

---

## Narrative-Based Collaboration Systems for Distributed Teams: Nine Research Questions for Information Managers

Stephen M. Fiore<sup>1,4</sup>, Rudy McDaniel<sup>2</sup>, and Florian Jentsch<sup>3,4</sup>

<sup>1</sup>*Department of Philosophy, University of Central Florida, Orlando, FL*

<sup>2</sup>*Department of Digital Media, University of Central Florida, Orlando, FL*

<sup>3</sup>*Department of Psychology, University of Central Florida, Orlando, FL*

<sup>4</sup>*Institute for Simulation and Training University of Central Florida, Orlando, FL*

---

**Abstract** *We propose a framework to explore how narrative can support distributed teams. Although information technologies enable distributed teamwork, they may increase the level of abstraction forced upon teams by the absence of co-location. To counter these effects, we explore how elements of narrative may be useful through their ability to convey team-related information. Nine research questions are presented that examine ways in which we can explore narrative information systems as tools for studying distributed teamwork.*

**Keywords** narrative, team cognition, collaboration, teamwork, team development

In this paper, we propose a theoretical framework to explore how the narrative form can be used to enable the monitoring of distributed teams conceptualized as information systems. We define distributed teams as groups of individuals who do not share a central geographic location and who are working towards a common task or have common goals driving each individual's performance. Such teams present challenges for information management; the size of the team, the sociocultural context from which each team member emerges, and even the individual personalities of the team members have a significant impact on performance when moving from a physical environment filled with "natural" cues to a virtual environment filled with "artificial" cues mediated by technology. As a result, new types of informational tasks become important. Separating relevant from non-relevant information, adjusting the focus or scope of communication processes, encoding events as organizational indices, and even ordering events in a causal sequence that is meaningful to different audiences all become important informational tasks for managers of distributed teams. We suggest that narrative is a useful tool for addressing these types of issues.

In our model, a narrative framework serves as an overlay for the unique demands of distributed team-based

activities. In distributed teams, the technology allowing for interaction may alter team development in ways different from traditional co-located task environments. Collaboration technologies support synchronous distributed work – for example, video conferencing and Internet chat rooms – and/or asynchronously distributed work – for example, electronic mail and bulletin boards (Avolio, Kahai, Dumdum, & Sivasubramaniam, 2001; Kock & Nosek, 2005). This form of collaborative environment, although it facilitates teamwork across organizations separated by distance, actually increases the level of abstraction forced upon teams due to the absence of co-location – a particular form of collaboration challenge referred to as *team opacity* (for a detailed discussion, see Fiore, Salas, Cuevas, & Bowers, 2003). Our approach is to construct a model for dealing with team opacity that is informed by recent research in cognitive science and narrative studies; this theoretical model can then be applied and manipulated using modern information technologies.

We can think of distributed team interaction as being *opaque*, in the sense that the normally transparent actions of teammates, actions that are observable in physical interactions, are now attenuated, or even entirely absent. Essentially, team opacity describes the more challenging interaction experience of increased ambiguity and artificiality associated with distributed environments. Within a socio-cognitive framework, this construct of *team opacity* is the result of an impoverished interaction context – what has been labeled a "virtual context" (Fiore, Cuevas,

---

Address correspondence to Stephen M. Fiore, Ph.D., Department of Philosophy and Institute for Simulation and Training, University of Central Florida, 3100 Technology Parkway, Orlando, FL 32826, USA. E-mail: sfiore@ist.ucf.edu

Schooler, & Salas, 2005), which is specifically defined as a blend of artificial and real environments. In distributed interaction environments, the *real cues* present from, for example, a system or from co-located team members, are combined with *representations of cues*, that is, cues arising from task artifacts or from distributed teammates that are filtered through or mediated by some form of communication technology. This decreased awareness of team member actions and tasks creates an environment lacking in the many cues (visual, auditory, and social) normally present in co-located team interaction.

For managers of information systems, this virtual context is problematic, especially when team performance or satisfaction data needs to be collected and stored. While it is relatively easy to encode the real-world cues present in team-based exercises, how does one think about encoding representations of cues, which may be highly idiosyncratic? Consider a typical problem experienced by project teams – that of dissatisfaction with a current turn of events in a team’s task. During synchronous interaction, this expression may be manifest via paralinguistic cues (e.g., sigh, posture), and during asynchronous interaction, it may instead be shown through withdrawal of participation. This issue is troublesome when a team is not co-located. For example, the sighs and mutterings of a team member in a real-world setting will more than likely communicate to other team members that someone is dissatisfied with the current course of events. In a virtual context, though, these cues may be insufficient to penetrate the technological barriers erected by peripherals such as inexpensive PC cameras and microphones. The mediation of this cue by technology may not do justice to its sense of importance or urgency. This is classic information theory in practice; since signal and noise have a competitive relationship, the signal must be of sufficient strength to overcome the noise in order for quality information to be communicated (Aleksander, 2002). Unfortunately, in distributed teamwork, additional noise is introduced by technological issues. This increased noise in turn contributes to team opacity.

Research associated with team opacity suggests that a cascading series of effects attenuates team development and potentially hinders future coordination and cooperation within distributed teams. First, team opacity alters the subjective experiences of the team in that the social cues normally fostering factors such as team cohesion (cf. Salas, Dickinson, Converse, & Tannenbaum, 1992) are absent. This, in turn, likely impacts the team members’ perceptions of one another in terms of team competencies and the development of shared knowledge (e.g., Fiore et al., 2003) as well as in how they think of themselves collectively (cf. Whitney, 1994). The confluence of these effects results in the underdevelopment of critical team-related knowledge and attitudes. In this paper, we describe how narrative may be an effective means through which to surmount some of these problems. We believe that the construction of a sound

investigative model is the first step in formulating specific research goals for the investigation of narrative as a tool for overcoming distributed team opacity.

