When Collections of Creatives Become Creative Collectives: A Field Study of Problem Solving at Work

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This paper introduces a model of collective creativity that explains how the locus of creative problem solving shifts, at times, from the individual to the interactions of a collective. The model is grounded in observations, interviews, informal conversations, and archival data gathered in intensive field studies of work in professional service firms. The evidence suggests that although some creative solutions can be seen as the products of individual insight, others should be regarded as the products of a momentary collective process. Such collective creativity reflects a qualitative shift in the nature of the creative process, as the comprehension of a problematic situation and the generation of creative solutions draw from—and reframe—the past experiences of participants in ways that lead to new and valuable insights. This research investigates the origins of such moments, and builds a model of collective creativity that identifies the precipitating roles played by four types of social interaction: help seeking, help giving, reflective reframing, and reinforcing. Implications of this research include shifting the emphasis in research and management of creativity from identifying and managing creative individuals to understanding the social context and developing interactive approaches to creativity, and from a focus on relatively constant contextual variables to the alignment of fluctuating variables and their precipitation of momentary phenomena.

Key words: creativity; social cognition; problem solving; innovation

Introduction

Francis Jehl, one of Thomas Edison's longtime assistants, once explained that, "Edison is in reality a collective noun and means the work of many men." He was referring to the group of engineers who worked together and with Edison in the one-room laboratory in Menlo Park (Millard 1990). However, while individuals often acknowledge the collective nature of their creative accomplishments, research on creativity has centered primarily on the individual. Kurtzberg and Amabile (2001), for example, recently summarized the state of creativity research:

> In all of the [current] approaches, the focus has rested squarely on the individual, highlighting individual cognitive processing, stable individual difference, and the effects of the external environment on the individual. Relatively little attention has been paid to team level creative synergy, in which ideas are generated by groups instead of being generated by one mind. (p. 285)

Without denying the role of individual contributions, is it possible to recognize moments when the creative insight emerges *not* within a single individual, but rather across the interactions of multiple participants in the process? This paper presents research that studied those moments in organizations when creative insights result from collective rather than individual efforts, and where no individual insight is by itself responsible for solving the problem.

What turns collections of creative individuals into creative collectives, where particular interactions yield creative insights, yet those insights cannot be attributed to particular individuals? An answer to this question is important because the need for individual creative genius is steadily being displaced in organizations. In today's rapidly changing environments, the complexity of problems requires solutions that combine the knowledge, efforts, and abilities of people with diverse perspectives (Brown and Eisenhardt 1998, Eisenhardt 1990). When individuals do not have the necessary expertise, ability, or motivation to generate creative solutions alone, they sometimes find ways, through moments of collective effort, to produce creative outcomes.

This paper focuses on those moments of collective creativity and the factors that precipitate them. Such an approach differs from the existing research on creativity and innovation along two dimensions. Rather than focusing on the group and organizational variables that make up the *ongoing* context for creativity, this perspective recognizes the fleeting coincidence of behaviors that triggers *moments* when creative insights emerge. And rather than viewing this eureka moment as the sole province of *individual* cognition, this perspective focuses on those insights that emerge in the *interactions* between individuals.

The literature on creativity in organizations has, for example, generated significant understanding of the effect

of ongoing group and organizational context on individual creativity (Amabile 1983, 1995), but is less concerned with action and interaction at the collective level. Research on creativity and cognition focuses on the moments of individual insight and, similarly, does not address the phenomenon at the collective level (Sternberg 1999, Gentner and Markman 1997). Finally, the literature on innovation primarily explores the creative process at the collective level of organizations, yet is largely concerned with the ongoing organizational context associated with collective outputs and neglects those moments when creative insights occur. By contrast, this paper explores the intersection between the momentary (rather than the ongoing) and the collective (rather than the individual) aspects of creativity—those moments when creative insights result from collective, rather than individual, efforts.

The role of such moments of collective creativity is evident in the following example from Design Continuum, one of the firms in our field study. In 1988, Reebok hired Design Continuum to develop a successful response to the introduction of the Nike Air line of basketball shoes. Rather than develop a product design that was similar to Nike's concept, Design Continuum created the Pump shoe, a form-fitting shoe that worked because of an inflatable air bladder built into its sides. This idea first emerged in a brainstorming meeting when one of the designers, who had previously designed an inflatable splint, suggested that by building ankle support into a basketball shoe such splints might prevent injuries. Another participant, who had worked on hospital equipment before, recognized that existing medical IV bags could be modified to provide the oddly shaped air bladders that would make this "splint-in-a-shoe" concept work. During a subsequent brainstorming meeting with several other designers, who had worked with diagnostic instruments (and the little pumps, tubing, and valve components that made up those products), a solution emerged for how to inflate and deflate the shoe easily. In its first year, the Reebok Pump shoe accounted for over $1 billion in revenue in the highly competitive athletic-shoe market and gained wide praise in the business press for its creativity.

The series of events that created the Reebok Pump shoe idea at Design Continuum illustrates the collective moments of the creative process observable within organizations. Within the project team, a few people knew about the client's demands, another knew about inflatable splints, another about IV bags, and others about pumps. The social interactions within these brainstorms enabled connecting these ideas across members of the organization. Only during these momentary interactions did the design team come to recognize how their disparate knowledge of inflatable splints, IV bags, valves, pumps, and other useful ideas could be relevant to designing a better basketball shoe.

In studies of creativity, however, we rarely look at—let alone for—such fleeting moments. For this reason, we explored such moments through a field study of creativity in organizations. The model is grounded in observations of work, interviews, informal conversations, and archival data gathered in intensive field studies of work in six professional service organizations. Analysis of the data from these studies identifies four interrelating activities that, together, appear to precipitate moments of collective creativity: help seeking, help giving, reflective reframing, and reinforcing. These activities constitute an alternative framework for understanding and managing the creative process within organizations—one that shifts the focus away from the relatively stable contextual variables that surround creative individuals and to the behavioral influences on the momentary interactions between people.

Creativity in Organizations

To investigate collective creativity as a distinct phenomenon that emerges in interactions, we adopt the perspective that creative solutions are built from the recombination of existing ideas (Amabile 1988, Van de Ven 1986, Weick 1979, Hargadon and Sutton 1997). Rather than focusing on those aspects of the creative insight that represent the ex nihilo generation of new and valuable ideas, this perspective looks at how creative moments represent the confluence of old ideas. By focusing on the creative insight as a confluence of old ideas, we consider how individuals may contribute discrete "old" ideas within a particular social interaction, and observe how the "creative" value of those ideas evolves through their combination—confluence—with others.

While the field of psychology provides insights into individual creativity within organizations, this research has traditionally focused closely on the individual insight. The perspective of creativity as the confluence of an individual's traits, behaviors, and motivations remains a central assumption of modern creativity research (Sternberg 1999). As a result, the study of creativity in organizational settings predominantly focuses on the ongoing contextual influences that shape individual creative output (Amabile 1983, 1995; Csikszentmihalyi 1988; Drazin et al. 1999; Oldham and Cummings 1996; Woodman et al. 1993). For example, Woodman et al. (1993) outline an interactionist model that nests individual creativity within the group, which "constitutes the social context in which the creative behavior occurs" (p. 303). While this long tradition provides evidence of the ongoing influences of group context on individual creative behavior, it stops short of describing how supraindividual creativity emerges in interactions to become a distinct and collective problem-solving phenomenon.

