APPLYING THE NARRATIVE FORM AND XML METADATA TO DEBRIEFING SIMULATION-BASED EXERCISES

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We suggest that narrative techniques can be used in conjunction with debriefing tools to aid in the framing of complex distributed team activities. We suggest that modified narrator perspectives (points of view) can be useful in debriefs for individuals and teams to improve interpositional knowledge (IPK) on a post-process level, and can be used in place of, or in conjunction with, more traditional types of pre-task training which occur through techniques such as cross-training. We conclude with an example framework for modified narrative perspective debriefing that is created using the eXtensible Markup Language.

In this paper we argue that principles derived from narrative theory are an effective means for structuring the debriefing of complex training events. We discuss narrative in the context of distributed training and how its tenets can support a science of debriefing. We discuss narrative as it relates to debriefing distributed simulation-based exercises, the means through which teams of teams in the military practice complex tactics serving some strategic goal.

This paper represents a continuation of prior work that builds upon theory and data from differing disciplines to propose techniques and/or technologies that may aid in the conceptualization of improved means of information conveyance in debriefing distributed training environments. Specifically, Fiore, Johnston, and Van Duyne (2004) presented the notion of a *training space* to illustrate how events within this space can be integrated to facilitate the learner's attempts to experientially and cognitively link training concepts. These ideas were built upon the work of Fiore, Salas, Cuevas, and Bowers (2003) who argued that, to understand distributed team process and performance, interaction must be recognized as occurring over both time *and* space. These three time frames, broken down into, *pre-*, *in-*, and *post-process* factors need to be systematically integrated to facilitate actual team coordination. For example, pre- and post-process coordination encompasses how team members plan for and ruminate on their actual task interaction (i.e., in-process coordination).

Following this work, Fiore and colleagues additionally considered how the sequentiality inherent in distributed simulation based exercises can be leveraged (Fiore, Johnston, & McDaniel, in press). Using the principles developed in narratology Fiore et al. (in press) discussed the use of narrative as a learning tool and outlined how the primary features of narrative (Bruner, 1991) can be utilized for debriefing distributed simulation based exercises. Specifically, they described how narrative and story can be used to describe simulation-based exercises in sequence. They argued that it is the unfolding of events in the simulation, and the interaction of actors within the mission, that creates the story to be conveyed in a debrief. Further, they described how the features of narrative seamlessly blend with object-oriented programming methods and can be used to structure debriefing events. Here we add to our theorizing by describing how presenting performance information via differing perspectives represents a unique way to potentially build interpositional knowledge.

BUILDING INTERPOSITIONAL KNOWLEDGE THROUGH CROSS-TRAINING

Interpositional knowledge (IPK) is knowledge that has been broadened from an individual to a group context. IPK thus encompasses both an individual's knowledge about mission objectives as well as additional knowledge about the teammates that are helping that individual work towards a common goal. Arising out of research in the Navy's Tactical Decision Making Under Stress program, and the notion of shared cognition in complex team environments (see Cannon-Bowers & Salas, 1998), IPK can be viewed as a specific form of shared mental model. This type of knowledge may include specific details about the external factors or motivating forces compelling a team member to act in a certain fashion. Interpositional knowledge, thus, is a specific form of shared mental model that has been shown to be related to team performance (e.g., Marks, Sabella, Burke, & Zaccaro, 2002; Volpe, Cannon–Bowers, Salas, & Spector, 1996). A lack of IPK has been attributed to diminished coordination skills on team task activities, a reduction in team interaction, and poor overall communication effectiveness (e.g., Volpe et al., 1996).

In order to build this type of knowledge, researchers have examined how cross-training methods are able to encourage the acquisition of IPK. Volpe et al. (1996) explain the concept of cross-training as a training methodology in which team members are trained to understand not only their individual goals and duties, but also the goals and duties of other team members within their unit. With cross-training, the objective is to enable team members to develop an understanding of the tasks, duties, and responsibilities of co-workers. In this way they are better able to understand roles and build shared expectations as to particular task related responses (e.g., Cooke, Kiekel, & Helm, 2001). Essentially, overlap in the knowledge, skills, and attitudes foundational to a given team task are argued to be critical to coordinated performance.

