Fiore, S. M., Metcalf, D., & McDaniel, R. (2007). Simulating Narrative: On the Application of Narrative Theory for Experiential Learning. In M. Silberman (Ed.), *The Handbook of Experiential Learning* (pp. 33 - 58). San Francisco: Pfeiffer.

THEORETICAL FOUNDATIONS OF EXPERIENTIAL LEARNING

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IN THIS CHAPTER, we will discuss how theory and methods from cognitive and simulation sciences can be integrated with principles of narrative theory in order to produce powerful experiential learning systems. By grounding these ideas within Kolb's experiential learning cycle (Kolb, 1984), we suggest that the principled and creative use of story within simulation can scaffold thinking, thus supporting both reflective observation and abstract conceptualization. Second, we suggest that well-designed simulations that encourage active experimentation and supply concrete experience support the "doing" that is foundational to the experiential learning process.

In this chapter, we first describe a set of the core elements of experiential learning, specifically focusing on learning and transfer and the importance of context and environment to this task. We then discuss narrative theory, also from a theoretical perspective, in order to illustrate how elements of narrative can be implemented into a simulated environment. Next, we reveal how a theoretically sound integration of these factors within experiential learning supports the affective, behavioral, and cognitive elements of experience. Finally, we describe what we see as relevant examples from industry and academia. These examples illustrate how the principled and informed use of narrative, linked with simulation, has the potential to produce powerful learning outcomes.

Learning and Transfer

In this section, we discuss some of the cognitive underpinnings of the experiential learning (EL) cycle. Following Kolb (1984), we define learning as "the process whereby knowledge is created through the transformation of experience" with knowledge resulting from "the combination of grasping and transforming experience" (p. 41). We describe here some of the fundamental cognitive processes necessary for the design and delivery of simulation and training tools that support experiential learning. Our main point is that context is inextricably linked with the notion of learning and transfer.

Context and Cognition

Context has as its Latin root, *contextus*, "a joining together," which, in turn, was derived from *contexere*, "to weave together," with *com* meaning "together" and *texere*, "to weave." What must be recognized is that a particular context helps us to weave together our understanding of events in order to form a mental model of the world with which we are interacting at any given moment in time. This definition is presented not as an academic exercise, but rather to support the argument that contextual elements represent a critical factor for understanding human learning.

In particular, the definition of context illustrates why researchers must attend to context in respect to the design and/or methods developed and used for learning. Over the years, there have been a number of theoretical and methodological ideologies that have come forth in debates concerning the understanding of how context influences and interacts with learning.

The psychological sciences have a long history of producing competing methods and theories for understanding the complex phenomena associated with human learning. These can be generally classified into one of two primary approaches. On the one hand is *in vitro* research, which describes laboratory approaches that rely on tasks that can repeatedly reproduce some set of standardized conditions. On the other hand is *in vivo* research, where behavior is investigated in natural contexts in order to understand how dynamic and contextual factors influence and/or determine performance. This latter argument emerged primarily from ecological psychology (e.g., Gibson, 1966), with some researchers suggesting its roots can be traced back to Bartlett (1932) and even Dewey (1902). Nonetheless, ecological psychology is most closely associated with the writings of J.J. Gibson, who argued that human behavior must be understood in its relation to the environment and noted how significantly our environment affects our cognition. Some academics within ecological psychology use the term "radically situated" when referring to this aspect of mental behavior (e.g., Barker, 1968). Essentially, Gibson viewed humans as being inextricably linked with a larger system (the environment), and he argued that in order to adequately understand humans within this system, the environment must always be part of the analysis.

More specifically, and from a methodological perspective, Hoffman and Deffenbacher (1993) described how these ecological factors must be an essential part of psychological research if we are to truly understand humans in context. They argued that both theoretical and practical gains can be realized by simultaneously considering both ecological *and* epistemological factors associated with human learning and behavior. They described such research in human behavior in terms of *epistemological relevance* and *ecological salience*. Epistemological relevance pertains to the degree to which the experimental approach relies on concepts from existing theories, and ecological salience describes the degree to which the materials or tasks of study pertain to what is actually perceived or done in the context in which the cognition is occurring.

These debates led to the creation of fairly intense theoretical views on human behavior, one of which was the *situated cognition* approach to human behavior. For example, when writing about cognition and learning, Clancey (1991) argues the following:

Indeed, situated cognition leads us to reject both the idea that human memory consists of stored representations (i.e., descriptions of how behavior or the world appear to an observer over time) and the idea that reality has objective

properties (Lakoff, 1987; Tyler, 1978). There is no correspondence between mental processes and the world because both our habits and what we claim to be true arise dialectically, by the interaction of mental processes and the environment. Concepts are not pre-defined feature lists stored like things in my head. I regenerate and reconstruct such representations in my acts of speaking, writing, drawing. (p. 110)

The latest incarnation of this view, found in a theory known as *embodied cognition*, dissolves any boundaries between cognition and the environmental context. From philosophy to neuroscience, the integration of embodiment and cognition is becoming increasingly recognized as a foundational issue that needs to be considered in its entirety. This notion states that:

... bodiness is a combination of a physical structure (to the biological body) and an experiential structure, which corresponds to the living, moving, suffering, and enjoying body. From here we arrive at the dual acception of embodied cognition, which refers, on one hand, to the grounding of cognitive processes in the brain's neuroanatomical substratum, and on the other, to the derivation of cognitive processes from the organism's sensorimotor experiences." (Garbarini & Adenzato, 2004, p. 101)

What appears to be essential in these arguments is the concept of context and the claim that cognition and learning are inextricably linked to context. With this assertion in mind, we turn next to a theory of learning and transfer that empirically supports the important role that contextual processes play in cognition. We then discuss how the generalizability of this theory fits well with the complexities of modern workplaces.