Research by cognitive psychologists, in contrast, offers potentially useful insights into how the creative process happens in the moments when individuals solve problems that may be applied to the collective level (Gentner and Gentner 1983; Gentner and Markman 1997; Reeves and Weisberg 1993, 1994). This research describes how individuals facing problematic situations find solutions through a process of analogical reasoning, of trying to make sense of a new situation (the target analog) by relating it to a more familiar one (the source analog). Analogical problem solving occurs when an individual recognizes similarities in the new situation to old problems (and their solutions) that he or she has learned in the past. Transferring these existing solutions from old problems provides a solution to the new problem. This research helps us understand the momentary processes of individual creativity, yet there is no guarantee that individuals will use their past knowledge, let alone the appropriate past knowledge, to generate novel and creative solutions. To arrive at creative insights requires actively reframing situations in ways that trigger more distant searches for solutions (Schank and Abelson 1977). This is because the same mechanisms that allow individuals to make sense of novel situations in terms of old ones often encourage them to recall more recent, familiar, or expected ideas and, as a result, to misinterpret new situations as familiar old ones rather than see them as opportunities for creative insights (Lave 1988, Weick 1995). Thus, finding novel solutions is inherently linked to the issue of defining problems—which definition of the problem is recalled identifies which set of solutions is considered relevant (Getzels 1975). However, because problems often arrive in organizations rooted in given contexts, individuals often have trouble reframing on their own.

Organizations may therefore benefit when people come together to collectively work on defining and solving problems, and we need to deepen our understanding of how such collective problem solving happens. Existing field studies have shown that solving creative problems collectively in organizations relies on connecting past experiences to the problems of current situations. For example, Hargadon (2002, 1998; Hargadon and Sutton 1997) describes how organizations that span multiple industries are able to generate creative ideas by gaining access to ideas in one domain and applying them in others. Building on the theory of organizational memory (Walsh and Ungson 1991), these papers explain how these firms' innovative accomplishments result from their work practices that transfer ideas over time and across projects. Similarly, Nonaka and Takeuchi (1995) describe innovation as taking place in the communication and translation of knowledge from the individual to the organization. However, while these studies focus on collective creativity as the confluence of existing ideas, they do not explore the nature and origins of those particular moments when such connections occur. Thus, to provide a parallel for how the creative process unfolds, both in organizational context and across rather than within individuals, we look to the literature on collective cognition.

Collective Cognition and the Creative Moment

Recent theoretical and empirical work has developed the notion of collective cognition in organizations (Meindl et al. 1996, Thompson et al. 1999, Hutchins 1991) to explain supraindividual cognitive processes. Weick and Roberts (1993), for example, outline the concept of collective mind as a means for understanding how individuals working together perform effectively in high-reliability organizations, such as aircraft carrier flight decks (see also Weick et al. 1999). That perspective requires a focus that is "at once on individuals and the collective, since only individuals can contribute to a collective mind, but a collective mind is distinct from an individual because it inheres in the pattern of interrelated activities among many people" (p. 360). High-reliability organizations are characterized by their emphasis on avoiding errors rather than pursuing efficiencies, where remaining mindful to deviations from expected events helps organizations respond rapidly to potentially hazardous problems. However, a perspective of collective mind may also help explain highly creative organizations, where the emphasis on novel solutions also requires mindful exploration.

While there is potential for moments of collective mind to emerge in any group, Weick and Roberts (1993) identify the critical role of heedful interrelating, the *mindful* engagement of individuals in the social interrelations of the organization, for shaping the nature and extent to which collective cognition occurs in a particular moment. Mindfulness describes the amount of attention and effort that individuals allocate to a particular task or interaction. Participation in group interactions, as a result, becomes a product not of membership or presence within a group, but of the attention and energy that an individual commits to a particular *interaction* with others in the group. Through the mindful interpretation by group members of an ongoing experience and the mindful generation of appropriate actions, collective cognition connects individual ideas and experiences in ways that both redefine and resolve the demands of emerging situations.

The idea of collective cognition, joined with our understanding of creative problem solving, provides a framework for understanding moments of collective creativity. Collective mind resides in the mindful interrelations between individuals in a social system. One person's action or comments, when considered by others, shapes theirs, which in turn (when heeded) shapes the next. A focus on the collective aspects of these interactions recognizes that one person's past thinking and

action take on new meanings—to everyone involved—in the evolving context of subsequent thinking and action. Consider the case of the Reebok shoe described earlier. One designer's suggestion of a shoe-as-a-splint might easily be dismissed as crazy, and ultimately forgotten. Or, the same crazy suggestion is considered and built on by others, becoming more realistic and, ultimately, leading to a creative solution. Here the original comment takes on new meanings—becoming creative—through the mindful interactions of participants in the problem-solving process.

Rather than relying on each individual's cognitive skills, collective creativity represents particular moments when people's perspectives and experiences are brought together to bear on problematic situations in ways that create distinctly new solutions. At these points, what to think of as a problem and how to think of it become the products of a collective process. We examine such collective creativity by framing the phenomenon as a moment when individuals come together to find, redefine, and solve problems that no one, working alone, could have done as easily, if at all. From within this framework, the paper explores the behaviors that trigger such moments of collective creativity, how those behaviors interact, and how they are supported within the organization.

Research Setting and Methods

This research program began by asking how individuals in organizations redefine and reuse their old knowledge and experiences in ways that provide the raw materials for solving new problems (or solving old problems in new ways). Intensive case studies were conducted within six organizations whose work was almost wholly structured around generating novel solutions to novel problems. These organizations were professional service firms that did not provide a common or consistent work product, but rather attempted to solve problems that varied across applications and industries. Most clients engaged them expecting novel and valuable solutions to the particular problems they faced and, within each engagement, expected these solutions to draw from the combined knowledge and experiences of the entire firm. The evolution of McKinsey & Co., one of the organizations in this study, exemplifies these demands. Initially, McKinsey & Co. was created with the confidence that bright, broadly-educated young consultants could creatively solve the problems that older and more parochial clients could not (McKenna 1995, 1996). During the 1960s, as clients and competitors became more knowledgeable about business practices, the firm was forced to change its business model to one of presenting each consultant as a portal into the combined experiences of the entire firm. As one senior McKinsey partner explained, "We had to deliver on the implied promise that if you

were engaging McKinsey, you were engaging a world-wide network of knowledge." To do that meant changing its organizational practices to reflect this new requirement. Many professional service firms today share this approach, and in both marketing promises and management practices attempt to bring the full range of organizational knowledge and experiences to bear on any one client's problems.

Because of the dynamic nature of their clients and projects, these sites offered a unique glimpse into the problem-solving process in organizations. Few projects, if any, could be treated purely as replications of past projects because each new project and client demanded relatively novel solutions.[1] Within the organizations and groups studied, then, arriving at a creative solution was not a deviation from expected routine but rather *was* the expected routine. The participating organizations consisted of two management consulting firms, two engineering design consulting firms, and two internal consulting groups within multidivisional firms (see Table 1). These firms represent a theoretical, and not random, sample of the phenomenon of interest (Dougherty and Hardy 1996, Eisenhardt 1989), in that all six firms provided creative products to their clients and were measured and rewarded based solely on the creative value of their work product. Thus, they were chosen because their process and performance offered increased opportunity to generate insights regarding the creative process. Moreover, these firms varied in terms of the type of project they worked on (management solutions and product designs) as well as the type of client they worked for (external and internal). The case studies were not conducted to test how creative these firms were, but rather to understand how the creative problem-solving process takes place across a variety of project types and within different relational forms. The logic behind the selection of these sites follows.

Management Consultants. Accenture (then Andersen Consulting) and McKinsey & Company participated in this study. These firms provide clients with help in identifying, adopting, and implementing management practices that are new to the client firm, for example, globalization strategies, reengineering efforts, and enterprise systems implementations. To these consulting firms, each project represents a novel problem and requires a solution that was mindful of the needs of that client. The research focused on the actions and perspectives of consultants who were attempting to bring the range of the organization's experiences to bear on the problems of their particular client and project.