### The Narrative Form as a Tool for Connecting Distributed Teams

At the core of our argument is the notion that distributed team knowledge is more effectively conveyed and more memorable when conveyed through stories. Klein (1998) has discussed the utility of stories and storytelling techniques in business settings. He notes that organizational decision makers use story-building activities to both retain organizational knowledge and to make sense and build better accounts of situations. We build upon such notions to suggest that because storytelling as a means of information transmittal can support not only the social but also the cognitive and affective components of team experience, it may support collaboration systems devised to address the limitations imposed by team opacity. Specifically, the convergence of social, cognitive, and affective dimensions into one means of information conveyance may aid in the development of a type of virtual context that can facilitate team development.

For the purposes of this article, a narrative is defined as a structured expression of a given team member, or team’s, experiences. This expression should be in a story-like form, containing elements such as a central character (protagonist), some element of adversity (antagonist), a time and location (environment), and a central “theme” (plot) describing the nature of the adversity and how it is successfully or unsuccessfully overcome. Depending on the informational needs of a particular team exercise, these stories might be written (or spoken, or even performed) by the individual team members, by a subject matter expert collecting debriefing data, by the team leader, or even by an outside observer trained to capture information in a narrative form. Different authors will yield different types of stories as these authors may find different meaningful events within the team experience that relate to their own backgrounds or areas of expertise. It can be especially enlightening to collect stories from multiple authors and then compare the major events (or potential informational indices) that emerge from each individualized narrative. Additional schemes for classifying and categorizing informational indices in narratives can be found in the annals of narratological research; scholars such as Mieke Bal have long been analyzing the particularities and structures of actions and events found within the narrative form (Bal, 1997).

To further understand narrative from the context of teamwork, we describe a set of the elements of narrative classified along three interrelated dimensions –*social*,

*cognitive*, and *affective* – that have the potential to create a virtual context we believe to be helpful in overcoming team opacity and facilitating distributed team development. Figure 1 presents a conceptual representation of our framework. For discussion purposes, we have parsed the separate components of narrative that we submit form a compelling foundation for the development of narrative-based collaboration systems. From this framework, we generate candidate research questions for the scholarly community to consider in the design and development of narrative-based collaboration technologies. Note that the inherent interdisciplinarity of such an endeavor requires true collaboration among not only scientists and practitioners, but also among the organizational, cognitive, computational, and communication sciences with fields such as narratology (the study of storytelling and the narrative form). In this way, principled research and development can be pursued to address the emerging collaboration challenges facing global industry (Bal, 1997).

### Narrative and the Social

A number of theoreticians contend that story and narrative are innate characteristics that are based upon the social nature of human interaction. Some suggest that narrative is inherent to human existence, arguing that we create internal mnemonic representations of social interactions and human experience using forms of narrative and story for representing and organizing these activities (Bruner, 1991). Others similarly argue that humans are naturally interpretive beings and that they need some sort of interpretive framework through which to make meaning of reality, suggesting that stories provide this type of framework (White, 1995).

From an anthropological and humanistic perspective, a long line of researchers note that the narrative form may be one of the earliest means for retaining knowledge

and for passing that knowledge on to future generations (e.g., Denning, 2001; Fiore, Jentsch, Becerra-Fernandez, Salas, & Finkelstein, 2005; McDaniel, 2004; Nelson, 2004; Snowden, 1999; Sugiyama, 2001). Interestingly, in her work in developing interaction systems based upon principles of artificial life, Dautenhahn suggests that one of the foundational elements of human social understanding involves “biographical reconstruction, the interpretation of another person’s behavior and appearance based on the situatedness of another’s mind in time and space” (Dautenhahn, 1999, p. 61). From this line of thought, and in terms of team-oriented social communication, her *Narrative Intelligence Hypothesis* describes storytelling as a form of communication that evolved in response to the increasingly social demands of society and the need to communicate information about third-party relationships (Dautenhahn, 2003).

As the research above illustrates, stories are natural vehicles for social expression. They are also useful as templates for conversational and organizational communication and as generational tools (longitudinal scaffolds) for social knowledge management. Nonetheless, despite a growing body of anecdotal literature and case studies from business and organizational science (Denning, 2001; 2004; Gargiulo, 2006), it remains to be seen how such stories may function as social devices in distributed team environments connected by information systems. To foster a dialogue among those investigating the management of information systems associated with these collaborative technologies, we must identify and pursue candidate research issues in this area (see Table 1). Three questions related to the social elements of distributed teamwork can be linked to conversational dynamics, cultural context, and social context.

First, we need to understand how the social elements of collaboration and communication dynamics are altered in distributed work. In distributed teams, the dynamics surrounding conversational groups may

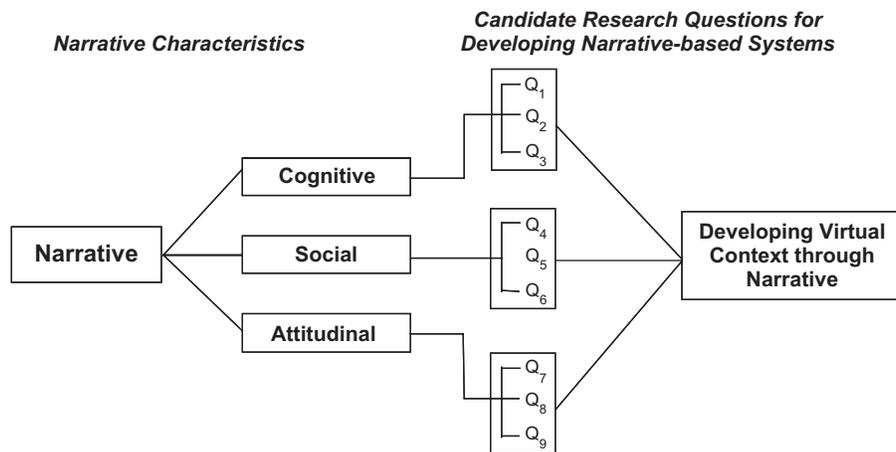


Figure 1. Theoretical framework for developing narrative-based systems.