Context and Transfer

The acquisition of knowledge and skills for today's complex workplace cuts across cognitive processes, ranging from perception and memory to category learning, problem solving, and decision making. Given the complexity and variety of these task environments, we briefly review a theoretical approach to learning that has evolved over the last quarter of the 20th century in order to encompass a wide range of cognition. In particular, transfer appropriate processing (TAP) can be used to support an understanding of experiential learning within a variety of different domains. This theory draws from over twenty years of research in cognitive psychology (e.g., Adams, Kasserman, Perfetto, Bransford, & Franks, 1988; Morris, Bransford, & Franks, 1977; Needham & Begg, 1991; Perfetto, Bransford, & Franks, 1983).

In its initial incarnation, TAP was used to argue against principles of levels-of-processing theory (Craik & Lockhart, 1972) and the supposed encoding strength of deeper processing (Morris, Bransford, & Franks, 1977). Some had argued that, rather than the depth of processing, "It is the qualitative nature of the task, the kind of operations carried out on the items that determines retention" (Craik & Tulving, 1975, p. 290). Original investigations of this theory focused on recognition and recall, but it has been greatly expanded on in order to account for dissociations in the types of implicit and explicit memory tasks used in response to verbal and pictorial stimuli (e.g., Roediger & Blaxton; 1987; Roediger, Weldon, & Challis 1989). More recently, the TAP theory has been used to disentangle prospective memory success/failure by focusing on the relation between the intent to perform and the task itself in which the memory requirement is embedded (Marsh, Hicks, & Hancock, 2000). Thus, TAP has been effectively used to help us understand recognition and recall memory, implicit and explicit memory tests, and prospective memory—all by exploring how a variety of contextual factors influence cognitive processing.

Transfer appropriate processing theory has additionally encompassed more complex cognitive processes. For example, within problem-solving research, TAP theory supports the notion that initial strategies influence later problem solving and that the matching of strategies during learning and test facilitates overall problem-solving effectiveness. This research has been conducted on everything from simple puzzle tasks (Adams, Kasserman, Yearwood, Perfetto, Bransford, & Franks, 1988) to more complex tasks such as learning graphics software (Caplan & Schooler, 1990). Finally, studies in using problem-based learning to train clinical reasoning for medical students have been developing a theoretical accounting of the learning process using TAP (Hmelo, 1998). More recently, TAP theory was used to account for varieties of findings in category learning Markman and Ross (2003) suggest that "category acquisition occurs in the course of using categories for different functions. The particular information that is acquired about a category member in the context of carrying out a particular task depends on the information that is required to carry out that task successfully" (pp. 609–610). As such, TAP theory has helped researchers in more complex areas of cognition to understand how context across learning and later retrieval impacts process and performance.

Theoretical Issues of Context, TAP, and Simulations for Training

From the perspective of understanding experiential learning, what is important to recognize with TAP theory is that synchronization between processes engaged during the time of learning or acquisition of a given material and the eventual use of

that material is crucial for performance across a surprising number of tasks (Roediger, Gallo, & Geraci, 2002). Contextual factors, therefore, are critical to learning and retention over and above what is typically described in the learning literature. More specifically, TAP is most cogent with respect to experiential learning in that TAP theory has consistently identified that *"recapitulating specific encoding and retrieval operations enhances performance"* (p. 325). This notion is critical to experiential learning, given that the study of learning can so often be contextually bound, yet examples of linkings between TAP theory and experiential learning have been rare.

Another important issue related to contextual learning is that the simulation and training literature does not speak about context as a disparate unit. Instead, it often refers to notions of *fidelity* in research paradigms and notes how certain components of the learning environment must match the actual environment being trained. Nonetheless, a substantial body of research suggests that only certain components of the simulation need to be faithful to the operational setting. Simulation researchers note that the use of simulations with high physical fidelity had little if any impact on the actual operational job tasks (Taylor, Lintern, Hulin, et al., 1999).

Similarly, research has successfully used low fidelity PC-based simulations to train complex individual and teamwork skills (Gopher, Weil, & Bareket, 1994; Jentsch & Bowers, 1998; Taylor, Lintern, Hulin, et al., 1999). The general guidance from research in simulations is that fidelity needs to be determined by the task's behavioral and cognitive requirements such that they can support an appropriate learning environment (Salas & Burke, 2002). Thus, the concept of fidelity is similar to what we have suggested regarding context. Importantly, the research on fidelity suggests that it is the mental process to which we must be faithful, not necessarily the physical environment. Thus, ecological validity can be construed as a form of task-relevant fidelity to a cognitive process or to a particular content. In particular, *cognitive* fidelity is the term used to describe a requirement for the learning environment to faithfully reproduce the mental processes necessary for a given task (see Durlach, & Mavor, 1995; Entin, Serfaty, Elliott, & Schiflett, 2001).

In this section, we showed how context, transfer, and fidelity provide a firm foundation for an overall epistemology in experiential learning. We submit that the strong foundation of research in transfer appropriate processing is a cogent means with which to support experiential learning. In particular, TAP theory can help to address the lack of true integration of the simulation and experiential learning research communities and the equivocal nature of the findings with respect to the differing importance of physical, task, and cognitive fidelity across a variety of experiential learning studies. Specifically, TAP theory can help us to understand what aspects of fidelity are important to promote learning and transfer. To this end, the practicing community must consider how the conditions at acquisition of the knowledge match conditions at the application of that knowledge.

