

WORKING P A P E R

The Group Matters

A Review of the Effects of Group Interaction on Processes and Outcomes in Analytic Teams

SUSAN G. STRAUS, ANDREW M. PARKER,
JAMES B. BRUCE, AND JACOB W. DEMBOSKY

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SUMMARY

Overview

Intelligence analysis fundamentally involves cognitive activities. It consists largely of tasks such as identifying problems, generating and evaluating hypotheses and ideas, identifying, providing, and assessing factual information and opinions, judging the probability of events, aggregating information, and making decisions. However, intelligence analysis often occurs in group settings and therefore also involves social processes.

Social science research documents a number of process gains, or benefits of using groups, for tasks such as problem solving, judgment, and decision making. For instance, groups provide opportunities for division of labor and therefore can be more efficient than individuals, and groups are generally more effective at solving problems and making decisions than the average of the individuals within the group, in part because the group can draw on more diverse knowledge and skills. In fact, a number of experts have emphasized the importance of using teams for conducting intelligence analysis (Hackman & O'Connor, 2004; Johnston, 2005; Medina, 2008; Smith, 2008; Sunstein, 2006).

At the same time, groups consistently fail to meet their full potential. *Process losses* refer to factors that prevent groups from reaching optimal levels of performance. When performing intellectual work, process losses *generally arise from the group interaction* and reflect failures to adequately *collect, share, integrate, or apply* relevant information.

This report reviews the research literature on group processes that are most relevant to the work of intelligence analysts. In this review, we describe a number of common process losses (and gains), discuss their underlying causes, and present possible methods to improve group processes and performance on analytical tasks. Included in our review is a bibliography consisting of key references by topic, with annotations for selected articles based on relevance to intelligence analysis.

Common Process Losses in Groups

We focus on six common and robust process losses in analytic teams. These include productivity losses in brainstorming, the common knowledge effect, group polarization, confirmation bias, overconfidence, and pressures toward uniformity.

Productivity Losses in Brainstorming. Generating ideas is a fundamental aspect of intelligence analysis. For example, intelligence analysts are called on to provide forecasts to policy officials about events such as a surprise attack or a government collapse. Successful forecasting requires creativity - generating novel ideas, using unconventional approaches, and an ability to think outside the box.

Many types of groups rely on brainstorming for idea generation. Despite the popularity of the method, research has demonstrated repeatedly that interacting groups produce fewer ideas than the same number of individuals working alone, or "nominal" groups. These productivity losses are due largely to a phenomenon called *production blocking* such that listening to others and waiting for one's turn to speak blocks the production of new ideas among participants. Despite the cognitive stimulation provided by exposure to others' ideas, production blocking usually overrides these gains in groups interacting orally.

The Common Knowledge Effect. The complexity of intelligence problems requires input from analysts with a broad range of knowledge. Although group outcomes can benefit from diverse perspectives and expertise, groups frequently fail to capitalize on their intellectual assets. Relevant information that is held by a minority of group members (unshared or unique information) often fails to be introduced into the group discussion, and when it is mentioned, it is often overlooked. Groups are more likely to mention and discuss information that is held by all group members (shared information). This well-replicated phenomenon is called the *common knowledge effect*. It is problematic when the unshared information, when combined, favors a different alternative than the shared information (called a "hidden profile"). The preponderance of studies shows that groups fail to solve hidden profiles; they select the

alternative that is supported by the shared information, even when all of the unshared information is introduced into the discussion.

The common knowledge effect occurs, in part, because more members have shared information, and therefore it is more likely to be sampled than is unshared information. Group members also prefer to exchange shared information because they are evaluated more favorably when they discuss information that others already know. Another contributing factor to this phenomenon is that most group members enter the discussion with preferences that are supported by shared information. The group discussion and decision are subsequently biased toward these preferences. Furthermore, this bias is exacerbated by a tendency for people to resist changing their initial judgments, choices, or attitudes, even in light of information showing that their preferences are no longer appropriate or have negative consequences.

Group Polarization. Intelligence analysts are often called on to make judgments involving more aggressive or cautious policy choices. Numerous studies show that group interaction tends to exacerbate attitudes held by individuals, particularly in groups that are homogeneous in prior beliefs and values. Because group-level decisions are likely to be affected by shifts in group member attitudes, the implication is that group decisions will become more extreme, such that a group of modestly risk-seeking individuals will become much more risk-seeking, and a group of mildly risk-averse individuals will yield a more highly risk-averse decision. The tendency for groups to make more extreme decisions than individuals is called *group polarization*. One explanation for group polarization, referred to as social comparison, suggests that when individuals learn the positions of other group members, they succumb to normative pressure and shift their attitudes in the direction that the group is leaning. A second explanation, called persuasive arguments, proposes that polarized arguments are made in proportion to the prior positions of group members. Hence, a more homogeneous group will quickly build a weight of evidence in their initially-leaning direction. Evidence supports both hypotheses, with stronger support for persuasive arguments.