As a tool for increasing interpositional knowledge, cross-training has shown to be effective in simulation environments in which complex activities require individual yet cooperative actions to be performed in order to meet team goals (Volpe et al., 1996). An additional form of cross-training that has been shown to be effective is positional rotation (Cannon-Bowers, Salas, Blickensderfer, & Bowers, 1998). "Positional rotation enables greater development of interpositional knowledge, which helps to enhance team functioning in difficult environments that require implicit coordination strategies" (p. 360, Hollenbeck, DeRue, & Guzzo, 2004).

In sum, cross-training aids teams to obtain a better understanding of team function. Thus, rather than simply concentrating on their own tasks and not connecting that task to higher order team performance, they develop a fuller understanding of team roles, possibly facilitating coordination.

BUILDING INTERPOSITIONAL KNOWLEDGE THROUGH NARRATIVE-BASED DEBRIEFING

As discussed, traditional cross-training techniques can be critical in enhancing IPK. After team objectives have been completed, however, there remains an additional opportunity for building IPK through debriefing, which we refer to as *post-process* cross-training. Following Fiore et al. (2003), *post-process* describes any form of team related interaction where discussion or rumination on prior task performance occurs. In the present context, after-action reviews and/or debriefings represent a form of post-process coordination in which we suggest a unique form of cross-training can occur.

Within this theorizing, we construct a model of post-process information management used for achieving IPK building through a narratological debriefing scenario using modifiable points of view. Whereas more traditional cross-training functions by creating anticipation and prompting adjustment during on-task activities, the debriefing session is more effective in terms of post-process comprehension and behavior adjustment for use in future tasks.

Any type of debriefing in which a participant is informed about the roles, responsibilities, and limitations of their teammates will aid building IPK. We suggest, though, that a narrative debriefing session is particularly useful for building and sustaining IPK. In particular, narrative is well-suited for debriefing because of its intuitive and script-like structure, its requirement for causal event representations, and its affective dimension, all of which are necessary characteristics for a framework that is used to understand and report human experience.

We next briefly discuss the salient features of narrative, and present a potential model for cross-training using narratives in debriefing. We reveal how using a metadata support system allows one to modify the degree of external information (e.g. the motivating forces behind teammates' actions) one has access to, thereby varying the amount of cross-training performed in a given debriefing session.

Using Narrative to Represent Experience

Much research has chronicled the tendency of humans to follow script-like or schematic structures (e.g., Bartlett, 1932; Bower & Morrow, 1990; Bransford & Franks, 1971; Schank & Abelson, 1977; Rumelhart, 1980; Mandler, 1984; Trabasso & Sperry, 1985). The narrative form is enticing for those researchers seeking to frame human experience precisely because it is so programmatic and script-like in structure. For instance, stories have a beginning, middle, and end, much like an event a team member would be asked to tell about during a debriefing session. This event might be an activity that represents a slight deviation from the assigned objective, a normal task completed on the way to the overall objective, or any other event of substance which occurs during a mission.

In addition to its flexibility as a scripting tool, narrative also allows an author to easily express event causality. In describing these cause and effect relationships, there is a clear delineation of events separating one experience from another. It is possible to represent this event sequence with a series of individual event nodes in a debriefing session – for example, before the event happened I was doing [event A], while it happened I did [events B through F], and after it happened, I did [event G]. Much like the experience itself, then, the act of narration involves traversing through these series of events in a fashion best suited for the telling of the story.

The affective nature of storytelling can also be useful for debriefing purposes. For example, narratives have shown to be more influential that pure statistical data on the affective reactions of participants. In one study, Kopfman, Smith, Yun, and Hodges (1998) presented ninety undergraduate participants with two messages about organ donation, one in narrative form and one presented as statistical evidence. They found that the cognitive reactions of the participants were more influenced by the statistical evidence while the affective reactions were more influenced by the narrative messages. Further, research coming out of organizational psychology suggests that emotional aspects of feedback may lead to improved performance (O'Leary-Kelly, 1998) and emotional response has been linked to learning in skill acquisition studies (Koepp et al., 1998).