As TAP has shown the importance of qualitative guidance for simulation and training, we turn next to another methodology that is highly compatible with qualitative transfer between learning and operational environments. Not surprisingly, this technique is something human society is already highly dependent on for many types of learning and knowledge acquisition: storytelling.

Narrative Theory

Using the principles of narrative theory, we examine a framework of representation that is natively intuitive and familiar to anyone who has ever told a story in order to illustrate a point or to clarify an example. Narratology, a line of critical inquiry developed by literary theorists in the 1960s, attempts to study and classify narratives based on the various structural and syntactical elements of discourse found in stories (see Bal, 1997; Barthes, 1998; Genette, 1980; McQuillan 2000; Onega & Landa, 1996). In this section, we explain the fundamental properties and theories of narratology and explore the implications of such a paradigm for addressing issues in experiential learning. This overview illustrates how this paradigm may be useful for developing an improved model for experiential learning that is grounded theoretically and practically in an organizational context.

Pioneering accounts of successful learning and training using storytelling and creative implementations of the narrative form can be found in many different industries, from the World Bank and the Bank of Canada to NASA and IBM. Perhaps most effectively, researchers and practitioners in knowledge management (KM) have relied on narrative and story to capture organizational content as well as convey organizational history. According to Davenport and Prusak (1997), this approach uses information technology to maximize the *human* elements of communication while concurrently leveraging the flexibility and processing power of computers and digital networks. Such an approach allows technology to take on a more organic and flexible role within social networks and encourages the technological solutions to adapt to their users, rather than the more traditional (and unfortunate) reversal of this model.

For simplicity's sake, in our discussion of narratology we use the terms "narrative" and "story" interchangeably. Although narrative may also refer to the actual act of narrating, to the practice of telling a story, or even to the particular telling of a story using a particular medium, in this chapter we prefer to adopt a more colloquial definition in which narrative and story are equivalent semantic entities (c.f., Bal, 1997; Genette, 1980). To refer to the active task of storytelling, we use the terms "narration" or "narrating." We broadly define a story or narrative to be a series of events experienced by a central character (or protagonist)

as this character struggles to overcome one or more obstacles (or antagonists) within some specific environment. In addition to the primary character serving as a protagonist, additional *actors* or *agents* exist within the narrative to bond with this central character or to provide other dramatic functions. The analysis of dramatic expression in narrative form has been the territory of literary scholars for hundreds of years and we turn next to the field of literary theory for an explanation of the fundamental nature of narrative.

Literary treatments of narrative vary according to the perspective from which they are generated. For example, a field of inquiry in literature known as structuralist semiotics attempts to break down a linguistic system into logical units known as signs. Signs, in turn, are composed of binary relationship between a *signifier*, or the sound pattern of a word, and a *signified*, or the actual concept or meaning of a word (see Saussure, Bally, Sechehaye, & Riedlinger, 1986). To some theorists, then, a story is in fact a *signified* entity, while a narrative serves as a *signifier* for a particular story (Genette, 1980, p. 27). In this model, a single story might have multiple narratives, depending on the characteristics of the storytelling medium and the particular methods of narration (e.g., whether the story is told from the point of view of an omniscient narrator or rather from the point of view of a character in the story itself). While structuralism was later challenged by the deconstructionist movement (see Derrida, 1997) on the basis of being too rigid and reductive, the ideas it brought for the formal taxonomy of language have nonetheless proven useful in various contexts.

Russian formalists later appropriated the term *narratology* in order to reference the same type of semiotic distinction in a broader narrative context. In this paradigm, the *fabula* is the chronological construction of events in a particular story (analogous to the plot of a story), while the *syuzhet* is the representation of these events as told through a particular medium. The *fabula* is the story; the *syuzhet* is the telling. In this sense, one *fabula* or plot can have many different *syuzhets*, or manifestations. Further distinctions of narrative are possible on a more general level; stories can be classified based on their medium or form, the subset of narrative techniques used in their construction, the point of view of the narrator, the type of plot structure, the sources of dramatic tension, their selection of plot devices and primary characters, and so forth.

Genette's *Narrative Discourse* (1980) is a structuralist work that attempts to formulate a systematic theory of narrative based on the characteristics of order (narrative time), duration, frequency, mood, and voice. Of particular interest in this work is Genette's tendency to represent narrative elements using what he calls "pseudo-mathematical formulas" (p. 114). For example, in his discussion of narrative frequency, Genette proposes formulas for the narration of a story that happened once (1N/1S), a repeated narration of a repeated story (nN/nS), or the

repeated narration of a single story (nN/1S) (pp. 114–115). What is of some use to experiential learning theory is not necessarily the formulas themselves, but rather the general idea that narration can be algorithmically represented in a fashion suitable for finite state representation or for the application of graph or pathfinding theories. In these narrative graphs, the vertices are composed of fabula or plot event structure, and, by extension, be modeled computationally as a series of finite states. Inserting an actor or agent into the beginning state of this series then allows an audience to experience the story as that story is told through the eyes of a protagonist. Furthermore, once the plot is modeled in some fashion, perhaps using the object-oriented programming methodology (see Fiore, Johnston, & McDaniel, 2005, for an example) various sjuzhets can be generated simply by rendering or displaying the story using different types of technological mediums. These mediums may be plain text or HTML renditions of the story on a website, Flash-animated or cartoon-type versions with models of the various characters, film versions with simulated or real actors and actresses, or auditory versions of the story as read by a narrator or the protagonist.