**Table 1.** Candidate Research Questions Pertaining to Social Elements of Distributed Teamwork

Q1. <i>Conversational Dynamics</i>	How can information collaboration systems support more realistic and interesting team conversations, which integrate storytelling techniques?
Q2. <i>Cultural Context and Figurative Language</i>	How can elements of figurative language (such as metaphor) be implemented to build connections within cross-cultural or specialized teams?
Q3. <i>Social Context</i>	How can narrative improve social connections between distributed team members?

change due to the limitations of technology-mediated communication tools. Conversational story prompts, in which team members are asked to communicate using a story-like format (protagonist, antagonist, time, place, and central concern) can help to communicate a more holistic account of experiences to any connected listeners. These accounts may be generated entirely by an author, may use computer-assisted prompts or pre-fashioned scripts for speedier delivery, or may incrementally communicate a story over the duration of a conversation. Protagonists may be the individual team members (first person accounts), another person known within the organization, or even a fictional character (third person accounts). Antagonists would be composed of opposing forces, either internal from within the protagonist or external from within the environment, that provide a sense of conflict to the story. Time, place, and central concern could likewise be linked to organizational events or otherwise fictionalized through analogy or metaphor (see Q2 later in this discussion).

We use the term “listeners” broadly to represent any of those individuals experiencing a given narrative. On the one hand, this change in context may expand the number of possible listeners by allowing technology to take on some of the burden of the communication process using, for example, avatars scaffolding paralinguistic cues. To illustrate, in virtual worlds such as Second Life, where avatars enable interaction, we may see the emergence of more embodied narratives as storytelling unfolds in dynamic and real-time settings. On the other hand, to the degree embodied interaction is not so easily supplanted, collaboration technology may limit the number of listeners due to decreases in the capability to contextualize a story for fellow listeners. Related to this, the general change to the storytelling process as it moves from a “real-world” communication environment to a virtual communication environment is also an issue needing research. For example, we must understand how storytelling and its reception, when it is conveyed synchronously (e.g., via chat), or asynchronously (e.g., via web-postings), is differentially impacted by both the technology used and the timing of the telling (narrative pacing).

Second, moving beyond just the communication dynamics, we also need to understand the socio-cultural framework surrounding distributed teamwork in information-rich contexts. In particular, we must ask how much we understand the culture emerging in distributed teams. Figurative language is often used in storytelling to help bridge gaps in understanding by relating known entities to concepts that are unknown or unfamiliar. From this, a general research question is, can we rely on figurative language and other prominent narrative devices to try and build an appropriately familiar cultural space within distributed environments, or a common ground and shared understanding of acceptable conventions, practices, and terminology? The goal in this exercise is to choose appropriate narrative language that acts as a bridge between different types of thinking or different areas of knowledge.

The operational elements of narrative are mostly ubiquitous across cultures (we do not usually see a story without a hero or heroine, even though these characters may be flawed) but techniques for figurative language can vary widely depending on the genre and storyteller. One storyteller might rely on many metaphors, or comparisons between two seemingly unrelated subjects, which are often paired as well known concepts with lesser-known concepts and used for the sake of elucidation or poetic impact. For example, a storyteller creating a story for a non-technical audience might compare a virtual database to a physical file cabinet. They are not physically congruent, but they are conceptually similar.

Another author might choose metonymy, or the substitution of one subject for another that is more complex, in order to clarify a particular aspect of the story. Synecdoche, which is a type of metonymy, is commonly used when a part of something is used to represent the whole (e.g., a “set of wheels” is easily understood within a narrative as an automobile). Alternatively, a charity fundraising group may adopt synecdoche to better convey the sense of *who* is being helped. For example, rather than providing statistics about the number of poor and malnourished people in a particular region, one would tell a story about a child or a family to represent the population of people being helped. Here the personal case is more easily grasped and elicits more sympathy (Hall, 2007). Still another author might use a combination of these literary forms or another figurative device altogether.

Regardless of technique, figurative language that is used to compare concepts or objects, as is done with metonymy or metaphor, may facilitate comprehension of cultural issues within the work. In metonymy, understanding relies upon contiguity of concepts (wheels are contiguously related to automobiles), whereas in metaphor, it relies upon similarity (a physical file cabinet operates similarly to a virtual database). For example, the word “Shakespeare” may be used to describe a talented

writer in the metaphorical sense, or, to use it metonymically, it may refer to the author's work. Although somewhat similar in purpose, metonymy tends to not be as ornamental (Frisson & Pickering, 1999; Papafragou, 1996) but both could be used to lend familiarity to an unknown cultural practice. The question then becomes one of informational integration: can the cultural differences of a team-based exercise be bridged through narrative support systems using figurative language? As an example, narrative characteristics such as metaphor might enable collaboration technologies to better connect teammates coordinating across organizational or national boundaries. Research could help address the degree to which metaphor based systems are effective in this regard or whether metaphor in and of itself (e.g., as a story fragment), can foster a shared sense of community and culture.