Product-Design Consultants. The two product-design consulting firms were IDEO Product Development and Design Continuum.[2] These two firms are, in order, the two largest product-design consulting firms in the country. Product-design consultants provide engineering or

Table 1   Participating Organizations in Study

Management Consulting Firms

Accenture
  Accenture's 38,000 employees provide strategic business and technology solutions to clients. Examples of creative solutions include:
  - Demand chain solution provided to a client combining Internet infrastructure with SAP inventory-control software.
  - Solution for health-care company adapted from previous banking solution combining Internet and human-resource software.

McKinsey & Company
  McKinsey & Company, with 4,000 employees, offers strategic business solutions to clients in almost all sectors of business. Examples of creative solutions include:
  - A strategic planning model for a client facing deregulation built on problems learned by working with past clients in another, previously deregulated industry.
  - A purchasing effectiveness program for one client built from an awareness of past solutions and problems with cost-cutting projects of previous clients in other industries.

Internal Consultants Within Multidivisional Firms

Hewlett-Packard: Strategic Processes and Modeling Group
  Hewlett-Packard develops and manufactures high-technology products for a wide variety of industries. The Strategic Processes and Modeling Group works with the 150 or so divisions within the firm to optimize their manufacturing and distribution processes. Examples of creative solutions include:
  - Supply chain management model continually combines problems and solutions of previous application environments.
  - Inventory-costing model combined marketing strategies from consumer-goods industries with traditional inventory models.

Boeing Company: BCAG's Operations Technology Center
  Boeing designs and builds commercial and military aircraft, helicopters, space and missile systems, and electronic and software systems. The Operations Technology Center works with the many factories of the Boeing Commercial Airplane group to support and advance their manufacturing process. Examples of creative solutions include:
  - Metal-stamping process improvement built from process solutions in other factories and from incorporating external materials.
  - Composite-materials production processes transferred technological knowledge from military divisions to within Boeing's Commercial Airplane Group.

Engineering Design Consulting Firms

IDEO Product Development
  IDEO's more than 300 employees provide engineering and design services to clients in over 40 industries and have contributed to the design of more than 3,000 new products and, at any one time, are involved in approximately 50 development projects. Examples of creative solutions include:
  - A blood analyzer that integrates the client's chemical analysis equipment with technical components from the computer industry.
  - The mechanical whale for the movie "Free Willy," which combines traditional special effects with ideas from computers, hydraulics, and robotics.

Design Continuum
  Design Continuum, with over 90 employees, has worked for more than 100 different clients in dozens of industries. Examples of creative solutions include:
  - Pulsed-lavage emergency room wound cleanser that integrates a low-cost pump from a toy squirt gun with medical product-design guidelines and materials.
  - Reebok pump shoe that combines the client's shoe designs with inflatable splints, and technologies (and suppliers) from IV bag manufacturing.

industrial design services, or both, to clients. This study focused primarily on the activities of those individuals involved in engineering design, which in these firms ranges from conceptual work on possible new products or technologies to detailed engineering drafting or analysis.

Internal Consulting Groups Within Manufacturing Firms. Two internal consulting groups within Hewlett-Packard and Boeing also participated in this research. The size and multidivisional structure of these organizations led to the formation of groups that act as independent consultants, working with many of the different divisions on the particular problems they face.

Within Hewlett-Packard, for example, the Strategic Processes and Modeling Group (SPaM) provides supply chain management solutions tailored to the needs of the different operating divisions that employ their services. Within Boeing, the Operations Technology Group (Ops Tech) specializes in providing manufacturing solutions across the production facilities of different divisions and different factories within divisions. In both cases, divisions contract for the services of these internal consulting groups, presenting them with problems related to their ongoing operations.

Data Collection Methods and Analysis
Observing creativity as it occurs naturally is extremely difficult, particularly when key contributions are only

recognized later as they trigger new insights in others and are built upon. To understand how social interactions shape new perspectives on problematic situations and uncover potentially relevant past experiences, the field study relied on ethnographic-research methods, which allow the researcher to uncover the perspectives of the people in the organization. Data were gathered from multiple sources within each organization (Yin 1994). Gathering evidence from multiple data sources addresses potential problems of construct validity within a case study because these different sources "provide for multiple measures of the same phenomenon" (Yin 1994, p. 92). While each source has particular benefits, such as the narrative and insight provided by informant interview, each has particular problems as well, such as informants' individual biases and retrospective rationalizations. Taken together, multiple measures allow for triangulation, a process of data evaluation that builds support for any findings or conclusions from the convergence of multiple, independent observations. The research design collected data from five sources: (1) interviews with key informants, (2) project postmortems, (3) observations of work, (4) tracking of particular projects (whether "live" or retrospectively), and (5) documents and technological artifacts of the organization. For further details about each of these sources, please see the appendix.

To develop the inferences about creativity from within the fieldwork, we used an iterative process of cycling between the data, emerging theory, and relevant literature. Following Glaser and Strauss (1967) and Miles and Huberman (1994), we developed initial categories of actions related to collective creativity through several intensive passes through all the interview transcripts and field notes. Then, to relate these categories, a set of iterations usually began with a hunch inspired by the data or literature. For example, an informant mentioned that asking others for help on a problem she was facing, often gave her new insights into the problem, suggesting that such social interactions shaped the creative process in ways that working alone did not. To see if such hunches could be grounded, we returned to the interview transcripts and to the field notes and systematically compiled pertinent evidence from all six case studies by gathering related instances of how shared work practices might play a role in the individual creative process and how they might differ from existing conceptions of creativity. Across the field sites, if there was consistent support for a particular characteristic of collective interaction in the creative process, we retained the theme. When evidence contradicted an emerging theme, we abandoned it, returning to the theory to investigate and refine the framework (for example, in one firm such collective moments were viewed as fun, suggesting that collective moments are precipitated by positive affect on behalf of the participants; the data from the other sites, however, did not support such a conclusion and it was abandoned).

We then wrote up the inferences regarding each retained category, weaving together conceptual arguments, additional evidence, and citations to pertinent literature.

Precipitating Moments of Collective Creativity in Organizations

This paper uses the evidence from these field studies to build a theoretical framework for understanding the moments when collective creativity occurs in organizations. This framework highlights the role of collective cognition in transforming an organization's old knowledge into creative alternatives for future action. In doing so, it provides an alternative framework for understanding and managing the creative process within organizations—one that shifts the focus from individuals to the interactions between them, and from a constant phenomenon (i.e., creative individuals and organizations) to a series of momentary, transient phenomena (i.e., creative moments in organizations). Below, we describe how such collective moments of creativity happen in organizations, and explain the activities that make them possible.

We can say that collective creativity has occurred when social interactions between individuals trigger new interpretations and new discoveries of distant analogies that the individuals involved, thinking alone, could not have generated. Such moments, in the firms studied, seemed to emerge from within social interactions that, like brainstorming, brought together those facing particular new problems and those with potentially useful past experiences. For example, the CEO of Design Continuum recognized these effects of social interactions:

> You pick two people, with different experiences and maybe even different training and put them together and you've got that kind of a synergy, an exchange of ideas. Because whatever this person says will provoke a hundred different ideas in this other one and a hundred different memories.

However, we cannot yet say when such opportunities for collective creativity are missed, because there is still little understanding of these moments and what triggers them.