Confirmation Bias. In the course of group deliberation, evidence both supporting and contradicting particular points of view will inevitably arise. In such situations, however, both groups and individuals have a disproportionate tendency to search for and focus on information that supports pre-existing hypotheses, or confirming evidence, and tend to fail to search for or give sufficient attention to disconfirming evidence. As a result, individuals or groups often make decisions based on incomplete information. In addition, this biased information search tends to lead groups to unwarranted confidence in their stated hypothesis.

The confirmation bias may be due to a more basic tendency to seek out instances where events occur, rather than when they do not occur. It also is related to the relative diversity of prior opinions in the group, whereby groups that are composed of members with different perspectives are less likely to exhibit the confirmation bias.

Overconfidence. In intelligence analysis, where information is often accompanied by varying degrees of uncertainty, knowing how much one truly knows can be a challenge. Unfortunately, individuals, including some intelligence analysts, have a tendency to overestimate the extent of their knowledge (or other aspects of performance), particularly in difficult domains (such as those with high uncertainty) - a robust phenomenon called *overconfidence*. Overconfident individuals may be less willing to seek out additional information or incorporate the opinions of others, thereby failing to collect or apply task-relevant information. Overconfidence appears to worsen in groups, particularly when groups face situations that do not have demonstrably right or wrong answers. It also tends to be worse in larger groups and in homogenous groups. Overconfidence may be due, in part, to the convergence of both the common knowledge effect and confirmation bias, given that these processes falsely reinforce commonly and strongly-held perspectives in groups.

Pressures Toward Uniformity and Groupthink. Because intelligence analysis occurs in group settings, social influence processes are inevitable. Decades of research has documented the power of groups to change the attitudes and judgments of individual members. Groups

pressure their members to go along with the dominant view, and individual members often conform to the group's opinion. Such pressures toward uniformity inhibit members from sharing dissenting information, challenging others, and considering alternative solutions or courses of action – thereby eliminating or reducing the benefits of cognitive diversity in groups.

There are a number of reasons why pressures toward uniformity and conformity to such pressures occur. Uniformity helps groups define their social reality and establish norms for behavior, which allow groups to function more efficiently. Research also shows that members who refuse to conform experience social pressure, and ultimately, rejection. Given that even brief episodes of ostracism produce intense psychological distress, group members may go along with the group to avoid being rejected. Low status members of groups (e.g., members with less experience) tend to conform more than do high status members. If low status members also hold critical information, then performance outcomes (e.g., judgments or decisions) may suffer.

The idea that group cohesion creates pressures toward uniformity is one of the underlying tenets of Janis's (1972) influential theory of *groupthink*. Despite the acceptance of groupthink as valid by lay audiences, academic researchers, and policy analysts, the model has been called into question by numerous scholars in the scientific community. This skepticism is due, in part, to the methods used to evaluate groupthink, such as analysis of selected case studies, which can be subject to a variety of biases, and in part to the lack of support for basic principles of the model from more rigorous research approaches. There is little question that processes such as pressures toward uniformity and self-censorship are associated with ineffective judgment and decision making. However these phenomena do not support the groupthink model in that they often occur in the absence of antecedents and symptoms of groupthink; likewise, purported antecedent conditions of groupthink (e.g., cohesiveness, stressful conditions) do not necessarily lead to defective decision making.

Improving Group Processes

Many of the process losses we have reviewed are not independent phenomena. The processes can be mutually reinforcing in that when one type of loss is present, there is a greater likelihood that the group will experience other losses; conversely, when groups are able to avert one type of loss, they may be less prone to experiencing others.

Consequently, solutions directed at one type of loss may reduce the incidence of other problems. In particular, solutions that foster task-based dissent can alleviate multiple process losses by encouraging members to better identify, generate, share, and use relevant information. We describe a number of strategies to facilitate divergent thinking in groups. We have classified these strategies into three categories: (1) modifications to group structure; (2) adoption of specific procedures; and (3) facilitation and training.

Modifying Group Structure. The group structure can be modified by changing the team's composition, member roles, and size. Perhaps the most powerful structural intervention to promote the generation and use of divergent information is to compose groups to be heterogeneous in the opinions and expertise that they bring to the team. However, as groups work together over long periods of time, they tend to become more homogeneous in their perspectives. Bringing in experienced (versus novice) members from other teams can help groups be more productive and creative. In fact, some organizations intentionally vary composition to enhance innovation in groups.

Groups can also modify their structure to increase cognitive diversity by creating and emphasizing member roles. For instance, members can be assigned to various information roles (e.g., by having each member research a different problem) within the group. Another strategy is to assign group members to serve as the devil's advocate. A related technique is to rotate responsibility to advocate for particular hypotheses or alternatives. Rotating advocacy positions prevents members from selecting information that supports only one alternative. Whether diversity in functional specialties is natural or contrived, members should be made aware of each others' expertise.

Finally, whereas there is no known optimal number of members in a group, organizations should avoid composing groups that are so large that they preclude true interdependence and meaningful interactions among members. Large groups also tend to experience other unfavorable phenomena including greater overconfidence, larger productivity losses, and lower cohesiveness.