By allowing team members to incorporate this emotional material, stories may be better able to capture the emotional context of high-stress activities. Stories have the potential to capture interesting implications or intersections between motivations and behaviors that might otherwise have remained unexplained or unspoken during a debriefing session.

Narrative and "Point of View"

The narrative form is a deceptively complex means of information conveyance. We are all familiar with narrative and story and the storytelling or listening experience. Nonetheless, the explicit characteristics of narrative and components of storytelling are unfamiliar to those outside narratology. Within the field of narratology, a number of researchers have described what makes up the building blocks of narrative. Bal (1997) describes the task of creating a story

as consisting of a series of six ordered steps: arranging the events into a sequence, allocating time to describe each event, characterizing actors, describing locations, adding additional relationships (e.g. symbolic or allusive), and choosing a point of view with which to describe these story elements and the relationship between them. The last step, selecting the point of view or perspective of the story, is the one we concentrate on for the purpose of this debriefing model. As Bal explains, this step provides the focalization of the story, and reveals the relation between the entity doing the perceiving (the narrator) and the entities being perceived (characters and environments). It is this last step we focus on for the remainder of this paper.

In terms of available points of view for a narrator to use, there are three options: first person, second person, or third person. In addition to these primary distinctions, the third person view is also describable by three sub classifications: third person omniscient, third person objective, and third person limited. Each of these various points of view provides a different type of focalization for a particular story. Table 1 provides an illustration of each of the differing possible perspectives an author is able to take within the narrative form.

First person point of view is told from the perspective of a single person who is recounting the events of a story to an audience. This point of view is characterized by the use of "I," as shown in Table 1. This perspective provides a stronger connection with an audience in that empathy is generated as the character explains what they are experiencing. These experiences are revealed through their personal thoughts and dialogue with other agents. The "I" referred to in the story does not have to be the primary character in the story; this entity may instead be a witness to certain events. Alternatively, they may be otherwise privy to information that has occurred previously and that they are now re-telling. In fiction, the first person point of view may be complicated by introducing private thoughts of other characters into narratives, in order to further develop or expand the story for its readers (Nielsen, 2004).

The second person point of view, which is rarely used, replaces the use of "I" with the use of "You." In this scenario, the narrator is speaking to the central character of the story directly. While difficult to execute (i.e., it is often hard for the reader to understand that the author is not talking directly to him or her) the second person perspective might have some interesting implications for narrative debriefing. For example, if two team members were asked to provide statements of their interpretation of one another's actions, this perspective would provide a natural way for them to dictate these events.

Third person points of view are characterized by stories in which the narrator is not a character. In these types of stories, characters are identified throughout by their names or by third person personal pronouns (he, she, they, etc.). This type of point of view is further classified into the third person omniscient point of view, in which the narrator of the story knows all thoughts and feelings of the characters, the third person objective point of view, in which the narrator can only explain verbalized dialogue or observed behaviors, and the third person limited point of view, in which the narrator can only access a single character's thoughts and emotions.

Table 1. **Narrative Points of View**

Point of View	Example Narrative Excerpt
First person	*I was standing on the flight deck when I noticed the sailor limping towards me.*
Second person	*You were standing at watch when you noticed the sailor limping across the deck.*
Third person omniscient	*John was standing at watch and thinking about how nice it would be to get some sleep when he noticed the sailor limping across the deck. He wondered what had happened to his crewmate. The sailor was in fact only pretending to be injured. And he was confident that he was going to get away with it.*
Third person objective	*John was standing at watch with heavy lidded eyes when he noticed the sailor limping across the deck. The limp seemed somewhat awkward and forced, and John suddenly snapped to attention. His eyes then narrowed as he studied this new development.*
Third person limited	*John was standing at watch and thinking about how nice it would be to get some sleep when he noticed the limping sailor. He wondered what seemed strange about the man. He finally realized that the limping seemed forced and unnatural, and that the man appeared to be faking his injury. John grew suspicious.*