Analysis of the field data reveals four sets of interrelating activities that play a role in triggering moments of collective creativity: (1) help seeking, (2) help giving, (3) reflective reframing, and (4) reinforcing (see Figure 1). *Help seeking* describes activities that occur when an individual who either recognizes or is assigned a problematic situation actively seeks the assistance of others. *Help giving*, conversely, represents the willing devotion of time and attention to assisting with the work of others. *Reflective reframing* represents the mindful behaviors of all participants in an interaction, where each respectfully attends to and builds upon the comments and actions of others. And, *reinforcing* reflects

Figure 1   Interactions Precipitating Moments of Collective Creativity
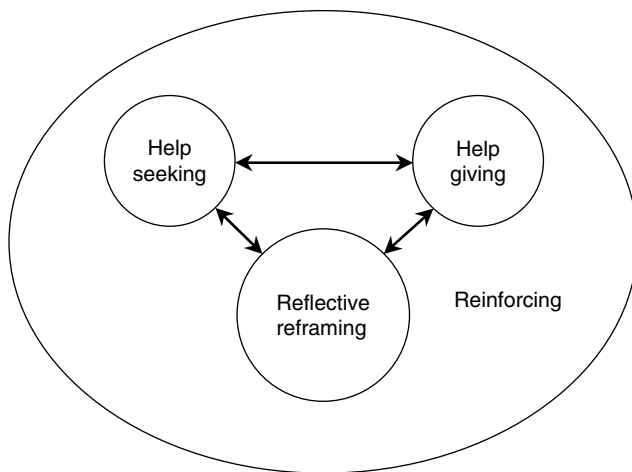
those activities that subtly (and sometimes not so subtly) reinforce the organizational values that support individuals as they engage in help seeking, help giving, and reflective reframing; reinforcing happens as a direct consequence of engaging in these three activities (e.g., help giving as a response reinforces help seeking) as well as through more indirect actions within the organization (e.g., increased status or promotions for those who engage in these activities).[3] We explain the role of these activities in greater detail.

Help Seeking

The field data identified a set of actions that individuals used to induce others to join in efforts to resolve a particular problematic situation—help-seeking behaviors—and that play a necessary role in enabling moments of collective creativity. In the organizations of this study, the set of actors and patterns of interactions surrounding any one problematic situation were often fluid. Thus, participation in a particular problem-solving process depended on who was invited to do so—who was assigned to a project team, who was invited to a brainstorming session, or even who was approached in the hallway. This differs from Weick and Roberts's (1993) conception of collective mind in high-reliability organizations such as aircraft-carrier flight decks, where the set of actors and patterns of interactions are relatively fixed. As a result, help-seeking behaviors played a significant role in determining who joined in any collective effort, and thus what knowledge and experiences were brought to bear on a problematic situation.

These organizations had an array of formal means for soliciting interactions around a particular project or problem. IDEO and Design Continuum, for example, relied heavily on formal brainstorming meetings. IDEO also held regular and organizationwide Monday morning meetings in which people would discuss the particular projects and problems they were working on and

any interesting solutions they might have found. Similarly, HP's SPaM Group held weekly meetings where they would discuss the status of current projects, and people in these meetings would often solicit help that focused on coming to a collective understanding of their particular problems. Boeing's Ops Tech group also met as a unit each month, but also gathered in smaller groups for coffee each morning in different factories and, in a fashion similar to Orr's (1996) copier technicians, shared war stories and discussed work in ways that often identified connections between past experiences and current projects.

There were also many informal and unstructured methods for soliciting help, and informants often described these methods as more important and useful than the formal means. As an engineer at Design Continuum stated, "There's no consistent vehicle for people to share their ideas, problems, projects. Right now the only way that can happen meaningfully is face-to-face." In HP's SPaM group, when people had problems (or simply needed a break from their work) they would walk the halls asking questions and waiting for a head to pop up over a cubicle wall and begin a conversation. Similarly, a McKinsey partner explained how, rather than attempt to solve a problem by himself, he would first seek out others' ideas:

> What I would logically do is the most comfortable thing, which was to go to somebody who's in the practice and who I know from the office and say, "I'm running into some issues about IT cost production, how do you think about that? Who's the best person to call?"

Traditional approaches associated with individual problem-solving efforts, like generating a solution alone or searching the organizational database, were ignored in favor of initiating hallway conversations, calling ad hoc meetings, and "tapping into personal networks." Also, these interactions would often spur further interactions, until they created a unique and often unexpected path across multiple offices within McKinsey that ended, for example, when someone in the Oslo office was helping someone from San Francisco that they had just met on the phone. Such help-seeking behaviors created opportunities for social interactions that connected distant people within these organizations and, by doing so, helped move opportunities for creativity from the individual to the collective level.

Help-seeking actions are often inhibited because they carry the stigma of ignorance and the implication of failure (Lee 1997, Ashford et al. 2003). However, these repercussions were largely absent in the organizations studied, where the seeking out of help was perceived as a necessary means for bringing the organization's knowledge to bear. For example, asking others in to work on new problems was codified in IDEO's *Design Methodology Handbook*, which suggests that early in

projects designers should "Set up at least two introductory brainstormers [brainstorming meetings] to get the best minds in the company, the collective consciousness of the office, working on your problem." In words that also reflect reinforcing actions, described later in more detail, one senior engineer at IDEO described how blame for any particular design failure depended on whether the engineer had asked others for help or not: If they had not sought help, then they would be held individually responsible. Such help-seeking behaviors may be stigmatized in other organizations where problems are relatively routine, where individual roles are more clearly delineated, and where ignorance in those roles is more unexpected. In the firms studied, however, because most problematic situations differed from day to day, and because help seeking was a value that these firms reinforced, such behaviors carried less stigma and brought more benefits. The activities prompted sets of momentary interactions that connected those facing problematic situations and those with potentially relevant—though rarely obvious ex ante—knowledge and experience.

Help Giving

While help-seeking activities identify and invite other organizational members to participate in problem-solving efforts, such activities do not always ensure the collaboration of others. In traditional bureaucratic organizations, for example, it is not uncommon for people to respond to requests for help that fall outside their existing job assignments by asking for formal permission from their managers or requiring complex paperwork to ensure compensation (through internal budget transfers) for the time spent working for another team or manager. Such constraints on spontaneous responses to help seeking impede help giving. Social interactions that lead to moments of collective creativity, in contrast, require that those who are invited to help actually give help, and do so in a timely manner.

For example, the McKinsey partner in Oslo not only returned the message from an unknown colleague in San Francisco that day, but spent considerable time helping with that colleague's request despite an already busy schedule. This also happened in HP's SPaM group when one day Katherine walked down the hall and asked, "Bob, I'm working on this thing and I'm kind of stumped. Can I borrow your brain?" Bob put down his work and the two of them found a nearby conference room where they then spent an hour working on Katherine's project. Bob's willingness to give his time and attention ultimately led to recognizing that a section of software Bob had previously written could be adapted to help solve Katherine's problem. In more formal interactions, such help giving is sometimes acknowledged through the routine use of project time cards. For example, at IDEO and Design Continuum, when someone participates in a brainstorm on another project, they

record that time and it is billed to the appropriate client. However, more often moments of collective creativity are products of hallway conversations and other ad hoc interactions, which would likely be inhibited by the efforts required for formally accounting for this help.

The need for willing collaboration also shapes the choices people make when soliciting help. One McKinsey partner described how he would consciously decide whether to ask a more senior (and busier) partner who had potentially more relevant past experiences or ask someone more junior who, while not as experienced, had more time and inclination to respond: "You talk with whom you can. You explore until you find people in the firm that are accessible, near enough in the time frame to talk about it." There were particular people who were considered thought leaders, experts, or gurus in these organizations—these were typically senior partners with established practice areas. However, because such experts were mostly very busy, people would often solicit help from others who might be less experienced but, importantly, more likely to respond and participate in the collective effort.

