Better Interdisciplinary Research Through Psychological Science

November 01, 2007

Psychological science is among the most frequently cited of the sciences, and the impact of this research extends far beyond our disciplinary borders (Boyack, Klavans, & Börner, 2005). The creation of psychological science, like the creation of scientific knowledge across nearly all fields, also is increasingly the product of scientific teams, as discussed in last month's Presidential Column (Wuchty, Jones, & Uzzi, 2007). The thesis here is twofold: (a) psychological scientists are in an ideal position to contribute to and lead interdisciplinary research teams addressing a wide range of theoretical and practical questions, and (b) psychological science can inform and contribute to the success of such interdisciplinary efforts.

During the first half of the 20th century, psychological science was advanced almost exclusively by the efforts of solitary investigators and their students, and such work remains the backbone of the discipline. In this regard, psychology is not unique, as reflected in federal scientific funding structures. The Research Project (R01) grant at the National Institutes of Health (NIH) is designed precisely to support a discrete, specified, circumscribed project, one that will be performed by the named investigator(s) and his or her students within an area representing the investigator's specific interest and competencies and based on the NIH central mission. This kind of granting continues to constitute well over 90 percent of the NIH extramural funding portfolio (http://www.nih.gov/about/director/StrategiesfortheFuture.pdf).

As complex psychological questions that exceeded the expertise of individual investigators began to be asked, multidisciplinary and interdisciplinary research began to gain momentum. As detailed below, advances in our understanding of social cognition and group processes have further prepared psychologists to lead interdisciplinary scientific research teams.

Multidisciplinary research is characterized by the aggregation of the work of different experts — that is, by investigators coming together with their different expertise to solve problems and then returning to their own disciplines, largely unchanged by the collaboration. Interdisciplinary research, in contrast, is characterized by synergies among experts that can transform scientific inquiry on a given topic.

Interdisciplinary scientific research is riskier than multidisciplinary research because multidisciplinary research requires only that one share an established procedure with an investigator in another field. Interdisciplinary research, on the other hand, often requires innovation at the conceptual and operational levels of research. The success of interdisciplinary efforts rests on interactions among group members — it is a group product rather than the simple sum of its individual products. Accordingly, interdisciplinary teams are more subject to failure than are solitary and multidisciplinary scientific efforts. But with this higher risk also comes the potential for higher payoffs. When interdisciplinary teams succeed, they have the potential to produce significant scientific innovations, make progress in solving what were thought to be intractable problems, influence multiple disciplines, and spawn new scientific fields.

Possible Pitfalls of Interdisciplinary Research

Research on group processes points to several factors that can contribute to a higher failure rate for interdisciplinary research than for solitary and multidisciplinary research, which, if addressed, should improve the chances of successful interdisciplinary work. Multidisciplinary research efforts represent an additive task in which the success of the group depends on the combined efforts of all the individuals. Although diffusion of responsibility and social loafing may diminish the efforts of the individuals involved in the multidisciplinary research, the total contribution of the group usually is greater than what any one individual could do alone (Latané, Williams, & Harkins, 1979).

Interdisciplinary research efforts represent a nonadditive task in which group performance may be no better or even worse than individual performance (e.g., Levine & Moreland, 1998). The development of an interdisciplinary research group requires learning the different languages of the various disciplines as well as comprehension of and appreciation for the different epistemological approaches and methods of each discipline (Schunn et al., 2006). The unique perspective and information each individual brings to an interdisciplinary scientific project is one of the features that potentially make it special. However, group members spend much more time discussing shared information than they do unshared information (Stasser, Vaughan, & Stewart, 2000; Wittenbaum & Park, 2001).

This latter issue constitutes a particularly pernicious problem for interdisciplinary scientific teams. To illustrate the problem, imagine the following conditions: (a) there are five individuals on a search committee who have come together to select one of two candidates, Sally or Susan; (b) all of the facts about the candidates are equally important; (c) all five members of the search committee know the same three positive facts about Sally and the same three negative facts about Susan — that is, the common knowledge gives Sally a score of +3 and Susan a score of -3; and (d) each of the five committee members knows one unique negative fact about Sally and one unique positive fact about Susan — that is, the unique knowledge gives Sally a score of -5 and Susan a score of +5. If all of the information is presented and discussed, Susan (whose net score is +2) would be hired over Sally (whose net score is -2). What research shows, however, is that people converge on the solution suggested by the *common knowledge*, in which case Sally (with a score of +3 based on common knowledge) would handily win over Susan (with a score of -3 based on common knowledge). Of course, there is no need to incur the high risks and costs of interdisciplinary scientific teams if one is going to settle for solutions based on common knowledge.

The lesson here is that bringing together different knowledge bases does not guarantee that all of the relevant knowledge will be presented or used in the group's problem-solving efforts. Common knowledge often garners more attention and carries more weight than does unique knowledge, even though the greatest benefit of interdisciplinary scientific teams comes from the synthesis that can arise from identifying and integrating the unique expertise each member offers.