Our third research question focuses on how distribution generally alters the *social context* associated with interacting at a distance. For example, some argue that variations in work characteristics substantially alter elements of the social context such as changes in informal leadership, and this, in turn, may alter organizational processes (Griffin & Mathieu, 1997). The attenuation of social context in distributed work was described in early research on electronic communication. For example, Sproull and Kiesler (1986) described how reductions in social context cues, as occurs with information exchanges using methods such as email, may lead to more self-centered, rather than other-centered, focus. In addition to changing the nature of the distributed interaction, this, in turn, may alter the development of feelings of connectedness between the communicators. If we assume that distributed teamwork similarly alters context, research must help us understand the degree to which narrative theory can aid in weaving together a distributed social context. In particular, research can guide the process of building informational support tools (such as the conversational narrative system discussed previously) to address or at least facilitate the social demands present in distributed work. The archetypal roles introduced in the typical narrative canon (e.g., hero, sidekick, or villain) can provide subtle social cues for the expected social interactions with a team. This may occur, either overtly in a finished story through direct characterization and exposition or more implicitly during the authoring process (think of your goal in this exercise as the sidekick – why does your story unfold in the way it does?). Here the story structure, and how it is enriched with detail, may act as a substitute for the impoverished social context. Different genres, which can be used to further inform the producers of stories, introduce similar types of character archetypes useful for this purpose. But, from this perspective of social context, research needs to determine whether the experiences and informational

needs of distributed teams are sufficiently different such that storytelling *may not* be enough to, for example, communicate information about third parties interacting over time and space (cf. Dautenhahn, 1999).

## Narrative and the Cognitive

From a cognitive perspective, research has explored how humans find it natural to interpret and comprehend script-like or schematic structures (e.g., Bartlett, 1932; Bower & Morrow, 1990; Bransford & Franks, 1971; Gagne & Glaser, 1987; Mandler, 1984; Rumelhart, 1980; Schank & Abelson, 1977; Trabasso & Sperry, 1985). These same processes lead to a fairly complex state of activation in that “the enabling events and causes [of a story] form a web of connections among other events and conditions” (Bower & Morrow, 1990, p. 45). Further, narratologists have been making important linkages between narrative theory and human cognition, producing a richer understanding of both areas on inquiry (Herman, 1997; 2003)

While much has been written about storytelling as a tool for organizational learning and knowledge management (e.g., Denning, 2001; 2004, Snowden, 2004; Swap, Leonard, Shields, & Abrams, 2004) there is still a general reluctance to acknowledge narrative as a legitimate tool for many types of cognitive learning tasks in which information must be codified and distributed (i.e., explicit knowledge tasks). In order to verify the influence of story on cognitive processes within distributed teams, more research is needed to determine how story can be used to facilitate the development of the type of knowledge argued to facilitate coordination. Within this context, we present a set of cognitive-based research questions to help us understand how we may be able to overcome such barriers (see Table 2).

First, we suggest that research must help us to understand the role and power of personal experience in distributed team development. In this way, we will be better suited to generate informational solutions based upon story and narrative. Some IT-based systems for experiential learning have been designed around first-person

**Table 2.** Candidate Research Questions Pertaining to Cognitive Elements of Distributed Teamwork

Q4. <i>Personal Experience</i>	How can narrative help scaffold the episodic memories of distributed team members for easy access in information systems?
Q5. <i>Team Decision Making</i>	How can distributed decision-making be facilitated through story-based information conveyance when team members are not co-located?
Q6. <i>Team Experience</i>	How can a broad, team-based metanarrative be used to create a contextually richer overview of team performance?

narrative experiences (McDaniel, 2004; Fiore, Metcalf, & McDaniel, 2007) but these technologies merely scratch the surface of what is possible. For instance, additional research can help us uncover the nature of the *episodic* experience, or memories of events and associated emotions associated with a given experience that is associated with distributed teams. These memories may be more easily accessible when they have emotions associated with them – emotions that can often be recalled and revisited through the encoding and expression of those memories' events in narrative form. Research looking into this issue might measure the event recall time for high-emotion versus low-emotion narrative conditions encoded in an information system. Additional affective elements are discussed in our final three research questions later in this article.

Since episodic memory consists of our memory for personally relevant experiences, these are event-based memories where the experience is consciously recollected and the context and time get reinstated. Tulving (1985; 1998) argues that it is the recollective quality of the episodic memory that is an important part of personal experience. In particular, “episodic memory does exactly what the other forms of memory do not and cannot do – it enables the individual to mentally travel back into her personal past” (Tulving, 1998, p. 266). With respect to teams, Fiore et al. (2003) suggest that episodic memories in teams are composed of prior interactions with teammates such as situations and scenarios engaged by the team and how the teams behaved within these experiences. Thus, we need to understand what it is that may be different about episodic memories as they develop in distributed teams when compared to memories formed in co-located teams. Further, research should determine whether story can be used to support the instantiation of distributed team episodic memories or strengthen the connections across such memories. For example, we argued that the impoverished interaction environment attenuates the team experience. A logical conclusion from this is that team-related memories are in some way weakened by this virtual context (Fiore et al., 2005). To the degree this assumption is warranted, collaborative systems must move beyond the file-sharing mentality and information managers and team leaders might find it valuable to move towards understanding how story-based systems can be used to compensate for a weakened episodic experience in teams.

For instance, using the conversational narrative tool mentioned previously, a simple technique for improving episodic memory recall would be the ability for users to insert narrative event “hooks” into their stories, which are more memorable than their everyday team-related tasks. These could be generated through the use of prompted guides – for example, “when telling your story, be sure to include a recent contextually rich memorable

event that can be connected to your topic in some fashion.” They could also be given advice on how to do this using the figurative language model discussed in Q2. Later, when a user is revisiting their story to seek ways to improve performance, they might not remember the details of their actions, but they would be more likely to remember a major event that has some connection, even if only a weak one, to that experience.

Related to this notion of experience and episodic memories, we must also examine how personal stories influence other facets of cognition in a colloquial context. From the standpoint of complex cognitive processes and the use of story, Norman (1993) explains that business decisions are often decided by personal life experiences and their expression in narrative form in business meetings and boardrooms. As he describes,

I remember . . . a meeting of senior executives at a major American company, decision makers inundated with statistics and facts. And then one of the highly placed decision makers spoke up: ‘You know, my daughter came home the other day and . . .’ and the story poured out. ‘Hmm,’ another executive said, ‘that makes sense, but you know, the other day . . .’ and out came a story. A few stories, some discussion on the stories, and the decision. All these facts and statistics, and in the end, the decision was based upon some personal stories (Norman, 1993, p. 129).