In terms of the points of view most useful to debriefings, we speculate that a combination of "first person" and "third person objective" perspectives would be best for building IPK. As shown in Table 1, it is possible for a descriptive narrator using the third person objective point of view to convey the same amount of information as would be present in third person omniscient. Furthermore, in debriefings, the individual thoughts of team members would be accessible through the first person narratives of those individuals and would therefore not need to be known by the third person narrator. We turn next to a discussion of how the computational sciences can be used to enable the development of automated systems for constructing narrative based debriefings.

eXtensible Markup Language

Producing multiple perspective debriefs is possible using metadata classification systems that wrap semantically meaningful tags around segments of debriefing data. The eXtensible Markup Language (XML) contains a markup syntax devised to meet the needs of high powered applications that place complex demands on information sources. XML has been established as a powerful tool for use in office applications (Aitken, 2004), databases (Appelquist, 2002), and both general Internet and custom data applications (Goldfarb, 2002; Musciano & Kennedy, 2000; Ray, 2001). Because of its flexible nature, it is possible to create custom tags based on the needs of a particular debriefing task. In order to make this process more effective, however, one could devise a common library of narrative tags to be used with debriefing. These might include descriptors for the debriefing, the team members' names, the involved team(s), and perhaps a descriptor for the perspective used during the debriefing. A

sample set of XML tags is shown later in this paper in Table 2.

As a markup technology, XML is not limited to describing textual data. This language can be used to provide supplemental archival or retrieval information for still images, video, audio, or any type of electronic file that is associated with debriefing events. Importantly, because of its cooperation with most Internet browsers, the language can also be used to support an Internet browsing system for accessing and retrieving post-task data from multiple perspectives. This might be done in order to build IPK and relay critical debriefing information through refresher training. For example, before the next training or operational event occurs, a team can remotely access all or portions of the debrief to be reminded of past performance. Thus, XML is suitable for both describing debriefing materials that have already been collected as well as for searching and browsing debriefing materials that need to be repurposed for future operations.

Example of a Narrative Debriefing

Table 2 presents an example of a debriefing session that has been encoded using XML. This type of file would be used to represent debriefing data collected from a five person team working on a simulated task. In this scenario, multiple points of view are represented, often for the same event, using tags that indicate these differing perspectives. This document, which would be stored as information in a text or database file, contains descriptive data related to the post-task debriefing. At the highest level in the XML tag hierarchy, a <debrief_session> tag is used to indicate the beginning of a debriefing session. Within this parent framework, there are three events which are nested within the <debrief_session> tag and that are therefore related to that particular debriefing session. The number of nested events here is arbitrary; there might be zero or hundreds of events present for a particular session, depending on the complexity of a team assignment.

Within the larger <debrief_session> unit resides several <debrief_event> tags, each representing a particular event relevant to that debriefing. In this scenario, each debrief event contains the following informational tags: (1) An *id tag* with which to identify the event and differentiate it from others in the same debriefing session; (2) A *name tag* to provide a more meaningful descriptor for the event; (3) A *perspective tag* to indicate the particular point of view used to tell the story related to that event; (4) A *narrator tag* to allow the debriefing administrator to specify the person telling the story (if told in first person perspective) or to specify themselves as the author (if told in the third person perspective); (5) A *unit id tag* to reveal the team involved in the task; and, (6) A *format tag* to characterize the medium used to capture this debriefing information and to outline any technologies that might be needed in order to access that information.

The purpose of this metadata is to provide additional options for working with gathered debriefing data. Aside from merely collecting mission-relevant information in a structured format, the XML tags allow this data to be repurposed as a training tool for team members. For instance, after a particular team task has been performed, a collection of first person perspective debriefings might be used to show a team member how his or her teammates were interpreting the mission.