Although innovation is one of the potential benefits of interdisciplinary teams, groups also are often less creative than individuals (Stroebe & Diehl, 1994). A number of factors contribute to this result. If a group is listening to one person's creative suggestion, the others in the group spend their cognitive efforts listening to (and being biased by) that person's suggestion rather than spending this cognitive energy on their own brainstorming efforts. In fact, they might forget aspects of what they had been thinking, thereby reducing the number of independent lines of creative thought generated. Evaluation apprehension in brainstorming settings can also cause people to edit what they think others would consider bizarre or risky solutions, even though those might be the very options about which the group

most needs to hear. Finally, people may either freeload or exert less cognitive effort when brainstorming because they perceive others as also responsible for generating ideas.

Factors that contribute to groupthink (Janis, 1982) are as likely to exist in interdisciplinary research teams as in business boards and presidential cabinets: high cohesiveness, insulation of the group, an illusion of invulnerability (e.g., due to real or perceived high intelligence), collective rationalization, direct pressure on dissenters, self-censorship, illusion of unanimity, high stress (e.g., time pressure), and stereotyping of those who disagree with or criticize the group. Groupthink can lead a reasonable and intelligent group to proceed along a path that in retrospect was obviously wrongheaded.

Psychological Science to the Rescue

Psychological science has uncovered the existence of and reasons for these (and other) deleterious effects, and it also holds the key to the construction of successful interdisciplinary scientific teams that avoid these foibles. For instance, factors as simple as proximity or deliberate coordination strategies; communication practices; and regular visits, workshops, or retreats promote conflict resolution, the development of trust, and synchronization of scientific work (Cummings & Kiesler, 2005).

The overweighting of common knowledge (rather than unique knowledge) can be mitigated by underscoring the importance of each individual's unique perspective and expertise and emphasizing the importance of identifying all of the potentially relevant information that each of the members might be able to bring to bear on the problem prior to the search for solutions. Leaders can take the initiative to introduce unshared information, to encourage others to do the same, and to extend discussion on a topic to permit discussion of all relevant information. Both familiarity with the language, expertise, and epistemological approaches of each group member and the siren of common knowledge can promote the successful search for and use of unique information.

Group creativity also could be improved by having individuals generate their ideas individually prior to group brainstorming sessions, establishing a supportive environment for what might seem at the outset to be outlandish ideas, and emphasizing the importance of the diverse knowledge held by the members of the interdisciplinary group (Brown & Paulus, 2002). And groupthink can be rendered less likely if the leader appears impartial regarding the possible hypotheses or interpretations, critical evaluation of all hypotheses is equally encouraged, input and criticism from outside experts are sought, time pressures are minimized, and important decisions are reconsidered before implementation (Janis, 1982). Thus, promoting dissenting views and focusing equally on the falsification of all hypotheses helps prevent groupthink and promotes true interdisciplinary science, with all the advantages that accompany it.

Interdisciplinary science flourishes in a culture in which discussions and interactions are constructive yet critical, rigorous but creative, momentous but playful, open but exclusive, and self-reinforcing and thus self-perpetuating. Given the impact psychological science is having on other disciplines and given the extensive literature on group processes and productivity, including in scientific teams, psychological science may provide useful guidance for the constitution, coordination, and management of interdisciplinary scientific teams. For all these reasons, psychological scientists may be especially well-suited to lead successful interdisciplinary research teams in the years ahead. ?

References

Boyack, K.W., Klavans, R., & Börner, K. (2005). Mapping the backbone of science. *Scientometrics, 64,*

351-374.
Brown, V.R., & Paulus, P.B. (2002). Making group brainstorming more effective: Recommendations from an associative memory perspective. *Current Directions in Psychological Science, 11*, 208-212.
Cummings, J., & Kiesler, S. (2005). Collaborative research across disciplinary and organizational boundaries. *Social Studies of Science, 35*, 703-722.
Janis, I.L. (1982). *Groupthink: Psychological studies of policy decisions and fiascoes (2nd ed)*. Boston: Houghton Mifflin.
Latané, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology, 37*, 822-832.
Levine, J.M., & Moreland, R.L. (1998). Small groups. In D.T. Gilbert, S.T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology, (4th ed., Vol. 2,* pp. 415-469). Boston: McGraw-Hill.
Paulus, P.B., Larey, T.S., & Dzindolet, M.T. (2001). Creativity in groups and teams. In M.E. Turner (Ed.), *Groups at work: Theory and research* (pp. 319-338). Mahwah, NJ: Erlbaum.
Schunn, C.D., Paulus, P.B., Cagan, J., & Wood, K. (2006, August). *Final report from the NSF innovation and discovery workshop: The scientific basis of individual and team innovation and discovery*. Washington, DC: National Science Foundation.
Scott, T.R. (1991). A personal view of the future of psychology departments. *American Psychologist, 46*, 975-976.
Stasser, G., Vaughan, S.I., & Stewart, D.D. (2000). Pooling unshared information: The benefits of knowing how access to information is distributed among members. *Organizational Behavior and Human Decision Processes, 82,* 102-116.
Stroebe, W., & Diehl, M. (1994). Why groups are less effective than their members: On productivity losses in idea-generating groups. In W. Stroebe & M. Hewstone (Eds.), *European review of social psychology* (Vol. 5, pp. 271-303). Chichester, United Kingdom: Wiley.
Wittenbaum, G.M., & Park, E.S. (2001). The collective preference for shared information. *Current Directions in Psychological Science, 10,* 70-73.
Wuchty, S., Jones, B.F., & Uzzi, B. (2007). The increasing dominance of teams in production of knowledge. *Science, 316,* 1036-1039.