Other literary studies of the narrative form and plot, while not always associated with the structuralist ideas of narratology, can be equally useful for thinking about how to tease apart the various elements of a given narrative or how to construct a new narrative that is compelling and worthwhile to the reader, viewer, or listener. For instance, studies of the elements of plot and drama generally arrive at a relatively small finite number of basic plots or dramatic situations (c.f. Booker, 2005; Polti, 2003). Booker (2005) speculates that there are essentially seven basic plots involved in storytelling: overcoming the monster, rags to riches, the quest, voyage and return, comedy, tragedy, and rebirth. While such a collection of plots seems alarmingly small and, at first consideration, woefully inadequate, careful analysis of successful stories generally reveals that many of these stories' authors do impressive jobs of combining plots and introducing slight variations in conventional formulas in order to maintain the interest and enthusiasm of an audience.

For example, Tolkien's *Lord of the Rings* (1967) is only one such story that contains examples of each of Booker's fundamental plot types (Booker, 2005, pp. 316–321). Frodo's journey to return the Ring of Power to the perilous land of Mordor obviously involves a quest, which is arguably the most salient of the seven plots. Frodo's company also undertakes a voyage from and return to the safety of the shire, and the narrative recounts an overcoming of several variations of monsters, the Dark Lord Sauron acting as the most heinous and powerful of these entities. The rags to riches plot is found in Sam the Hobbit's ascension to "Sam the Wise" as he transforms himself from an ordinary character at the beginning of the story to an unfailingly loyal and wise companion to Frodo by the end

(Booker, p. 318). Other instances of the remaining plots are evident throughout the story as Frodo and his band of adventurers encounter tragedy, romance, surprise, and adversity.

Other examples of narrative conformity to a small number of plots abound, regardless of the literary depth or semantic complexity of a particular story. For example, literature intended for young adults, such as the phenomenally successful Harry Potter series by J.K. Rowling or the Inheritance trilogy by Christopher Paolini, exhibits a similar pattern of normative plot structures with novel combinations and transformations of traditional fabulas. In these examples as well as in Tolkien's work, the plots that are apparent in such stories are those we expect to find in the genre of fantasy; spells, magical creatures, and evil antagonists are the types of plot devices we associate with the stories characterized as fantasy fiction. Other archetypal elements are, of course, associated with other genres of story—a reader will expect to encounter quite a different assemblage of actors and environments when picking up a science fiction novel or an existential short story.

In this section, we examined some of the fundamental ideas from narratology and considered the notion that all stories can be fashioned from a relatively small number of foundational plots. From this brief analysis, we draw what we believe to be two important conclusions related to the use of simulated narrative as a tool for experiential learning. First, we assert that it is possible to borrow from the work of structuralist theorists in order to define potential ways to represent and model information in narrative form. Second, we believe that it is not wholly implausible to formulate a small number of basic scenario plots with which to generate experiential narratives or scenarios of astonishing diversity. In other words, a series of basic plots can be used to convey the experiences involved with a wide variety of potential event sequences. The confluence of these is a potentially powerful means through which to create compelling experiential learning scenarios. In our next section, we turn briefly once again to material from the psychological sciences to help explain why it is that such predictable plot devices can hold so much appeal for us as narrative consumers and to speculate as to how new tools might be developed in order to take advantage of this narrative appeal to support sophisticated learning environments.

Linking Learning and Transfer with Narrative Theory

While the intricate details of narrative theory may be more interesting to literary theorists and critics, the notion of experiential learning is quite pertinent to the ways in which narrative information and the psychological processes involving

the human experience intersect. In prior work, Fiore, Johnston, and McDaniel (2006) note the influences of narrative on cognitive, social, and affective dimensions of experience. In this section, we select key research from each of these areas and discuss examples in which these various modes of information processing are affected, influenced, or advised by the narrative form. Next, we consider some examples of narrative techniques at work in organizational learning scenarios. We conclude with a brief interdisciplinary examination of the ways in which narrative can be used as a tool for organizational or experiential learning in digitized environments.

Our first task is to return to the notion of context and environment and to examine narrative through a psychological lens. First, we turn to the cognitive implications of storytelling. Jerome Bruner (1991) is well known for identifying ten features of narrative in his article *The Narrative Construction of Reality*. He outlined each of these ten features and explained the ways in which they informed or framed our observations about the world. Among these ten features were three that are especially pertinent to our discussion thus far. Bruner defines these three features as *normativeness*, *genericness*, and *canonicity and breach*. Normativeness and genericness suggest that narrative's use of genre is a way of representing human experience in a predefined fashion. Bruner also notes that "[genres] are also ways of telling that predispose us to use our minds and sensibilities in particular ways" (p. 15). In other words, not only do narratives function as conduits for prior experiences that one has encountered, but they also function as active agents of shaping and reconstructing knowledge as a person experiences a story. Another of Bruner's features, canonicity and breach, is found in those especially compelling stories in which "an implicit canonical script has been breached, violated, or deviated from" in order to challenge a reader's expectations and deviate from the narrative pattern expected by a reader (p. 11). Bruner argues that it is the breach in a script that makes the story interesting in the first place; that is, a story would not necessarily be very engaging to a reader if it were only a description of the mundane activities of one's day-to-day life. Only when something out of the ordinary occurs does a story become compelling enough to tell. Bruner's ideas about narrative provide some general guidance as to why narratives are so powerful as cognitive structures and as communicative technologies.

