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ABSTRACT

Business training and education are changing. Organizations have experienced dramatic changes in their structure, competitive environment, and the demographics and demands of their employees. As a result, organizations are seeking new and innovative ways to train employees. At the same time the evolution of technology mediated learning tools (TML) has resulted in flexible, interactive, engaging, learning technology tools that promote experiential learning, analytical thinking and problem solving. Simulation based technology mediated learning (SimTML) tools are gaining popularity in practice. SimTML facilitates lifelike environments that utilize animated pedagogical agents (APAs) which employ nonverbal communication traits in their interaction with the user. The effect is a lifelike, face-to-face interaction, between the user and the APA. The result is a flexible, interactive, engaging, TML tool that promotes experiential learning, analytical thinking and problem solving. This paper explores current SimTML technology, how we interact with learning technology, and provides selection and evaluation principles for organizations to use when evaluating SimTML tools for their own training programs.

Keywords: organizational training, technology mediated learning, human computer interaction, NVC, knowledge management, education research

I. INTRODUCTION

It is an exciting time in the field of business training and education. The use of technology in educational settings has been a common topic in the MIS literature [Syler et al. 2006]. It is predicted that the use of technology in training and education will continue to grow [Dick et al. 2006]. However it is important to note that today's technology mediated learning (TML) tools, built on the foundation of decades of research, look decidedly different from those of the past. One tool in particular, simulation based TML (SimTML) is gaining popularity in practice [Kenworthy 2006]. SimTML tools utilize animated pedagogical agents (APAs) which employ nonverbal communication (NVC) traits in their interaction with the user. The effect is a lifelike, face-to-face interaction, between the user and the APA. The result is a flexible, interactive, engaging, TML tool that promotes experiential learning, analytical thinking and problem solving [Shellman and Turan 2006].

SimTML is appearing on the business training horizon at just the right moment. Organizations are facing an unprecedented level of complexity brought on by a rapidly changing competitive environment, new organizational structures, a changing workforce, and a required flexibility and

agility that does not lend itself to the traditional educational setting [Tung 2006]. The result is a demand for new and innovative approaches to business training [Thomas 2007]. Many organizations are finding the flexible, interactive, engaging nature of SimTML an especially effective organizational training tool [Bernard 2006].

In spite of the popularity of TML in practice, and of SimTML in particular, the MIS literature focuses primarily on use in formal educational settings. As a result Alavi and Leidner [2001] made a call for TML research to address several important issues to close the gap between practice and research in the current MIS literature. These issues include: (1) address TML use in practice; (2) move from the traditional comparison approach to research and a focus on issues of relevance; (3) examine "how" we interact, via psychological processes, with TML; and finally (4) address the relationship between program design, structures, processes and use of TML in organizations. Since this call several studies have addressed the nature of our interactions with TML and the impact on learning [Benbunan-Fich and Arbaugh 2006; Syler et al. 2006; and Gemino et al. 2005-6]. However, the focus continues to be on use of TML in educational settings leaving the use of the technology in practice, the role of NVC in TML technology, and the relationship of the technology to structures and process in organizations yet to be explored.

SimTML builds on the cumulative MIS literature in a number of areas including TML, collaboration, distributed and virtual teams, and social presence. The computer science, engineering, and psychology literatures have moved away from the comparison research that characterizes so much of the MIS literature. The current literatures in these fields explore SimTML applied to organizations. These disciplines also explore the cognitive interaction between the user and technology on a much deeper level, including the implementation and impact of NVC traits in learning technology. This paper introduces these concepts to the MIS literature and redirects the focus from the comparison of two learning environments to the exploration of our interaction with learning technology on a cognitive level; as well as the impact on organizational training programs, processes and structures.

The goal of this paper is to introduce SimTML to the MIS literature. It is suggested here that SimTML, the product of years of interdisciplinary research, is an appropriate next step in the exploration of the use of technology in learning environments. A second goal is to increase our understanding of how SimTML tools can provide improved training opportunities for organizations that cannot be achieved in the absence of these tools. A third goal is to explore the impact and use of NVC traits embedded in the APAs in learning technology. Finally, this paper explores the impact of SimTML on program design, business processes and structures by addressing the selection and evaluation of SimTML for organizational training programs.