This incident Norman describes is not an isolated one. Decisions in industry and policy are often made solely on the exchange of stories between decision makers. As such, the conveyance of stories to team members who are not co-located, and in support of distributed decision making, is an area of research that can help us understand how technology can integrate task relevant information with personal experience.

Narrative systems might also enable the construction of a broader narrative or “metanarrative” (Stephens, 1998). A metanarrative is an embedded narrative or theme that emerges from more obvious, or surface-level narratives. For example, Cormac McCarthy’s Pulitzer-prize winning novel *The Road* (2006) is, on the surface, a story about a man and his son and their journey to survive in a post-apocalyptic world. However, it also contains a metanarrative with a subtext of cautionary political policies, ecological awareness, and environmentalism. Metanarratives can be used to strengthen a team’s collective episodic memories and perhaps create a contextually richer and personally relevant team story. By “contextually rich” we mean that the story communicates more subtle nuances of the activity that often go unnoticed – nuances related to the emotional states of the individuals, the differing perspectives of leadership and non-leadership, and even some of the “noise” related to outside observations or thoughts not immediately

relevant to the exercise. Here, research can help us understand the degree to which a team metanarrative can scaffold general awareness of activities beyond a particular teammate's own isolated experiences. From this observation, an information manager can ask whether narrative in teams can help to produce a common cognitive ground. For example, can informational systems be developed to support collaborative intersubjectivity, that is, a "ground of shared understandings necessary for productive intellectual collaborations" (Smart, 1999)? Using simple narrative techniques like varying perspective from third-person to first-person accounts may yield useful information about conflicting goals and objectives. Of course, the information systems supporting narrative communication must be designed from the beginning with this perspective-shifting ability in mind.

As an example of the use of perspective in distributed teams, Fiore, Johnston & McDaniel (2005) describe how a narrative-based debriefing session can be constructed as a powerful informational tool for building team knowledge. Specifically, it is designed to take advantage of the script-like structure of team objectives and show how the narrative requirement for causal event representations overlays well with team interactions that rely on meeting specific objectives. They suggest that narrative may be a useful means to teach role-related team knowledge within distributed teams by manipulating the perspective through which a story is told during a debriefing session. For example, a third-person perspective provides a useful "birds-eye" view of the action while a first-person perspective can be used to solicit information regarding an individual's thoughts as he or she moves through the exercise. Seemingly, redundant information can therefore be very useful when examined through the lens of an alternate narrative perspective and may strengthen a team's shared mental model associated with their task and teammates.

### Narrative and the Affective

Our final series of research questions are framed in regards to the affective dimension of both narrative and teamwork. Abrahamson (1998), as discussed in Berg (2000), suggests that the narrative form is effective because it is both motivational and personal. Norman (1993) presents stories as being powerful precisely because of their affective dimension; whereas techniques in logic allow a listener/reader to formulate a "detached, global judgment" (p. 130), techniques in storytelling allow an author to include their personal point of view and to understand – and take advantage of – the affective influence that their story will have on others. Of key interest, here is the ability to generate empathy—just as a masterful storyteller can use fiction or film to persuade

an audience to identify and care about her protagonist, so can an organizational storyteller use narrative information systems to propagate empathy throughout a network. Humanizing oneself through the act of storytelling in this fashion imbues an information system with affect.

In attempting to leverage this emotional power, interdisciplinary collaborations between computer science and digital media practitioners have enabled recent investigation into the ways in which storytelling can be used to elicit emotional responses in simulated and mixed-reality environments (Stapleton & Hughes, 2003). This line of research explores the ways in which mixed media environments can be used to produce research blending story, entertainment, pedagogy, and simulation (Hughes, Kontinen, & Pattanaik, 2004; Stapleton, Hughes, Moshell, Micikevicius, & Altman, 2002; Stapleton & Hughes, 2005).

In contrast to the cognitive dimension of narrative, the affective nature of storytelling is given a good deal of attention in the literature. It is common to read about stories as tools for dealing with emotional pain, depression, or mental illness (e.g., Carter, 2004). What is less common, however, is literature that deals with the impact of affective data on individual and team performance in distributed team environments. Generally, we can ask whether the inclusion of experience at the affective level helps or hinders the development of teamwork. Within this context, we offer the following speculations for research (refer to Table 3).

First, it is important for the information systems manager to consider the difficulty of building trust in distributed teams (see Fiore et al., 2003). This is critical because trust has been directly related to elements of team coordination, such as cooperation. Trust facilitates teamwork by increasing help-seeking behaviors as well as the free exchange of information (Jones & George, 1998). First, we must ask whether the affective elements of story can be used and even exploited within collaborative information technologies so as to build trust within distributed teams or determine how much trust should be given to individual team members. Perusing through stories is one way to quickly become familiar with the decision-making capacity

**Table 3.** Candidate Research Questions Pertaining to Affective Elements of Distributed Teamwork

Q7. <i>Trust</i>	How can story-based collaboration systems improve trust decisions within distributed teams?
Q8. <i>Emotion</i>	How can emotionally evocative stories be used to develop more cohesive teams?
Q9. <i>Impersonal Versus Personal Stories</i>	How are impersonal and personal stories important to the development and evolution of distributed teams?

of an individual both inside and outside of the boundaries of an organization. Stories with affective subtexts provide an additional opportunity to consider the emotional maturity and capability of team members.

