table 3 lists the variables that reduce social loafing, according to Karau and William's meta-analysis. The second column indicates how this variable is linked to Karau and William's collective effort model. Remember that this theory says people will be motivated to work on a task to the extent that they perceive that their successful performance on the task will lead to an outcome that they find attractive. Finally, column three provides design suggestions based on this variable. As an oversimplification we will treat thematically-oriented, synchronous systems like MUDs and MOOs, synchronous, unstructured systems like chats, and asynchronous bulletin boards and list servers as instances of online groups. We recognize, however, that there are important differences in the ways they operate and probably important differences in the ways that the variables associated with social loafing will influence members' behavior.

These suggestions in Table 3 are intended to illustrate the generative power of social psychological theory. For the purposes of this illustration we are assuming that Karau and Williams' theory is a complete and accurate theory of social loafing. Whether the suggestions derived from this theory will in fact improve participation rates in online groups and the health of the group more generally depends upon four factors. First, are the suggestions an accurate derivation from the theory? Second, are they implemented well? Third, are there other factors besides social loafing, such as differential commitment to the group, that lead to the unequal participation rates, and will interventions that counter social loafing have a beneficial or at least neutral effect on these other processes? Finally, do the efforts to increase participation rates affect other valued outcomes from the online group, such as communication volume, satisfaction that members get from the group, or their longevity with the group?

Variable	Link to theory	Design implication (Examples)
Identifiability	Direct deterrent to loafing; Individuals are accountable because behavior is directly connected to them.	Do not allow anonymity or aliases on the group.
Attractiveness of task	Increases the valence of individual outcomes	Provide opportunities for interactivity, because interactive communication is more attractive and less effortful than asynchronous communication. Sharply define the topic of the group, since this will recruit members interested in the topic. Do not constrain content of online communication, since free communication is more attractive (at least to sender).
Attractiveness of the group	Increases the valence of group outcomes	Sharply define the topic of the group, since this will recruit members who are similar to each other and help define group boundaries. Recruit members who have prior relationships outside of the group (e.g., organizational or geographic connection), because multiplex relationships are stronger than single-stranded ones. Develop management policy, norms, or tools to reduce inappropriate behavior.
Group size	Larger groups lower the probability that one's individual effort will lead to valued group outcomes	Place size limits or entry thresholds on new membership. Split active groups into subgroups, to maintain small group size. Cull non-participants to reduce size of group.
Uniqueness of own contribution	Intensifies probability that one's individual effort will lead to group outcomes	Mix members with different approach to same topics (e.g., MDs, caregivers, past patients, and currently ill on support groups), helping members to see their unique role.
Expectation that others will perform poorly	Intensifies probability that one's individual effort will lead to valued group outcomes	Mix novice and experts within a single group, making expertise more essential.

Table 3: Design ideas for online groups based on Karau and William's Collective Effort Model (1991).

The discussion below fleshes out a few of the design suggestions in Table 3, to illustrate the potential utility of the theory. Consider suggestions related to increasing the attractiveness of the group. The empirical literature shows that social loafing is reduced when members are more attracted to a group. We can term this the “attractiveness principle.” One can increase the attractiveness of a group either by influencing members' connections to particular others in the group or by influencing their commitment to the group as a whole. A long-standing topic in social psychology has been understanding the factors that lead to liking among individuals. For example, people typically like others who are similar to themselves, who are good-looking, intelligent, or have other positive social attributes, who have provided them favors, and with whom they have a history of interaction. (See (Berscheid & Reis, 1998) for a fuller discussion of the basis of interpersonal attraction.) Translating these principles into criteria for the design of online groups requires creativity.