Additional research has explored the use of narrative as a tool for learning and mental organization. Ong (1982) studied the communication patterns of primarily oral cultures and noted the reliance of such cultures on mnemonic devices such as the rhythmic or formulaic discourse patterns found in stories. In a preliterate culture, proverbial types of expression were necessary to retain the intricate details present in the oral expressions of prior experiences and scenarios as recalled by storytellers. A long line of research also documents the importance

of script-like or schematic structures in human cognition (Bartlett, 1932; Bower & Morrow, 1990; Bransford & Franks, 1971; Gagne & Glaser, 1987; Mandler, 1984; Rumelhart, 1980; Schank & Abelson, 1977; Trabasso & Sperry, 1985).

Next, we can consider the affective and social dimensions of narrative. Aside from its cognitive benefits, narrative is also touted for its ability to both elicit and communicate affective and social types of information. For instance, consider a corporation that has recently opened a new division across the country and that is attempting to gather market research based on that new location. A simple fact such as "We have recently opened a new customer service outlet in Spokane with unsuccessful results" becomes more powerful and expressive when reshaped into a brief (but complete) story such as "As assistant manager of our new service outlet in Spokane, I was recently surprised by the level of public animosity that accompanied our grand opening. Apparently, the construction process had disturbed a famous local bald eagle nest and frightened away the bird. During the first day of sales, our customers were ambivalent at best, and at worst, openly hostile." In addition to the minimalist details provided by the original piece of information, the narrative version adds agency (the assistant manager serving as the protagonist), conflict (the specific reason for the failure of the new location to garner public support), environment (a more precise setting), and emotion (the specific affective reaction of both the protagonist [surprise] and the external narrative agents in the story [public animosity, ambivalence, and hostility]). The additional contextual details present in the narrative version allow management to make a more informed decision as to how to handle the incident and how to formulate a public response.

Unfortunately, in addition to its affective use as a linking mechanism for after-the-fact types of applications, a narrative account is also that so much more *personal* for the employee, both during the formation of the story and during its dissemination or distribution to groups for use or analysis. Considerations for dealing with hesitant employees should be made. Furthermore, the potentially personal elements that make their ways into stories must also be dealt with in terms of security and mechanisms for enforcing personal privacy or adequately anonymizing the narrative experiences (whether collected through interviews or more high-tech mechanisms) gathered in corporate environments. More informal narrative exchanges such as this routinely occur across the country in boardrooms or with technicians during coffee breaks (see Orr, 1996) in order to institute executive policies and to propagate expert knowledge.

Additional ideas for linking the narrative form with digital technologies can be found in literature from the computer sciences. For instance, Minsky (1985) formulated a methodology for representing a story as a generic structure, which he calls a "story-frame," wherein new instances of stories are formed by filling in

generic placeholding terminals within this frame with specific instances of a time setting, a place setting, a protagonist, a central concern, and an antagonist (p. 265). Schank (1995) and his team at Yale invented the concept of a narrative script, which is "a set of expectations about what will happen next in a well-understood situation" (p. 7). Using the two techniques, it is possible to create a narrative framework in which story scripts with narrative terminals are created by an administrator in order to solicit those stories appropriate to a particular organizational event. As new stories are created, the generic placeholders are replaced with information specific to the stories being created by employees or users. A more robust definition of this narrative framework is found in McDaniel (2004), in which we discuss the EDNA-E narrative knowledge management application.

From this brief interdisciplinary literature review, we can draw several tentative conclusions. First, it now seems plausible that we can model stories in simulation environments by representing them as a series of narrative events with transitions between events that indicate the progress of the primary character in the story as narration progresses. These events, when seen in their entirety, are equivalent to the fabula or the plot of the narrative. Second, we know that some research argues that there is a small subset of basic plots from which all successful (and by successful, we mean those stories that captivate a reader's attention and encourage him or her to finish the story) narratives are drawn. With this in mind, we suggest that this represents a powerful tool in which to embed contextual factors key to learning. In particular, by linking technology and narrative, we increase the possibility for transfer of learning to the operational environment. Specifically, it is possible to create a scriptable rubric for classifying stories based on their content or genre, or for specifying how new stories should be created in order to adhere to some set of carefully formulated learning objectives. Finally, we can acknowledge the inherent flexibility of narrative and perhaps agree that this flexibility may be well-suited for the cognitive interpretation of complex events in experience management.

In sum, in this section we illustrated how, in addition to its role in the normal social channels of storytelling, the narrative form is adaptable to a technological or simulated digital environment as a tool for encapsulating or soliciting stories from employees or users. While such narrative information cannot easily be condensed into a traditional data structure, it does provide a linkage mechanism for additional information, such as the affective dissatisfaction recounted in the brief narrative account above. We feel that such affective information can be extremely valuable for directing and influencing the decisions of training and simulation scenarios. Moreover, when these narrative mechanisms are coupled with technology, the possibilities for experience-based learning and institutional growth are even more impressive.

Having presented a significant degree of theorizing on narrative and the types of stories useful for experiential learning, we turn next to a description of the characteristics of stories for simulation and learning and on sample applications. We hope that many of the theoretical features and ideas we have just discussed, such as context and environment, transfer appropriate processing, and narrative theory, will become concrete through the various examples and illustrations we next provide.