When interacting at a distance, collaborative information systems often encourage team members to work *efficiently* rather than *holistically* (e.g., team members are prompted to provide only task data through bullet points or short text rather than observations about the overall context of the experience). We can then ask this research question: would the conveyance of personal stories, even if only task related, be better able to support the building of trust within teams in such a way that the absence of co-located experience no longer matters, or is less important? Specifically, we ask whether sacrificing some informational efficiency so as to include added affective elements (e.g., a personal narrative describing an important aspect of the work related episode) might be worth the time if it adds trust in the longer term. This is in contrast to the definition of efficiency as a computer scientist might use this term, to describe an information transfer that is faster and takes up less space. We maintain that what is often seen as redundant information may in fact offer a rewarding look at affective information with meaning within the personal narrative of a team member or the metanarrative of the team. For instance, the surface-level narrative account might suggest that the team is very efficient, while an additional parsing of affective data could reveal an underlying sense of distrust and dissatisfaction as reflected in individualized team member accounts of an activity. We can think of this additional affective data gathering as a tradeoff between information speed and information completeness. When quick decisions must be made in real time or time-sensitive applications, it makes more sense to consider only the most salient parts of a team performance experience. Was the overall team objective met? Was each of the individual team member's objectives met? When a more languid pace is acceptable, the scenario can be assessed in more detail. Why did a particular team member not perform to expectation? What was he thinking about? What types of emotions was he experiencing? What was his own vision of how the events should unfold and what was his idea of how he should act in the scenario?

Our final research question considers the role of personal (i.e., non-work related) stories versus the role of impersonal (i.e., work-related) stories. Here we suggest that research is necessary to help us determine whether outside personal stories that capture the emotional and external experiences of team members are beneficial to team development. Related to this issue, research needs to determine if it is necessary to disentangle irrelevant affective information (noise, or signal-reducing information) from legitimate motivational information (signal-strengthening information) when using outside personal

stories to improve distributed teamwork. Although it would probably be possible for automated collaboration systems to filter out non-work-related stories using keyword filtering or other heuristic techniques, we need to first ask whether only work-related and impersonal stories are sufficiently memorable and interesting so as to be useful for improving teamwork. Consider that off-task communication has sometimes been considered inefficient, yet others suggest it creates the type of bond that is necessary for effective teamwork (see Kraut, Fish, Root, & Chalfonte, 1990). As such, would it also be necessary to include personally relevant, but non-work related, stories to build trust and/or cohesion in teams working over time and space?

## Conclusions

In this paper we began by arguing that distributed interaction hinders the development and evolution of teams by attenuating the interaction experience – a phenomenon we refer to as *team opacity* (Fiore et al., 2003). Our review of the literature on narrative leads us to suggest that the narrative form and its rich encapsulation of experiential information involves a host of social, cognitive, and affective processes that can be used to facilitate the transfer, comprehension, and retention of team-related information. This information can then be used by information managers to better improve both overall team performance or simply to gain a better understanding of the idiosyncrasies involved in individual team member activities. We have discussed the high-level elements of narrative and how they could be explored to convey team related information in such a way that team development is facilitated. In particular, “stories are important cognitive events, for they encapsulate, into one compact package, information, knowledge, context, and emotion” (Norman, 1993, p. 129).

Essentially, meaningful stories and the craft of storytelling are foundational to human interaction in that humans regularly engage in this activity – “constantly telling and re-telling stories about themselves and others. Humans are autobiographic agents, agents which are embodied and situated in a particular environment (including other agents), and which dynamically reconstruct their individual ‘history’ (autobiography) during their lifetimes” (Dautenhahn 1999, p. 63). Within this theoretical context the overarching question we have put forth is whether the narrative form can be utilized within collaborative information systems to scaffold the experience of interaction in distributed teams. To refine this central question, we have proposed nine narrative “how” questions anchored to the social, cognitive, and affective threads of distributed collaboration.

By developing collaborative technologies that allow information managers to assess social, cognitive, and emotional materials, teamwork will be better understood as an informational activity ripe with potential storage indices and layered units of meaning. Team metanarratives may be better able to capture the rich context (and subcontext) found in distributed work activities. Stories can capture both important and interesting intersections between the motivations and behaviors of teams – intersections that might otherwise have remained unexplained or unspoken. As Mateas and Sengers (1999) note, the narrative “can mean the internal imposition of coherence by which a person makes sense of her life, or the communally constructed group memory by means of which a group organizes past experience” (p. 8). As such, the story that is presented represents what should be the shared experience for a given team and/or team task across many varied situations. The stories can be a form of contextual glue that becomes the basis for an ensuing dialogue as teams evolve over space and time in information spaces mediated by both virtual and physical cues.

### Acknowledgements

Writing this chapter was supported by Grant N000140610118 from the Office of Naval Research awarded to S. M., Fiore, S. Burke, F. Jentsch, & E. Salas, University of Central Florida. The views, opinions, and findings contained in this article are the authors and should not be construed as official or as reflecting the views of the Department of Defense or the University of Central Florida.

### Author Bios

Stephen M. Fiore, Ph.D., is faculty with the University of Central Florida’s Cognitive Sciences Program in the Department of Philosophy and Director of the Cognitive Sciences Laboratory at UCF’s Institute for Simulation and Training. He earned his Ph.D. degree (2000) in Cognitive Psychology from the University of Pittsburgh, Learning Research and Development Center. He maintains a multidisciplinary research interest that incorporates aspects of cognitive, social, and organizational sciences in the investigation of learning and performance in individuals and teams. He is co-Editor of recent volumes on *cognition in teams* (2004) and on *distributed learning* (2007), *collaborative problem solving* (2008) as well as recent journal special issues on human learning and performance. Dr. Fiore has published in the area of learning, memory, and problem solving at the individual and the group level. As Principal Investigator, Co-Principal Investigator, or Senior

Personnel he has helped to secure and manage over \$14 Million in research funding from organizations such as the National Science Foundation, the Transportation Security Administration, the Office of Naval Research, and the Air Force Office of Scientific Research. He can be reached at [sfiore@ist.ucf.edu](mailto:sfiore@ist.ucf.edu).