Because people like those who are similar to themselves, members of topically oriented groups should have their joint interest in the organizing topic as a basis for similarity. Thus, they should be more likely to form friendships with others who subscribe to specific online groups with sharply defined topics, such as the usenet groups that concentrated on a particular soap opera (e.g., alt.tv.days-of-our-lives), rather than more general groups that encouraged discussion of all soap operas (e.g., rec.arts.tv.soaps) Similarity is desirable in its own right and provides a basis for conversation on a wide variety of topics, through which additional bases for friendship might emerge. Since relationships that support a variety of exchanges (termed multiplex relationships) tend to be deeper and longer lasting than those based on a single type of exchange, list owners, who run online groups, should encourage wide-ranging and hence off-topic discussion in their groups. This is the logic behind recommendations to define group membership sharply around a topic, but not moderate group or discourage off-topic conversation once people are members.

A second way to encourage members to increase their commitment to a group is to emphasize properties of the group itself, instead of the people who constitute it. For example, people feel more committed to groups that have clear boundaries, which differentiate group members from outsiders (Tajfel, Billig, Bundy, & Flament, 1971). This is another argument for constituting online groups with well-defined topics. People are more committed to groups for which they sacrificed to achieve membership (Aronson

& Mills, 1959). Together, these first two principles suggest the design of online groups where members must be vetted by group owner or membership committee. Vetting would contrast with the practice in many discussion groups, where joining is as simple as sending "SUBSCRIBE" in an email message. People like to affiliate more with high-status groups that have achieved success (Cialdini & et al., 1976). Archives from a group and frequently-asked questions lists that emphasized the group's accomplishments may help in this regard.

The social loafing research shows that people expend more effort on groups where they believe their own contributions are likely to be unique and other group members are less competent or skilled than they. Working through the implications of what we might call the "uniqueness principle" is substantially more difficult than working through the implication of the attraction principle. The practice in technical groups and health support groups of mixing experts with notices is consistent with the uniqueness principle. Constant and his colleagues (1996) showed that experts in a technical distribution list responded to "does anyone know" questions simply because they knew they had expertise that would be valuable to other subscribers. Most health support groups, like the usenet group alt.support.depression, encourage participation by variety of participants with complementary resources. They consist of those who actively have a disease, those who have previously had it, those who are providing support for someone with the disease, and medical professionals. Each type of member provides unique contributions, ranging from questions about symptoms, diagnosis and treatment, to information about these topics, reports on subjective experiences, and expressions of concern and support. Some people become members of these groups to receive information and support, while others become and remain members to provide it.

To some extent, however, the uniqueness principle is at odds with the attractiveness principle. Online groups filled with novices are likely to turn off the experts, because they are so dissimilar, because their presence tends to detract from the stature of the group as a whole, and because the majority of exchanges in the group are likely to go from expert to novice. To keep these countervailing tendencies in balance, online groups often develop Frequently Asked Question (FAQ) archives to relieve the burden on expert from handling the most mundane questions. (See http://www.faqs.org/faqs/ for an index of FAQs for many usenet groups). Some researchers have attempted to create software that integrates database lookup of information with advice from actual group members (e.g., Ackerman, answer garden), so that when experts are asked advice they can be assured that their contributions are unique and haven't previously been asked and answered.

6. Current status

The thesis of this chapter has been that social psychology provides a rich body of research and theory about principles of human behavior, which should be applicable to the design of HCI applications, especially applications to support multiple individuals communicating or performing some task. Simply put, as a discipline social psychologists know an enormous amount about how people form attachments to each other, how they make judgments of each other, how groups form and develop, and how groups organize to work together productively. Like the research reviewed here on social loafing, most tend to be mid-level theories, providing insight into a single aspect of human behavior in groups, rather than into groups in general. As in the case of the research literature on social loafing, these theories of group behavior and behavior in groups have implications for the design of computer systems to support groups.

However, researchers and developers in the field of Human-Computer Interaction have rarely taken advantage of this trove of empirical phenomena and theory. There are several reasons why this body of research has been under-exploited. First are the standard problems of disciplinary inbreeding. In CSCW, as in many fields, researcher tend to know about and therefore refer primarily to research reports published in the restricted set of journals which they consider core to the discipline. As Finholt and Teasley note (1998), researchers in HCI and CSCW primarily refer to articles published in CHI or CSCW proceedings and rarely refer to the reference literatures in cognitive psychology, sociology, anthropology, or social psychology.