Sample Applications/Examples

Organizational Narrative

From a corporate context, the notion of using story as a tool for organizational knowledge management has been well-documented in the literature (Abma, 2003; Denning, 2001, 2004; Post, 2002; Snowden, 2001; Swap, Leonard, Shields, & Abrams, 2001). Steven Denning has written two influential books that discuss the notion of using narrative as a tool for organizational learning and as a device to improve interpersonal communications. In *The Springboard*, Denning identifies three characteristics of effective storytelling for the purposes of knowledge management. The first of his characteristics is *connectedness*, the feature allowing the audience to find an opening with which to access the story and understand it on their own terms. This allows readers to relate to a story using their own backgrounds and experiences. His second characteristic is *strangeness*, which refers to the novelty or originality of a story as a result of the deviation of an audience's expectations. This fits in nicely with Bruner's notion of canonicity and breach, discussed earlier in the chapter, and verifies the idea that stories violating expectations are those types of stories that are what Bruner characterizes as being "tales worth telling" (p. 11). Denning's last characteristic of the "springboard story" is that of *comprehensibility* or of allowing an audience to connect the experiences of a story to their own lives. Again, this is in line with Bruner's ideas, in that narrative is a frame for reality in its implicit normativeness. This allows a properly crafted story to encapsulate real-world experiences and redistribute them in a way that is comprehensible in different ways by different members of an audience. Denning notes that there must be a proper balance between strangeness and comprehensibility in order for an organizational story to be effective in accomplishing its goal.

Denning's later book, *Squirrel Inc.* (2004), considers seven organizational objectives that can be accomplished using various types of stories. These objectives are to communicate complex ideas and encourage action, to communicate personal details, to communicate values, to encourage group work, to tame or neutralize gossip, to share information and knowledge, and to lead and provide
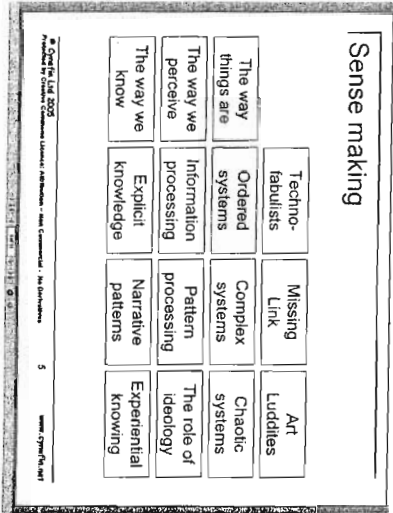
visionary focus (p. 150). Several of these objectives, if not all of them, are directly relevant to the typical types of goals found in organizational narrative scenarios.

Another pioneer in the field of organizational narrative is David Snowden, who worked for IBM for many years in the field of knowledge management. Upon his departure from IBM, he formed a unique research collective/consultancy called Cynefin to explore how one can leverage the integration of a number of theoretical concepts in the support of management theory and practice. Cynefin has been built around social complexity theory, simply described as that application of complexity theory to human systems (see Figure 2.1). In so doing Cynefin enables an organization to better engage in sense making by understanding the relationships among the way things are, the way we perceive our world, and the way we understand our world. In so doing we are able to recognize the complex networks that have evolved to support an organization at the intra- and inter-organizational level. Finally, the narrative form allows one to more efficiently gather and effectively interpret the data that exists in the environment (see Figure 2.2) so as to better represent the patterns of human activity (www.cynefin.net).

Cynefin is one example of how the narrative form is being used in the corporate world as part of information systems and management consulting. For analysis and searching of complex data, narrative provides context and an experiential learning form (refer to www.cynefin.net for additional detail and more recent developments).

FIGURE 2.1. CYNEFIN SENSE MAKING FRAMEWORK

Sense making

	Techno-fabulists	Missing Link	Art
	Ordered systems	Complex systems	Luddites
The way things are	Ordered systems	Complex systems	Chaotic systems
The way we perceive	Information processing	Pattern processing	The role of ideology
The way we know	Explicit knowledge	Narrative patterns	Experiential knowing

FIGURE 2.2. MASS NARRATIVE: JUMPING INDICATORS
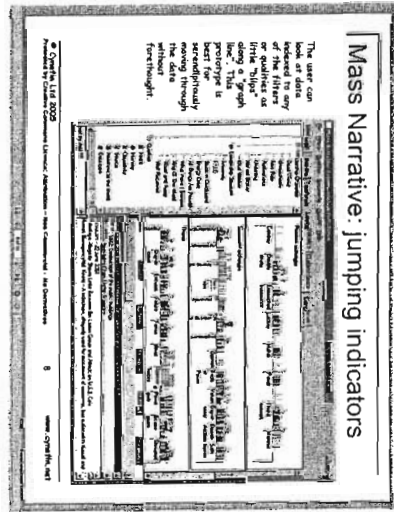
Mass Narrative: jumping indicators

Root Learning

Another example employs visual narrative techniques and an experiential element of game play to produce a compelling training and strategy alignment activity. Many large organizations, such as Alltel, GM, Pacificare, and Scotiabank, have all presented findings related to the reaction-level results of their initiatives using Root Learning (www.rootlearning.com/www/caseStudies.asp, 2005). For example, GM initiated this activity in their attempts to foster organizational change, particularly in the area of transforming human resources. As part of a learning initiative titled *HR Skills for Success*, the overall goal was to provide an experiential context for human resources personnel to better understand the organization's need for change (www.rootlearning.com/www/caseGM.asp, 2005). Root learning worked with thousands of GM employees in the hope of more simply conveying the complex messages emerging from the organizational change environment. Their aim was to transcend cultural and language barriers by employing narrative and visual metaphor via what they have labeled the Learning Map® process. To evaluate the effectiveness of this tool, the company self-reported data suggesting that participants felt that they had obtained both a clearer understanding of the importance of organizational change and that the learning map technique was an effective tool to convey this. Participants have also reported that, in international, cross-cultural settings, the ability to visually represent a

transformation story in which the organization is compared to the long-term strategic goals can build alignment among disparate parts of a large, complex organization and promote initial change management.