Furthermore, structuring these first person debriefings into a narrative format is expected to make them more accessible and transferable as units of interpositional knowledge. By constructing similar stories based on the same team event, these units retain relevance while also slightly modifying the overall team script into individually constructed stories. These can then include emotional content that helps a team member realize the external forces and motivations that may have caused that person to behave in an unanticipated fashion.

With these XML tags in place, it becomes possible to vary the amount of information a team member has about the operation of his or her team during the debriefing phase. In addition to the standard purpose of obtaining information related to a particular mission, a debriefing session could also be used to perform post-process cross-training by simply allowing a team member access to the stories told by their teammates in a first person point of view. To further reinforce any gain in interpositional knowledge, the third person point of view story as told from a higher vantage point would serve to illustrate how a slight deviation by a single team member might disrupt the pattern of the entire team.

In terms of the particular debriefing events contained in each <debrief_event> wrapper, these events would be contained in a video file in which a videotaped deposition allows the team member being debriefed (in the first person scenarios) or the mission commander (in the third person scenario) to explain what happened during the mission.

Table 2: Sample XML Debriefing File

```
<?xml version="1.0" encoding="ISO-8859-1"?>

<debrief_session>
<id>212</id>
<title>Debriefing Event 212: Reconnaissance</title>
<debrief_event>
<id>A</id>
<name>First person debrief 1 (Team Member A)</name>
<perspective>First person</perspective>
<narrator>Team Member 1</narrator>
<unit_id>Alpha Team</unit_id>
<format>Video</format>
</debrief event>
…
<debrief_event>
<id>E</id>
<name>First person debrief 5 (Team Member E)</name>
<perspective>First person</perspective>
<narrator>Team Member 5</narrator>
<unit_id>Alpha Team</unit_id>
<format>Video</format>
</debrief event>

<debrief_event>
<id>F</id>
<name>Third person debrief</name>
<perspective>Third person</perspective>
<narrator>Mission commander</narrator>
<unit_id>Alpha Team</unit_id>
<format>Video</format>
</debrief event>

</debrief_session>
```

LIMITATIONS

While this paper suggests some practical means for incorporating narrative into debriefing and for adjusting the points of views of these narratives to control for post-process cross training, there is still the need for empirical validation to establish the feasibility and effectiveness of such a methodology. While it has been established that narrative can be very helpful in certain environments (see, for example, Guterman & Rudes, 2005), the implications of using narrative with simulated team debriefings remain unexplored. We have suggested one such strategy for creating a narrative debriefing environment; this scenario now needs to be tested in an experimental setting.

The problems associated with this technique also need to be explored further. For instance, it is naïve to assume that teams will possess a native ability for storytelling and creating cohesive story structures; a firm script might be required to guide the team members during their respective debriefings. There also needs to be some algorithm in place for editing or removing needless or unnecessary information. The selection of such material is a problem itself, for it is often difficult to determine what parts of a story do in fact contribute needless or irrelevant information to the narrative. As such, narrative debriefs will need to be explored in conjunction with other techniques devised to structure or populate the debrief session.

CONCLUSIONS

As discussed at the beginning of this paper, this theorizing is a continuation of prior work building upon theory from differing disciplines to aid in our understanding of training in distributed environments. The training space conceptualization, developed by Fiore et al. (2003) illustrated how critical learning events should be integrated to enable the linking of training concepts. Via the incorporation of memory theory into techniques to diagnose and debrief performance, Fiore et al. (2004) built upon this approach and argued that memory hierarchies enable the development of principled methods for feedback presentation. Following this, Fiore et al. (in press) argued that it is the unfolding of events in distributed simulation and the interaction of actors within the mission that creates the story that needs to be conveyed in a debrief.

In this paper we have augmented this theorizing by showing how perspective, combined with XML, can create a system capable of extracting parts of a story in order to contextualize experiences as shown through a certain perspective. We illustrated how this technique might be accomplished in order to facilitate post-process cross-training for debriefing. Furthermore, we have suggested that a common library of XML tags combined with a narrative debriefing methodology can create a powerful framework for simulated team training on a post-task level. As for the practicality and real-world functionality of such a system, this remains to be established through empirical research.

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