Research into organizational citizenship behaviors—also described as extrarole behaviors or contextual performance—has suggested that such help giving is a critical behavior in organizations (Motowidlo 2000, Bateman and Organ 1983). Such research has focused on the individual preconditions and individual returns for such behavior (Motowidlo 2000), but has not considered these extrarole behaviors in relation to creativity in organizations. Here, we suggest that help giving plays a vital role in precipitating moments of collective creativity within a larger web of activities that include help seeking, reflective reframing, and reinforcing. Such helpful collaboration is central to collective efforts at creativity in organizations because, as the evidence suggests, it is difficult for individuals working alone to generate new interpretations of problematic situations or generate novel insights (Fiske and Taylor 1991). There were certainly times when, for example, solicitations for help arrived as clear questions and could be easily returned with equally clear answers. There were also times, however, when either people asked the wrong questions or when there were not yet clear questions to ask. Such times provided the clearest evidence for the third set of collective activities, reflective reframing.

Reflective Reframing

The moments when participants in social interactions make new sense of what they already know comprise a third important aspect of collective creativity that we call *reflective reframing*. For example, one manager at Accenture described his response when others sought his experience for their projects:

Sometimes [other consultants will] just bring us a challenge and say "it kind of sounds like X to me, that's

what you guys know so can you help me?" And usually it's not exactly what they describe but, hopefully, we can come up with something that does work for them.

Rather than mindlessly answering the question as given, or deflecting it completely, moments of collective creativity involve considering not only the original question, but also whether there is a better question to be asked.

When participants come together in collective problem-solving efforts, one person often has a good understanding of the problematic situation, while others have potentially relevant ideas and experiences to contribute. The locus of creativity in the interaction moves to the collective level when each individual's contributions not only give shape to the subsequent contributions of others, but, just as importantly, give new meaning to others' past contributions. Recalling the Reebok Pump design team, a later recognition—that IV bags might be used to make the inflatable splint-in-a-shoe—turned a previously unrealistic idea into a realistic one. Such recognition of potentially relevant new ideas and insights and such reframing of a problematic situation come about not simply because the right people were brought in to help on a project, or because they actively contributed, but also because the participants in the process were able to mindfully consider those contributions and change their previously held conceptions of both the problem and relevant solutions. These are the moments when creative output can no longer be accurately attributed to any one individual in the encounter—as each person's insights shaped and were shaped by the interaction.

Another brainstorming meeting at Design Continuum illustrates how reflective reframing enables collections of individuals to begin thinking collectively. In this meeting, designers were searching for alternative solutions for a complex valve mechanism for a gardening application. Nicole, a Design Continuum engineer, explained why she opted for a brainstorm to find help for her problem in designing a gardening tool: "The reason to have collaboration and brainstorming is because you could invite a bunch of people and not know what they're going to bring from their experience and their kind of internalized data base and all that stuff." During the brainstorm, Nicole remembered a similar problem in another context, but did not remember the details of the solution. However, her comment triggered another engineer, Don, to remember the details, as she related:

> Well, I remember a product that you could just plug into the faucet, it wasn't electric and it pulsed the water flow. You know this Water Pik thing that you just shoved on the faucet. How did that work? And Don [said] "Oh, it's got a little spring mast thing in there and a valve that moves back and forth."

Ultimately, Don's suggestion redirected the team's search for solutions and provided a key component to the final solution. Nicole and Don, individually, may not

have arrived at the potential value of a spring mast for solving the gardening project, but together, over a brief exchange, Nicole's initial suggestion prompted Don to recall past experiences that had until then not seemed relevant. Even this connection emerged only after the prompting and new perspectives generated by previous analogies that arose over the course of the meeting.

The interaction between Nicole and Don entailed more than an aggregation of two individuals listing potential problem definitions; it required mindfully listening and building on the contributions of the other (Weick and Roberts 1993, Weick et al. 1999). Beyond just building on each others' contributions, however, in reflective reframing, one person's suggested framing of the problem shifted others' awareness in ways that made new frames visible. Such shifts in the framing of a problematic situation allow participants to recall details not easily recognized in the original framing of the problem (Fiske and Taylor 1991).

In another case, the comments of someone from across the organization changed the way a project team at McKinsey working with a medical products company had been framing the problem of inventory management. A partner described how her reaction, after listening to the problem, was "Gee, by the way, this problem you're facing is the same one we faced when working with frozen foods." Within such interactions, introducing an alternative frame—*and reflecting upon it*—makes new aspects of the situation salient to other participants, prompting them to view the relevance of their past experiences in a new light. Such a process can occur at the individual level, but group interactions may increase the ability of its participants to generate and shift between alternative frames of a given situation—when each participant is willing to reconsider their previous assumptions.

Within the organizations studied, individuals chose social interactions that retained the equivocality of past experiences—the multiple meanings that might be considered and reapplied in a new context. As one Hewlett-Packard engineer described,

> When you read about somebody's experience and then actually go and talk to them about it you find the level of knowledge is so much deeper than what can be transferred through a paper or an hour-long talk. There's a wealth of hidden knowledge that's a result of the struggles, the agonizing they went through to try to figure out what's the right way to proceed rather than the wrong way.

Just as Getzels (1975) suggests in the context of individual inventiveness, defining a problem is a pivotal activity for creative production. Our informants recognized the importance of such struggles, and pursued them through interactions that encouraged reframing of the question. In these interactive moments, by mindfully considering the possibility that past knowledge may

have alternative meanings, problem solvers maintained the flexibility to see new connections between their past experiences and the current projects others faced. This flexibility enabled them to explore a range of interpretations of any given situation and, from this range, collectively consider and pursue possibilities that might not have emerged otherwise.

Reinforcing

Reinforcing activities are those that support individuals as they engage in help seeking, help giving, and reflective reframing and, as a result, they are also critical to enabling those moments when collective creativity emerges. The social interactions that shape collective efforts involve more than directly bringing people together; the interactions that give meaning and value to these collective efforts were also important. In organizations that value individual efforts and view creativity as a fundamentally individual process, it is unlikely that people will seek help from others or, for that matter, offer help in other people's efforts. Moreover, help that is given may be viewed as criticism or an attempt to gain ownership of ideas—reducing opportunities for reflective reframing and also, ultimately, the likelihood of future help seeking or giving.

We identified two types of reinforcing behaviors in the field data. First, individuals pursuing such collective moments are reinforced by any positive experiences that resulted from engaging in help seeking, help giving, and reflective reframing. When during an interaction someone reflects upon and reframes a problem by using their past experiences—in frozen foods or IV bags, for instance—the person who sought out the interaction leaves with a positive outcome, a creative insight, that makes it more likely they will seek help again on their next problem. An engineer at Design Continuum, for example, described how positive experiences within brainstorming sessions came from the extent to which individuals reinforced the contributions—both help giving and reframing—of all the participants:

> I find that the most successful brainstorming sessions here are with folks who can let go and give full credit to almost every team member or who, as a team member, is not really concerned about people saying this was so-and-so's idea, this was his idea or her idea. [They're] more concerned about defining and solving problems.

She would invite those particular people to another brainstorming session based on her previous experiences with them—reinforcing both her help seeking and their help-giving behaviors. The CEO of IDEO even noted that individuals often left the firm when it became clear they were no longer being invited to such brainstorms. Invitations to brainstorms reinforced reflective reframing activities by encouraging those who were invited to continue enthusiastically and mindfully participating, while sanctioning those who did not reflectively engage in the sessions.