Procedures. Groups can also adopt procedures or protocols to reduce process losses. Productivity in brainstorming groups can be enhanced by using methods that do not require group members to take turns. Examples include brainwriting, in which group members write their ideas on slips of paper and exchange them in a round-robin fashion, and electronic brainstorming, which is a computerized version of brainwriting. Analytical "tradecraft" provides structured approaches that can aid groups in a variety of intelligence analysis activities. Such approaches can improve diagnostic processes, facilitate divergent views, and encourage imaginative thinking. Examples include Analysis of Competing Hypotheses, Team A/Team B Analysis, Red Teaming, and "What-if?" Analysis. A number of these methods require the use of groups, and others can be enhanced by using groups rather than individuals.

Other less formal procedures can be used to increase identification, exchange, and consideration of diverse information, thereby reducing process losses such as the common knowledge effect, conformity, polarization, and overconfidence. These include:

- restricting group members from stating their preferences until all known relevant information about alternatives has been shared;
- encouraging group members to present or consider opinions or information simultaneously rather than sequentially;
- framing the discussion as a problem to be solved rather than as a decision to be made;
- extending discussion time;
- instructing individuals to consider more alternatives and unexpected outcomes;
- requiring individuals to make judgments about their level of uncertainty prior to group interaction and presenting this information to the group.

Facilitation and Training. Although a review of research on leadership is beyond the scope of this report, some of the studies we have included speak to the importance of the role of a group leader or facilitator in helping groups achieve more effective analytical processes. Providing trained facilitators can help groups overcome productivity losses in interactive brainstorming and be more creative. In other types of analytic tasks, leaders or facilitators can enhance group effectiveness by focusing on the decision process rather than the content of the decision. Leaders who encourage open discussion are likely to enhance the expression of divergent information and improve group decision quality, whereas leaders who focus on the substance of the group decision are most likely to lead their groups to poorer decisions. Leaders also serve a key role in creating a context that facilitates effective group processes. Elements of a supportive context include interdependence for a common goal; a clear and compelling purpose; appropriate task design, team composition, and group norms; sufficient organizational resources (e.g., rewards, information) to support desired behaviors, and access to effective team coaching.

Process losses also can be reduced by training group members to avoid common pitfalls of group decision making. Intelligence agencies tend to rely on on-the-job training and informal mentoring. However, formal training interventions can be used to help groups improve their processes. For instance, groups can be trained to develop a strategy for their discussion, to be cognizant of member expertise, and to be vigilant to information, particularly when the information diverges from the direction the group is leaning.

Like process losses, however, these strategies for improvement are interrelated. Techniques to increase dissent can have negative consequences, particularly if implemented independently. For example, membership changes, while promoting divergent thinking, create inefficiencies and coordination problems for groups, such as the need to train or socialize new members. Strategies designed to increase cognitive diversity in groups can result in reduced cohesion, greater conflict, and reduced member satisfaction. However, these negative effects can be mitigated if these strategies are accompanied by clear

group norms that value cognitive diversity and access to coaches can help teams engage in optimal processes.

Future Directions

The literature reviewed for this report focuses on controlled laboratory studies. The processes examined are well-replicated, and we can be confident in the internal validity of the findings. An important question for future research is whether the process losses discussed in this report generalize to intelligence analysis teams. Given that intelligence analysis consists largely of cognitive tasks, and such tasks are often conducted in interdependent groups, we expect that intelligence analyst teams exhibit the types of processes we have described. At the same time, there are some differences between these teams and the kinds of groups that are prevalent in psychological research. Key differences include group size (intelligence analyst teams may be larger); the experience of members of real teams, both with each other and with the task, as well as their level of engagement or commitment to the task; and unique characteristics of intelligence analysts' jobs, including high levels of risk and secrecy, and conditions of considerable stress involving time urgency, a dynamic context, and intense organizational pressures to avoid failure.

Ultimately, research is needed to investigate the dynamics of intelligence analysis teams and the efficacy of strategies to improve their group processes and outcomes. A program of research that uses a variety of methods (e.g., controlled studies, field studies, observation, and interviews) can establish convergent validity, or triangulation of results, as well as reveal boundary conditions, thereby increasing confidence in the accuracy of research findings. Examples of specific research questions include:

- To what extent, and under what circumstances, do the process gains and losses described in this report occur in intelligence analyst teams?
- What is the effect of diversity in members' knowledge and skills on information identification, knowledge sharing, and opinion change in the group?

- How do characteristics of individuals in the group, such as longer tenure, higher status, or affiliation, affect changes in members' judgments?
- What is the effect of providing trained facilitators on processes and outcomes?
- Does level of classification or compartmentation affect analysts' appraisal of the validity or importance of the information? Does information source contribute to systematic biases in group judgment?
- How does pressure to avoid failure affect collection, sharing, and use of divergent information?
- To what extent are the types of interventions reviewed in this report appropriate in light of the extant structure and culture of intelligence analyst teams?

Many experts argue for the need for groups to conduct intelligence analysis, but systematic studies of teams in this context are rare. The topic of group intelligence analysis is fertile ground for research, and a program of research on group dynamics in intelligence teams has the potential to make a significant impact on improving analytical processes and outcomes in the U.S. Intelligence Community.