The other, major reason is the mismatch of goals and values of HCI and CSCW research with those of social psychology. HCI and CSCW are primarily engineering disciplines, where the primarily goal is problem-solving. In solving a practical problem, it is likely that engineers will have to bring together many strands of knowledge. For example, in solving the problem of under-participation in online communities, those with an engineering ethic might bring together ideas from social loafing in psychology with ideas about public goods in economics (Fulk, Flanagin, Kalman, Monge, & Ryan, 1996). Public goods economics examines problems of collective action (Olson, 1971), such as people's unwillingness to contribute to public television and other public programs, or their over-readiness to pollute the environment. In these cases, behavior that is rational at the individual level has pernicious social consequences when many people make the same decision.

In contrast, social psychology views itself as a behavioral science, whose goal is to uniquely determine the causes for social phenomena. Although researchers who identify with the behavioral and social sciences are active in HCI and CSCW, they are active as applied scientists, importing ideas and methods from their home disciplines to solve design problems. A social psychologist's goal would be to distinguish the independent influence of the social psychological and the economic factors in causing under-contribution to groups. A standard research strategy in social psychology is to use experiments to manipulate one potential causal variable at a time while holding all other variables constant. For example, theories of social loafing attempt to explain why individuals are less productive in groups than when working individually. To distinguish the effects of believing oneself part of a group from the effects of the mere presence of others, for example, social loafing research studies people performing some task in the presence of others and compares the results under conditions where they believe that their output is pooled, and under conditions where they believe their output will be kept separate. This strategy allows the researcher to identify one factor, such the pooling of output, as a true cause, even though in the world outside of the laboratory, other causes may also be present.

This research strategy of holding other variables constant while examining the impact of a variable of interest makes it difficult to compare the strength of effects of different causal factors. This problem is compounded in laboratory experiments, because the strength of a variable depends upon the way an experimenter operationalized it, rather than upon how the variable is distributed in the world outside the laboratory.

In solving real design problems, contextual details are frequently important. For example, in solving the problem of under-contribution to online communities, the solution may depend upon whether the community is intended for adults or children, whether it has commercial or nonprofit content, or whether it uses an asynchronous technology, like email, or a synchronous one, like chat. In contrast, the norm in much social psychological research is to abstract these contextual details away. The goal is to have a theory that is as general as possible. Thus a theory of social loafing, for example, is more successful to the extent that it holds for physical and mental tasks, that it applies to college students and adults, or that it applies to history-less laboratory groups and to real-world groups with real histories, like swimming teams. Refinement of theory often requires specifying conditions under which phenomena of interest occur. Thus the finding that social loafing is less likely to occur when people are attracted to the group helps to define the theory. For a social psychologist examining social loafing, however, the source of the attraction should be irrelevant. But to someone designing a real online community, whether a group is attractive because members are rich, intelligent or good-looking, because they share a common interest, or because they are familiar with each other are crucial details.

A result of these fundamental differences between the values of problem-oriented designers and theory-oriented social psychologists is that the knowledge produced by the psychologists doesn’t fit with the designers' needs. It is often not detailed enough. As we have seen, social loafing, for example, is less likely to occur when members are attracted to a group. However, the research on social loafing does not provide guidance on how to make a group attractive, or on the implications of different methods. We have also seen that social loafing is less likely to occur when members consider themselves unique. However, a participant’s perceived uniqueness is likely to make the group less attractive to him or her. The social psychological research doesn’t indicate which of these phenomena is more powerful. This lack of concreteness leaves the designer to improvise when attempting to apply social psychological knowledge to solve design problems. It is perhaps for this reason that when CSCW researchers turn to the social science literature outside of their own field, they are more likely to consult ethnographic research than experimental social psychology. Ethnographic research is filled with a wealth of concrete detail, often at the expense of generalizability. From an ethnographic study such as Orlikowski's research on the use of Lotus notes in a software company (2000), one might learn how one company induced help desk personnel to contribute to a shared database. Judging the generalizability of the conclusions is an exercise for the reader.

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