Text-Based Applications

While lacking in immersive technology and high-fidelity graphics, textual story-based technologies are helpful for several types of experiential learning scenarios. For one thing, th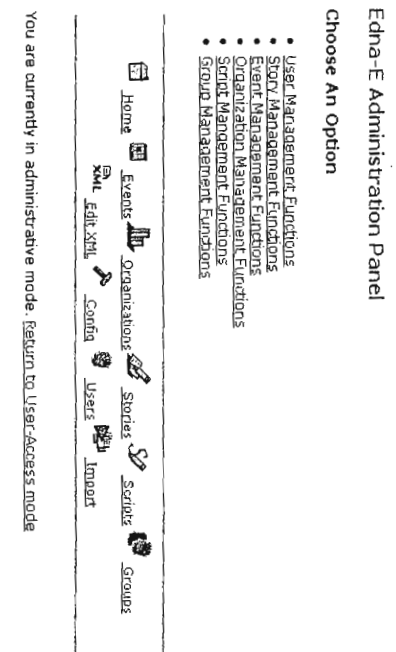eir light technological footprint means that they generally run with relatively few resources and do not require expensive hardware. For another, they can be useful for revealing algorithmic procedures for representing stories in digital environments. Finally, text-based storytelling systems can collect a text-based version of an experience that can then be streamed to any number of sophisticated media outlets—one fabula, many sjuzhets.

One example of a textual narrative knowledge management application that allows for the capture of contextual and environmental information is the Event-Driven Narrative Analysis Engine (EDNA-E) application developed at the University of Central Florida (see www.textsandtech.org/~rudy/edna-e/). This prototype web-based system allows an administrative user (or story administrator) to add a series of organizational events to a database (see Figure 2.3) that becomes viewable to a group of employees or an organizational unit. Users then respond to organizational events by following scripted templates (also added by the story administrator) and are given access to the stories created by other employees. Some

FIGURE 2.3. EDNA-E ADMINISTRATIVE CONTROL PANEL

Edna-E Administration Panel

Choose An Option

Home Events Organizations Stories Scripts Groups
XML Edit XML Config Users Import

- User Management Functions
- Story Management Functions
- Event Management Functions
- Organization Management Functions
- Script Management Functions
- Group Management Functions

You are currently in administrative mode. Return to User-Access mode

degree of automatic classification and analysis is made possible by pattern matching algorithms and validation routines enforced by administrative story scripts.

Another example of a textual narrative application, which has been around for some time, is the Inform Engine that emerged from the popular Zork video games in the 1980s. Zork delivered the type of branching story game that was presented entirely in a text mode. Upon reading text such as, "It is pitch black in this room. You are liable to be eaten by a grue," an appropriate response might be "Turn on lantern." The game would pick up on the key words or phrases, such as "turn on" and "lantern," and would take you to the next branch of the story: "Ah, you escaped narrowly and get to move forward through the cellar into the tunnel." Or, if you input the wrong information for that particular narrative or situation: "We're sorry; you have been eaten by a grue."

This example may seem not to have much bearing on the current professional environment. However, understanding this branched narrative could lead to other stories that have interactive branching and some level of simulated intelligence based on textual responses. These responses could then take someone step-by-step through a procedure and lead to a rich, narrative-based experience without necessarily using rich media.

More recent examples have used the same type of engine to deliver both simple graphics and text and to process the text of those inputs, even in environments that have a very small footprint, such as personal digital assistants (PDAs) or mobile phones. The attractiveness of the small footprint and the simplified processing of information could lead to some significant ways of creating engaging experiences, with minimal media, in an easy-to-use text-based interface.

Game-Based Applications

In K-12 education, many innovative projects have started to take advantage of graphically rich, story-driven videogame technologies in order to use the technologies today's youth are already using for entertainment purposes as educational vehicles as well. Quest Atlantis, the African American History Game, and Pax Warrior are three such initiatives that we describe in this section.

Quest Atlantis (http://atlantis.crlt.indiana.edu/start/index.html) was developed by researchers at Indiana University's Center for Research on Learning and Technology (http://crlt.indiana.edu/). This game was designed as a means through which technology and applications from the commercial gaming industry could be combined with research on learning and motivation. It is a three-dimensional virtual world that supports multi-user game play. The goal is to immerse the players in educational tasks via quests requiring the player to travel to virtual places (see Figure 2.4). In the course of "questing," the players perform