Rudy McDaniel, Ph.D. is Assistant Professor of Digital Media at the University of Central Florida. His research interests include narrative theory, video game technologies, knowledge management frameworks, and XML. As a consultant, he has designed Web-based applications for clients such as the IEEE Society and the Library of Congress, and has written interactive video game scripts for the Federation of American Scientists. Rudy is currently director of the Partnership for Research on Storytelling Environments (PROSE) lab at UCF, and can be reached at [rudy@mail.ucf.edu](mailto:rudy@mail.ucf.edu) or through his Web site at <http://www.dm.ucf.edu/~rmdaniel>.

Florian Jentsch, Ph.D., is Associate Professor in the Department of Psychology at the University of Central Florida and director of the Team Performance Laboratory affiliated with the Institute for Simulation and Training. Dr. Jentsch received his Ph.D. in human factors psychology from the University of Central Florida in 1997. He also holds master’s degrees in aeronautical engineering from the Technical University of Berlin and in aeronautical science from Embry-Riddle Aeronautical University. His dissertation on training for junior commercial flight crewmembers won the American Psychological Association’s 1998 George E. Briggs Award for the best dissertation in applied/experimental psychology, and he was also awarded the American Psychological Association’s 2002 Earl Alluisi award for Early Career Achievement in applied/experimental psychology. Dr. Jentsch’s research interests are in team training, human-robot-interaction, aviation human factors, cross-cultural research, research methodology, and simulation where he has co-authored over 150 publications, presentations, and technical reports. He has received grants and contracts from NAWC-TSD, ARL, RDECOM-STTC, ARO, and PEO-STRI, the Federal Aviation Administration, and the Transportation Security Administration. He also has consulted on system and software development projects for the FAA, the U.S. Navy, U.S. Army, NIH, NSF, and NASA. He can be reached at [fjentsch@ist.ucf.edu](mailto:fjentsch@ist.ucf.edu).

### References

- Abrahamson, C. E. (1998). Storytelling as a pedagogical tool in higher education. *Education*, 18, 440.
- Aleksander, I. (2002). Understanding information, bit by bit: Shannon’s equations. In G. Farmelo (Ed.), *It must be beautiful: great equations of modern science*. (pp. 213–230). London: Granta Books.