Second, the evidence suggests that reinforcing of these activities also comes from the shared values and beliefs of the organizations we studied; these organizations viewed collective problem solving as more desirable and, as a result, taught, rewarded, and promoted individuals based on those collective behaviors. These additional actions were perceived by informants as directly reinforcing particular efforts at help seeking, help giving, or reflective reframing, and ranged from rewards for seeking help or for helping on other people's projects to punishments for not seeking help on their own projects. Thus, the reward structure of the organization, in terms of promotions or credit for outstanding work, reinforced the behaviors that precipitated moments of collective creativity. For instance, a consultant within McKinsey explained how she used help seeking as a means to communicate to senior partners the interesting and challenging work she was doing, because those partners would later vote on her promotions. A promotion criterion that included rising to creative challenges therefore encouraged people to seek help to demonstrate that they met this hurdle, thus reinforcing help seeking. Additionally, one Design Continuum engineer explained that his organization rewarded good design work to the extent that people understood the particular challenges of each project. Thus he often sought others' help as a way to get credit for his own work. If there was a problem and he spent the weekend in the office solving it by himself, no one might ever know about either the problem or the solution. However, by asking others for help on his problems, they would see the difficulties he was facing and appreciate the solution he ultimately pulled together with the help of their reflective reframing.

Our informants were clearly aware of the status, credit, and rewards that accrued to those who contributed to moments of collective creativity. For example, a McKinsey partner explained that he rarely put sufficient information into the organizational database because others would not give him credit for these contributions—crediting themselves, instead, for finding the information. Therefore, he put only enough into the database to tease others into calling him directly, and into acknowledging the current value of his past experiences. In this way, mindful social interactions not only provided a means for sharing past experiences, they also provided the motive for doing so—as a way for individuals to demonstrate the difficulty of the problems they were working on and the value of their past experiences to others. Other, more asocial means of enabling knowledge sharing do not encourage people to participate in joint problem-solving efforts.

Reinforcing behaviors acknowledged, sometimes openly, the importance of social interactions in the creative process: People were expected to seek help from

others and, when asked, were expected to give help. Thus, reinforcing created shared beliefs about the importance of these activities for the work of the organization. One Design Continuum engineer explained that "no one here works in a box"—everyone was expected to ask for help whenever they had a problem. Further, such interactions encouraged individuals to seek others' help in framing and solving the problems they faced. One engineer at IDEO described how, when he arrived at IDEO, he learned to draw upon the ideas of others in the organization:

> Where I worked before, you just didn't ask for help. It was a sign of weakness.... [At IDEO] we don't have time to screw around. At the first hint I don't know something, I'll ask, "Does anyone know about this?" The whole thing here is you've got to leverage as much as possible. You ask for help—you are expected to ask for help here.

Also, a McKinsey consultant described how asking for help was not only accepted but expected of junior-level consultants: "[It's] a cultural thing. It is assumed that you will make those calls." Reinforcing and rewarding social interaction worked in combination to encourage the activities that created moments of collective creativity.

These four activities—help seeking, help giving, reflective reframing, and reinforcing—provide a framework for understanding how moments of collective creativity are triggered in organizations. As Figure 1 illustrates, help seeking, help giving, and reflective reframing are all mutually reinforcing activities that usually appear in combination and activate one another. Reflective reframing is the core of the creatively collective moment, as this activity is vital to drawing out prior experience and combining it in new ways. Also, in order for individuals to become a creative collective, help seeking and help giving must lead to moments of reflective reframing. However, we also might expect that these activities sometimes occur in the absence of the others: People might offer help without being asked, for instance. Finally, other reinforcing activities linked to organizational structures such as reward and credit play a key role in our model, as they create a shared belief in the importance of the three other activities.

Discussion

We have presented the findings of a field study that considers how moments of collective creativity emerge in organizations, and we identified a set of activities that precipitate such moments. We now turn to the implications of these findings for deepening our understanding of creativity, extending research in collective cognition, and understanding the boundary conditions of such research on supraindividual cognition.

Contributions to the Creativity Literature

This research extends our understanding of organizational creativity by highlighting the collective and transient nature of those interactions that generate creative insights. For instance, rather than thinking of supraindividual creativity as a persistent organizational phenomenon with varying degrees of collectiveness, our research suggests that it is a rare and fleeting phenomenon even in the most creative of organizations. Thus, this study presents a mesolevel picture of creativity that is different from studies of firm-level innovation (e.g., Hargadon and Sutton 1997, Nonaka and Takeuchi 1995) that focus on organizational structure, strategy, and ongoing practices. In highlighting the particular actions that enable collections of creative individuals to become a creative collective, we begin to see links between these actions and how they precipitate momentary shifts in the nature of interactions rather than alter persistent firm-level variables. This shift in focus suggests the effectiveness of larger and more explicit organizational practices (e.g., brainstorming, multifunctional teams, knowledge-sharing initiatives) may depend on more subtle microinteractions and their embeddedness within the social systems of the organization.

Our findings also extend individual notions of problem finding (Getzels 1975) and analogical reasoning (Gentner and Gentner 1983) to the mesolevel of analysis, by demonstrating how the process of reflective reframing happens during collective moments of interaction. Because people looking to solve their problems often cannot do so alone, these moments of reflective reframing are critical to the creative process in organizations. Our analysis suggests that it is not easy to predict when such moments might happen; however, we have proposed a set of behaviors that play a key role in generating the context for such moments, including help seeking, help giving, and reinforcing.

Moreover, this study offers ideas for extending psychological studies of creativity (e.g., Oldham and Cummings 1996, Amabile 1995), by highlighting how momentary collective efforts contribute to and are complementary with individual efforts. One of the prevailing models of individual creativity is the componential model developed by Amabile and colleagues (Amabile 1983, 1988; Amabile et al. 1996; Mueller et al. 2000). The componential model of creativity suggests that creative behavior is the result of the confluence of three individual-level components—domain-relevant skills, creativity-relevant skills, and task motivation (Amabile 1995)—that shape the likelihood that an individual will be creative in that situation. Using the concept of collective creativity, we suggest three ways the componential model may be extended to fit creative processes that take place at higher levels of organizing.

The componential model would be enhanced by considering the role that particular social interactions

play in enabling participants to identify which of their knowledge domains are relevant to solving a particular problem. Domain-relevant skills encompass all the knowledge an individual possesses to develop, synthesize, and judge a creative solution (Amabile 1995, pp. 85–87). Because collective creativity takes place in moments when any one individual does not hold all of the necessary knowledge to construct a creative solution, the potential for a creative solution requires the domain-relevant skills of multiple participants. One person might have a potentially valuable idea but not recognize its value, while another has enough knowledge of the problem to value that idea but not know of it. One engineer's expertise in medical IV bags, for instance, might not seem relevant to mention, nor another's expertise in valves and pumps, until a third suggests reframing the idea of a sneaker as an inflatable splint. Existing research has shown how individuals in problem-solving groups are reluctant to explore and share their nonoverlapping knowledge (e.g., Stasser and Titus 1987). Our findings suggest extending our conception of domain-relevant skills to consider the behaviors that encourage such sharing of domain-relevant information: What influences when particular individuals are asked for help, when that help is voluntarily given, when individual contributions are reflectively reframed, and when these three activities are reinforced by others in the organization?

Our analysis also suggests opportunities to expand our conception of intrinsic motivation. Intrinsic motivation has been shown to be a central and critical component of creative behavior, and this motivation depends upon the individual's sense of free choice and freedom from constraints (Amabile 1995, Koestler 1964). While intrinsic motivation is seen as an individual-level construct, the experiences gained in momentary interactions often shape its formation. For example, individuals learn what aspects of work life are important, how they should act, and how they will be evaluated by gathering verbal and nonverbal cues from the actions of others in their work environment (Salancik and Pfeffer 1978). Through moments spent interacting with respected others who are visibly engaged in and passionate about their work, newcomers may come to hold similar values regarding such work. Considering the moments in which help seeking, help giving, reflective reframing, and reinforcing behaviors encourage motivation would help us to understand the role of intrinsic motivation in creativity processes.