FIGURE 2.4. QUEST SCREEN

OTAK Interface

OTAK Symbol
Click spinning object to open a Quest summary in the side-bar

QA Side-Bar Pages
Functions such as:
- Info Page
- Quests
- Links
- E-mail

Chat Area
Share messages with other Questers in the virtual space

Avatar
Use the keyboard or mouse to move your avatar through the virtual space

Toolbars
Menus and buttons to:
- Select avatar
- Control avatar expression
- Change between first and third person viewpoint
- Customize settings

a variety of educational activities through which they interact with both real and virtual players. Importantly, the Quest community has shown how the game is able to connect "Quests" to local academic standards. For example, quests can be designed so that they require students to engage in activities that are socially and academically meaningful by traveling to virtual villages. These include quests ranging from researching other cultures to conducting environmental studies with embedded tasks such as calculating frequency distributions and developing action plans. Quest Atlantis builds on the Vygotskian notion of play in young children, viewing the game as a context for learning. "Play can be thought of as a scaffolding activity that expands the children's [zone of proximal development], engaging them in issues and debates that are not addressed directly through participation in society or even through the normal curriculum of schools (Barab & Jackson, 2006).
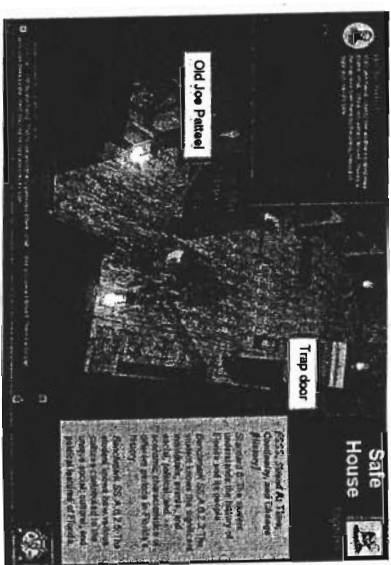
The African-American History Game (http://mundyhr.com/game.htm) was created by the University of Central Florida's Institute for Simulation and Training (www.ist.ucf.edu) in collaboration with UCF's School of Film and Digital Media (www.dm.ucf.edu), the Partnership for Research on Synthetic Experience (PROSE)

lab, and Carol Mundy's organization, African-American History Education and Culture (http://mundyhr.com). This project involved developing a story-driven learning game for research in teaching children about African-American culture and history. The goal was to create a compelling introduction to the Underground Railroad (see Figure 2.5) using existing commercial off-the-shelf technology for role-playing computer games to stimulate interest and understanding of events of historical significance while introducing the public to the Mundy Collection, a vast selection of artifacts associated with African-American history (Fiore, McDaniel, Greenwood-Ericksen, Scielzo, Sanchez, Cannon-Bowers, & Mundy, 2005). This effort demonstrates how interdisciplinary research that combines story lines, learning objectives, and candidate artifacts from local cultural collections can support research and development in the production of compelling story-driven games. Such partnerships allow the research community to work with those in the humanities to scaffold experiential interactions that allow children to learn about history via navigating a virtual world where they interact with historic artifacts, objects, and characters (Fiore, McDaniel, Greenwood-Ericksen, Scielzo, & Mundy, 2006). This particular game was developed using a modification of the popular Neverwinter Nights video game.

A final example that allows for complex decision making and a compelling interactive narrative engine is Pax Warrior. This is described as technology that builds on the notion of "interactive documentary" (www.paxwarrior.com/home/index.php). The developers suggest that this capability can easily incorporate

FIGURE 2.5. AFRICAN-AMERICAN HISTORY GAME

FIGURE 2.6. SCREEN FROM PAX WARRIOR

collaborative learning and simulation to support decision making. This can then be used to build an engaging game that aids in teaching topics such as history and social studies as well as current events. For example, Pax Warrior has created a module based on the political and civil unrest in Rwanda. (See Figure 2.6.) In this module, the player takes on the role of a commander from the United Nations and experiences the decision making necessary to solve such a complex scenario. Pax Warrior is just one example of the compelling nature of interactive narrative as an example of experiential learning in action.

Conclusion

The first half of this chapter was heavily weighted in theory and gave few examples of both the types of stories useful for experiential learning and the practical applications of narrative and simulation technologies. Hence, the latter half was fully focused on the characteristics of good stories for simulation and learning and on sample applications. We hope that many of the theoretical features and ideas we discussed earlier in the chapter, such as context and environment, transfer appropriate processing, and narrative theory, were made concrete through the various examples and illustrations we have provided.

While we have suggested that a digital storytelling model can be quite useful for certain types of experiential learning applications, a cautionary note is

necessary. We began our discussion of narratology by writing about the lack of human-oriented solutions to problems involving the manipulation of information or knowledge assets. While a narrative framework built on simulation technology does address the socio-cognitive and emotive nature of communication during the gathering of the stories, the actual *presentation* of this data to an audience is still a purely technological process. (The audience's *interpretation* of the data is another matter entirely.)

As a final caveat, we assert that the benefits in audience immersion and captivation that are more likely to be present during something equivalent to an oral storytelling session may in fact not be present to the same extent in a virtual session. In this instance, a user is simply reading a story from a computer terminal or directing a virtual avatar through a simulated environment to advance a scenario's story line. Also, in conjunction with simulation technology and narrative, interactive performance may extract even more impressive results from experiential learning tasks, especially given the added contextual influence of body language, vocal inflection, and so forth. Further investigation is needed to determine the efficacy of virtual storytelling systems as experiential learning tools in comparison to live presentations of stories, in which the sound of the storyteller's voice and the ambient cues from the environment are also present. Research from other fields with heavy narratological foci, such as folkloristics (Georges & Jones, 1995), is also worthy of examination as a potential source of useful information for linking narrative to experiential learning tools and technologies. In short, only via true interdisciplinary research, with researchers and scholars from the learning sciences and the humanities working together, can we realize how to construct experiential learning environments. Via the principled integration of context, story lines, and learning objectives, experiential learning has the potential to substantially improve learning.

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Acknowledgments