- Avolio, B. J., Kahai, S., Dum Dum, R., & Sivasubramaniam, N. (2001). Virtual teams: Implications for e-leadership and team development. In M. London (Ed.), *How people evaluate others in organizations* (pp. 337–358). Mahwah, NJ: LEA.
- Bal, M. (1997). *Narratology: Introduction to the theory of narrative*. Toronto: University of Toronto Press.
- Bartlett, F. (1932). *Remembering*. Cambridge: Cambridge University Press.
- Berg, G. (2000). Cognitive development through narrative: Computer interface design for educational purposes. *Journal of Educational Multimedia and Hypermedia*, 9(1), 3–17.
- Bower, G. H. & Morrow, D. G. (1990). Mental models in narrative comprehension. *Science*, 247, 44–48.
- Bransford, J. D. & Franks, J. J. (1971). The abstraction of linguistic ideas. *Cognitive Psychology*, 2, 331–350.
- Bruner, J. (1991). The narrative construction of reality. *Critical Inquiry*, 18, 1–21.
- Carter, B. (2004). Pain narratives and narrative practitioners: a way of working 'in-relation' with children experiencing pain. *Journal of Nursing Management*, 12, 210–216.
- Dautenhahn, K. (1999). The lemur's tale - Story-telling in primates and other socially intelligent agents. In M. Mateas & P. Sengers, (Eds.), *Proc. Narrative Intelligence*, AAAI Fall Symposium 1999, AAAI Press, Technical Report FS-99-01 (59–66).
- Dautenhahn, K. (2003). Stories of lemurs and robots – The social origin of story-telling. In M. Mateas & P. Sengers, (Eds.), *Narrative Intelligence*. Amsterdam: Johns Benjamins Publishing Company.
- Denning, S. (2001). *The Springboard: How Storytelling Ignites Action in Knowledge-Era Organizations*. Boston: Butterworth Heinemann.
- Denning, S. (2004). *Squirrel Inc.* San Francisco: Jossey-Bass.
- Fiore, S. M., Cuevas, H. M., Schooler, J. & Salas, E. (2005). Understanding memory actions and memory failures in complex environments: Implications for distributed team performance. In C. A. Bowers, E. Salas, and F. Jentsch (Eds.) *Creating High-Tech Teams: Practical Guidance on Work Performance and Technology* (pp. 71–87). Washington, DC: American Psychological Association.
- Fiore, S. M., Jentsch, F., Becerra-Fernandez, I., Salas, E. & Finkelstein, N. (2005). Integrating field data with laboratory training research to improve the understanding of expert human-agent teamwork. In the *IEEE Proceedings of the 38th Hawaii International Conference System Sciences*. Los Alamitos, CA.
- Fiore, S. M., Metcalfe, D., & McDaniel, R. (2007). Theoretical Foundations of Experiential Learning. In M. Silberman (Ed.), *The Experiential Learning Handbook* (pp. 33–58): John Wiley & Sons.
- Fiore, S. M., Salas, E., Cuevas, H. M. & Bowers, C. A. (2003). Distributed coordination space: Toward a theory of distributed team process and performance. *Theoretical Issues in Ergonomic Science*, 4, 3–4, 340–363.
- Frisson, S., & Pickering, M. J. (1999). The processing of metonymy: Evidence from eye movements. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25, 1366–1383.
- Gagne, R. & Glaser, R. (1987). Foundations in Learning Research. In R. Gagne (Ed.) *Instructional Technology: Foundations*. Hillsdale, NJ: Erlbaum.
- Gargiulo, T.L. (2006). *Stories at Work: Using Stories to Improve Communication And Build Relationships*. Westport, CT: Praeger Publishers.
- Griffin, M. A., & Mathieu, J. E. (1997). Modeling organizational processes across hierarchical levels: Climate, leadership, and group process in work groups. *Journal of Organizational Behavior*, 18, 731–744.
- Hall, S. (2007). *This means this, this means that: A user's guide to semiotics*. London: Laurence King.
- Herman, D. (1997). Scripts, Sequences, and Stories: Elements of a Postclassical Narratology. *PMLA* 112, 1046–1059.
- Herman, D. (Ed.) (2003) *Narrative theory and the cognitive sciences*. Stanford, CA: Center for the Study of Language and Information.
- Hughes, C. E., Konttinen, J., & Pattanaik, S. N. (2004). The Future of Mixed Reality: Issues in Illumination and Shadows. *Proceedings of the 2004 terservice/Industry Training, Simulation, and Education Conference (I/ITSEC)*, Orlando, Florida.
- Jones, G. R. & George, J. M. (1998). The experience and evolution of trust: Implications for cooperation and teamwork. *Academy of Management Review*, 23, 531–546.
- Kock, N. & Nosek, J. (2005). Expanding the Boundaries of E-Collaboration. *IEEE Transactions on Professional Communication (Special Issue on Expanding the Boundaries of E-Collaboration)*, 48, 1, 1–9.
- Klein, G. (1998). *Sources of Power: How People Make Decisions*. Boston, MIT Press.
- Kraut, R. E., Fish, R.S., Root, R.W., & Chalfonte, B.L. (1990). Informal communication in organizations: Form, function, and technology. In S. Oskamp & S. Spacapan (Eds.), *Human Reactions to Technology: The Claremont Symposium on Applied Social Psychology* (pp. 145–199). Beverly Hills, CA: Sage Publications.
- Mandler, J. (1984). *Stories, Scripts, and Scenes: Aspects of Schema Theory*. Hillsdale, NJ: Erlbaum.
- Mateas, M. & Sengers, P. (1999). Narrative Intelligence. In M. Mateas & P. Sengers (Eds.) *AAAI Fall Symposium on Narrative Intelligence*.
- McCarthy, C. (2006). *The Road*. New York: Alfred A. Knopf.
- McDaniel, R. (2004). A Software-Based Knowledge Management System using Narrative Texts. Unpublished doctoral dissertation. University of Central Florida, Orlando, FL.
- Nelson, K. (2003). Self and social functions: Individual autobiographical memory and collective narrative. *Memory*, 11, 125–136.
- Norman, D. (1993). *Things that Make Us Smart: Defending Human Attributes in the Age of the Machine*. New York: Addison-Wesley.
- Papafragou, A. (1996). On metonymy. *Lingua*, 99, 169–195.
- Rumelhart, D.E. (1980). Schemata: The building blocks of cognition. In R. J. Spiro, B. Bruce, & W. F. Brewer (Eds.), *Theoretical Issues in Reading and Comprehension*. Hillsdale, NJ: Erlbaum.
- Salas, E., Dickinson, T., Converse, S., & Tannenbaum, S. (1992). Toward and understanding of team performance. In R. Swezey & E. Salas (Eds.), *Teams: Their training performance* (pp. 3–29). Norwood, NJ: Ablex.
- Schank, R.C., & Abelson, R.P. (1977). *Scripts, plans, goals, and understanding: An inquiry into human knowledge structures*. Hillsdale, NJ: Lawrence Erlbaum.
- Snowden, D. (1999). Three Metaphors, two stories and a picture - how to build common understanding in Knowledge Management Programmes. *Knowledge Management Review*. Melcrum Publishing. March/April.
- Snowden, D. (2004). Narrative patterns: The perils and possibilities of using story in organizations. In E. Lesser & L. Prusak (Eds.), *Creating Value With Knowledge* (pp. 201–216). New York: Oxford UP.
- Stapleton, C. B., & Hughes, C. E. (2003). Interactive Imagination: Tapping the Emotions through Interactive Story for Compelling Simulations. *IEEE Computer Graphics and Applications*, 24, 5, 11–15.

- Stapleton, C.B. & Hughes, C.E. (2005). Mixed Reality and Experiential Movie Trailers: Combining Emotions and Immersion to Innovate Entertainment Marketing. *Proceedings of SCS 2005 International Conference on Human-Computer Interface Advances for Modeling and Simulating (SIMCHI '05)*, 40-48.
- Stapleton, C. B., Hughes, C. E., Moshell, J. M., Micikevicius, P. & Altman, M. (2002). Applying Mixed Reality to Entertainment. *IEEE Computer*, 35, 12, 122-124.
- Stephens, J. (1998). *Retelling stories, framing culture: traditional story and metanarratives in children's literature*. London: Routledge.
- Sproull, L. & Kiesler, S. (1986) Reducing social context cues: Electronic mail in organizational communication. *Management Science*, 32, 11, 1492-1512.
- Sugiyama, S. M. (2001). Narrative theory and function: Why evolution matters. *Philosophy and Literature*, 25, 233-250.
- Swap, W., Leonard, D., Shields, M., & Abrams, L. (2004). Using mentoring and storytelling to transfer knowledge in the workplace. In E. Lesser & L. Prusak (Eds.), *Creating Value With Knowledge* (pp. 181-200). New York: Oxford UP.
- Trabasso, T., & Sperry, L.L. (1985). Causal relatedness and importance of story events. *Journal of Memory and Language*, 24, 595-611.
- Tulving, E. (1985). How many memory systems are there? *American Psychologist*, 40, 385-398.
- Tulving, E. (1998). Neurocognitive processes of human memory. In C. von Euler, I. Lundberg, & R. Llinas (Eds.), *Basic mechanisms in cognition and language* (pp. 261-281). Amsterdam: Elsevier.
- White, M. (1995) The narrative perspective in therapy. *The Family Journal*, 2, 71-83.
- Whitney, K. (1994). Improving group task performance: The role of group goals and group efficacy. *Human Performance*, 7, 55-78.

Copyright of *Information Systems Management* is the property of Taylor & Francis Ltd and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.