Finally, understanding the social nature of creative insights may shed light on the nature of creativity-relevant skills. One of the goals of the literature on collective cognition is to account for the influence of social systems on individual cognition, focusing on the social context of thought rather than on individual mental processes (Porac et al. 1996). We demonstrate that momentary social interactions, although fleeting and difficult for visitors to observe, may carry significant weight in shaping how participants pursue the creative process. Because collective efforts at problem solving are a more observable cognitive phenomenon than the same efforts carried out by individuals, the social interactions that make up the creative process in these firms may shape expectations for how individuals should work alone. Individuals participating in group problem-solving sessions may learn by observing others' behaviors, for example, by similarly looking for analogies and experimenting with alternative frames when they are later working alone. For instance, one Design Continuum engineer described how his environment shaped his approach to creativity:

> You have that different perspective partially through the experience of just being exposed to all different kinds of programs directly but also just getting in the habit of doing that. You can see that you need to apply other manufacturing processes to places that have never heard of them.

In this way, our findings demonstrate that mindful interactions across individuals provide not only a collective mechanism for generating solutions, but can also shape the subsequent creativity-relevant skills of individuals working alone.

Understanding Collective Cognition and Group Process

In building on the literature of collective cognition and, in particular, of collective mind and heedful interrelating, we hope to focus attention on how collective creativity is a social process, solving problems by pooling the resources of people in the moment and, ultimately, across a series of moments. This is similar to the mindful processes seen in high-reliability organizations in the sense that reflective reframing, like heedful interrelating, is necessary for creative interactions as well as reliable ones, because in both cases participants must be aware that "any 'familiar' event is known imperfectly and is capable of novelty" (Weick et al. 1999, p. 91). Our understanding of collective creativity differs from collective mind, however, in that our focus is on the processes that generate creative disruptions from the established order as opposed to maintaining order in the face of disruption.

Therefore, we suggest that a different process of mindfulness is called for in creative organizations. Mindfulness in settings requiring high reliability depends upon people interrelating their actions with their representations of the collective enterprise (Weick and Roberts 1993, pp. 362–363); in these organizations the ends of the enterprise are clear—to maintain order in the face of change. In contrast, in settings requiring creativity, the ends of the enterprise are not clear, as the goal of the process is to create new solutions—to maintain change in the face of order. Within creative organizations, mindfulness may be better characterized by the process of

reflective reframing, which includes not only representations of the existing order, but also the introduction and construction of frames, or representations, of potential new orders. So while the literature on collective mind calls our attention to the importance of managing surprises by being preoccupied with failure and committed to the resilient pursuit of the routine (Weick et al. 1999), our analysis suggests that future research on collective cognition might explore how mindfulness, characterized here as one aspect of reflective reframing, also pursues novelty out of the routine.

Our understanding of the momentary processes of collective creativity may also help us delve more deeply into the behavior that underlies some of the findings in the literature on group process. The literature on brainstorming, for example, finds that individuals perform better than groups on creative tasks (Diehl and Stroebe 1987, 1991; Mullen et al. 1991; Paulus et al. 1996) and attributes this poor group performance to such factors as social loafing, social anxiety, blocking, and downward comparison. On the other hand, minority dissent and high participation among group members has been found to increase innovation (Carsten and West 2001), as has performance pressure (Paulus and Dzindolet 1993). Our study illustrates that in social interactions that arise within stable and ongoing communities (such as organizations), these factors are themselves products of past social interactions and shared values. Therefore, in organizations that reinforce behaviors of help seeking, help giving, and reflective reframing, we would expect that there would be little social anxiety, and normative pressures to participate in collectively creative interactions would enable increased group creativity.

Our research demonstrates the importance of the social and momentary nature of collective cognition and, as a consequence, provides insight into why knowledge-management systems often fail in organizations. Specifically, we believe this failure is related to the value people place on reflective reframing as an element of the collective creativity process. All of the firms studied had invested, sometimes heavily, in formal databases and other means for storing the knowledge generated in past projects and other experiences. The intent of these knowledge-management systems was for individuals to access the organizations' past knowledge and, individually, solve the problems they faced in a project.

However, as consistently as these organizations adopted such databases, informants described their ineffectiveness. A Design Continuum engineer recounted the failure of such a database:

> We had this library where different people were supposed to maintain different things. This person was going to maintain a library of glues, this one a library of plastic parts. And it just completely fell apart; it didn't go two weeks before it had completely fallen apart.

Considerable organizational investment had gone into capturing and codifying individual knowledge to make it available to all in the organization, yet these efforts were not valued by the very people they were intended to serve. An Accenture partner explained, "Everybody here has their own [network] in terms of just using voice mail and having your own set of personal contacts...I don't think anybody here actually peruses the Knowledge Exchange to get that type of information." And one Hewlett-Packard informant related, "It's all in people's heads. The model's out there somewhere but there are so many models in the network drive that if you didn't know, you'd spend days trying to find out what you were looking for." Rather than search on their own through codified knowledge, the problem solvers of these organizations relied on those social interactions that helped them recognize nonobvious connections between the organization's knowledge and their current projects.

Technical knowledge-management efforts may be ignored because these more asocial practices discourage the moments of interaction that lead to reflective reframing and reconsidering of old ideas in new contexts. Databases codify knowledge, storing it in ways that can be easily retrieved using known and expected keywords. When problems are well known, these systems provide effective access to the solutions that are typically associated with those problems. However, the very efficiency of database deposit-and-withdrawal mechanisms makes them difficult tools for finding nonobvious links between ideas. Databases rely on individuals who know what they want to do, where they want to look, and what they want to find. In short, most databases neither reflect on questions nor make unanticipated connections between those questions and other ideas and experiences residing in the database. These connections are made, instead, in the reflective reframing that occurs through momentary interactions in organizations.

Boundary Conditions

The phenomenon of collective creativity depends on the actions of help seeking, help giving, reflective reframing, and reinforcing that take place before (and after) moments of collective insight. Such actions are often constrained or undermined in organizations, however, and keep problem solvers from tapping into each other's past experiences. For example, in many organizations, seeking help from others has social costs, as it can reflect the tacit admission that one is unable to solve problems on one's own, a confession of inadequacy that few are willing to make (e.g., Lee 2002). As Edmondson (1996, 1999) shows, these costs can be mitigated through the creation of a climate of psychological safety in which people trust that they can be open about making mistakes and asking questions. However, this type of openness in spontaneous gatherings requires behavioral reinforcement that extends beyond (and before) the "team." Such

reinforcement is provided for the creative organizations we studied through behaviors that rewarded and encouraged collective problem-solving activities.

Further, the actions that precipitate collective moments may be inhibited by the status hierarchy within organizations. While our field sites were somewhat egalitarian professional organizations with a focus on creative ideas, we would expect that less-egalitarian organizations, such as those with strong occupational hierarchies, would provide less opportunity for such moments. For instance, Lee's (2002) study of feedback seeking in hospitals suggests that those with higher occupational status are not as likely to seek help. One would imagine that moments of collective creativity would occur less frequently in that type of organizational setting.

It should also be noted that while creative solutions often reflect such collective efforts, the people in these organizations were aware of other times when the sharing of ideas and experiences did not happen. For example, one manager in Boeing's Ops Tech group explained:

> There are cases where the person who has the knowledge is sitting right next to you and it goes unnoticed and you plow a lot of ground that you didn't necessarily have to. There's still a lot duplication of effort. There just isn't any way that I know of to make all knowledge that has ever been done on something available to the person at the time in which they need it. It's all a matter of getting the right knowledge into the right hands at the right time.

So, while the evidence suggests that collective cognitive processes link the past knowledge of organizational members to current problems faced by others, it also suggests this process occurs only in those moments when that past knowledge is made available across the organization.

Collective creativity can also have costs as well as benefits. The emphasis on a collective process, for instance, may come at the cost of accomplishing other types of work. For instance, encouraging consultants to spend time contacting one another rather than using available solutions in the corporate database can result in not completing work on time, or in reinventing the wheel (Hargadon and Bechky 2005). Additionally, focusing on collectively creative interactions is not always prudent: For particular problems, sometimes a better solution is not necessary (Nemeth and Staw 1989, Staw 1995).

Future Research

This study sought to identify and develop an initial model of collective creativity and the actions that precipitate such moments in organizational settings. As such, qualitative methods and inductive theory building were a useful approach to identifying and describing the phenomenon. However, these methods are not as well suited to testing propositions and hypotheses derived from the theory. The relative effects (and metrics) of help seeking, help giving, reflective reframing, and reinforcement on collective cognition and similar group processes may be better studied using more quantitative methods in laboratory techniques or field surveys.

Future research might continue studying processes of collective cognition through laboratory or field studies based on tests and exercises developed to study individual cognition (see, for example, Gentner and Gentner 1983; Gentner and Markman 1997; Reeves and Weisberg 1993, 1994). What experimental conditions that shape help seeking and help giving, for example, might be used to induce or suppress subsequent reflective reframing among pairs and groups of individuals working jointly to solve such creativity tasks? In field studies, how might past group performance shape subsequent help seeking among collaborators?

Future field research could also focus on exploring the nature of reinforcing activities, as this study did not find differences in the types of reinforcing behaviors across firms. However, one might expect that reinforcing actions might work more or less effectively in encouraging collective creativity. As Orlikowski (1993) found while studying technological adoption, reinforcing behavior can be tricky—when such actions run counter to the shared expectations of the organization members, their effectiveness is minimal. Thus, while the interactions of collective creativity may be momentary, the support structure that firms create for such moments cannot be ephemeral, and future research is needed to fully investigate the differences in effectiveness of reinforcing activities.

Analyzing the creativity that emerges through collective, momentary processes has implications for managerial action as well. For instance, while the social-psychological findings about creativity suggest applications to small, close groups that act, at times, like individuals (Amabile 1988, p. 141), the emphasis in such research has been on creating "high-performance" teams as a persistent phenomenon (e.g., Katzenbach and Smith 1993, Lipman-Blumen and Leavitt 1999) and not on enabling the fleeting moments that possibly underlie such high performance. The data from this field study suggest that, rather than attempting to build lasting groups, organizations might support the activities—help seeking, help giving, reflecting reframing, and reinforcing—that facilitate the spontaneous formation of ad hoc groups formed around particular problems. This implies that managers, in addition to managing creative individuals in the creative process, should also focus their attention on reinforcing the interactions that turn individuals into creative collectives.

Further, while much of the creativity literature is focused on individual creative ability and its expression in the organizational context, managers might find collective creativity more dependent on individuals' abilities to interact with others. This perspective suggests organizations seeking creative outcomes, such as new

product development groups, should select and reward individuals who pursue collective achievements over individual ones. Additionally, managers might encourage, or even require, routine interactions between project teams in order to foster the social interactions that precede and ultimately precipitate collective moments that cross traditional organizational boundaries. For example, both IDEO's brainstorms and McKinsey's transitory team structures routinely bring together people from across projects in ways that foster friendships and informal help seeking and help giving.

Conclusion

The phenomenon of creativity exists relatively independently of the interpretive frameworks we use to study it. Approaches that focus on the individual and inventive aspects of creativity will find within any creative solution key roles played by particular individuals and particular ideas that break from established expectations. At the same time, however, approaches that focus on the social and continuous aspects of a creative solution will find key roles played by particular interactions and preexisting ideas. In this way, collective perspectives on creativity neither deny the existence of the individuals involved nor deny the novelty of their ideas. Rather, a collective perspective makes salient other aspects of a persistently complex phenomenon. Popular and scientific interest in individual creative accomplishments shapes not only how we as social scientists choose to describe and measure creativity, but also how people in organizations approach their work and how they later explain it. In some cases it provides a model for individuals engaged in creative efforts to work alone and ignore potentially valuable past ideas—to reinvent the wheel. In other cases, it provides a language that masks (to participants and observers alike) what is a collective process. The data from this research offers one glimpse into how organizational creativity takes place as a collective process. Returning to the recognition by one of his longtime assistants that Edison was in reality a "collective noun," this research suggests that the study of creativity in organizations might benefit from the incorporation of more such collective nouns into our vocabulary.

Appendix. Research Methods—Sources of Data

Interviews with key informants. Individual interviews offered detailed narratives of the problem-solving process. Such recollections are prone to individual experiences, biases, and retrospective rationalizations, yet often give voice to highly informed understandings of those who are closely involved in the process. In total, over 110 interviews were conducted (with the in-depth study of IDEO Product Development accounting for approximately 60 of these). The first author interviewed between 6 (all of Hewlett-Packard's onsite members of the SPaM Group) and 12 informants within each of the other organizations, ranging from executives to project managers to engineers and other "front-line" employees who are actively engaged in the problem-solving work of the organization. Interviews pursued three goals: to define the overall structure, work practices, and culture of the organization; to identify and describe the patterns of interaction within and from outside the organization; and to identify potential projects that exemplified creative solutions.

Project postmortems. Project postmortems are traditionally formal opportunities for project teams to reflect on the merits and mistakes of a recently completed project and record the experiences of the project team for others. In this research, they served as team interviews intended to discuss the history of particular projects. These postmortem interviews provided a useful picture of past events because participants offered multiple perspectives on common events and often filled gaps in what, from any one informant, may have been an incomplete recollection.

Observations of work. Observations of ongoing problem-solving activities varied by the type of work performed within each organization. While small and focused problem-solving sessions, like brainstorming meetings (Osborn 1957), offered a glimpse into the social interactions that constitute the creative process, ideas and solutions were also generated in ad hoc, informal hallway interactions. Observing these meetings and social moments provided insight into how social interactions shaped individual participants' perspectives on the problem, and subsequent responses. Within each site, the first author observed several problem-solving meetings and informal interactions in which groups faced problems and actively generated alternative solutions.

Tracking of particular projects. Interviews and project postmortems helped identify past projects that reflected, in their outcomes, new combinations of existing ideas. For these projects, the first author interviewed relevant individuals to determine the source of inspirations for the innovative features of the project and tried to determine the path of information flows that brought these innovative ideas together. Such follow-up interviews acted as "task-related tours" (Spradley 1979) in which informants provided concrete details of past events and, by doing so, recollected specific interactions that shaped the outcomes of these projects.

Documents and technological artifacts of the organization. Written material also served as a data source describing the work, structure, and culture of the organizations. These sources included the popular media, existing organizational research, and original and compiled historical data. For this research, technological artifacts included products, prototypes, sketches, and—in some cases—presentations that made up the work product of the organization. Studying the artifacts of an organization enabled the identification of instances in which old solutions were used to solve new problems. This analysis motivated subsequent data gathering to understand the organizational processes that led to these solutions.

Endnotes

[1]While a number of professional service firms offer a single or limited set of preexisting services, such as tax preparation, legal advice, or the implementation of enterprise software, this study was interested in those organizations that engaged in open-ended projects, where the solutions were not known in advance.

[2]The data for the IDEO case study was gathered during the first author's 18-month ethnography of this organization. The original field notes, interview transcripts, archived information, artifacts, and videotaped meetings were revisited to generate new insights into the creative process within this organization.

[3]We present these four activities as distinct behaviors because they fit the data reasonably well and provide a simple and analytically useful way of summarizing these data. Nonetheless, the behaviors and motivations that informants described and we observed could not always be cleanly distinguished: Aspects of more than one activity were often present in any interaction. One person's help seeking, for example, was also a way of reinforcing the help a designer had previously given.

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