This paper proceeds as follows. First, the current organizational environment is discussed, illustrating the potential of SimTML use in practice. Second, a theoretical background reveals how several research streams are assimilated into SimTML. SimTML is then presented, addressing both "how" we interact with TML on a cognitive level, and demonstrating how SimTML meets the current organizational demand for innovative problem-based training tools. Next, a set of principles for the selection and evaluation of SimTML use in practice are presented, addressing the relationship between organizational structures and processes and the use of SimTML in practice. A popular leadership-training program, Virtual Leader, is presented as an exemplar of the effectiveness of the SimTML in practice. Virtual Leader is then evaluated with the selection and evaluation principles presented in this paper, followed by a discussion section.

II. THE CHANGING ORGANIZATIONAL ENVIORNMENT

In order to fully understand the potential of the use of information technology in business training it is important to understand the dramatic changes that are occurring in today's organizational environment. These changes can be categorized into three complex areas: globalization facilitated by information technology; changing employee demographics; and frustration with traditional training and education options.

Globalization has rapidly transformed the organizational environment and the nature of competition [Iniguez de Onzono and Carmona 2007] forcing organizations to become increasingly agile, fluid, innovative and reactive. The result has been dramatic changes to both the nature of work and the structure of the organization itself [Burke and Ng 2006]. Distributed work is increasingly common and requires new organizational forms, such as virtual teams [Rosen et al. 2006] which in turn requires new forms of communication between knowledge workers. Outsourcing and offshoring relationships have changed the nature of organizational teams, communication and knowledge [Kankanhalli et al. 2006-7]. New forms of training that adapt to these changes are needed.

Globalization has changed who organizations employ and the training needs for this changing workforce. To meet the needs of a culturally diverse, distributed workforce, Hawawini [2005] emphasizes the need to bring education to the world in lieu of the traditional model where individuals travel to the education. Given the cultural, distance, and time differences of a global workforce distributed TML is a necessity [Thomas 2007].

Global demographics are having a dramatic impact on the type, number, age, and location of the workforce today. Seventy-eight million baby boomers, or 28 percent of the U.S. workforce, will soon be retiring; this aging workforce threatens to leave a significant deficit in "deep knowledge" [Aiman-Smith et al. 2006, pg. 16], and will leave organizations engaged in a "war for talent" as they face a workforce with a significant skill shortage [Thomas 2007]. Fifty percent of executives in the United States will be eligible to retire by 2012 [Field 2007]. This emphasizes the necessity of methods to quickly train existing employees in order to address the pending skill shortage. The population decline is not unique to the U.S., it is occurring across all of the world's "richer" nations, and even in less developed countries where reproduction rates have historically been high [Longman 2004].

The numbers of retiring baby boomers would not be a problem if there were adequate numbers of experienced younger employees to replace them; however these generations are considerably smaller. In addition to the difference in size, the members of Generation X and Y have different work demands and expectations. Both generations are comfortable with technology, quick to change jobs, have a preference for "doing" rather than "listening" (experiential or problem based learning), require experiences and excitement in their work, desire continuous professional training and personal growth, and place a high priority on work life balance [Dolezalek 2007]. Organizations now have to figure out how to attract, train, and retain these workers. Flexible and innovative TML is a much better fit for these generations than the traditional classroom setting.

Organizations turn to traditional business schools to produce new students that have the "skills, flexibility and training to compete in a new economy characterized by globalization and technological change" [Thomas 2007, p. 9], and they aren't finding them. Organizations are criticizing business schools, stating that they are outdated, inflexible, and irrelevant to practice [Mintzberg and Gosling 2002; Bennis and O'Toole 2005; Mintzberg and Gosling 2006, Thomas, 2007]. Often they turn inward to internal training programs. Some have created their own "corporate universities" to address their training needs [Mintzberg and Gosling 2002; Hawawini 2005; Onzono and Carmona 2007]. TML tools are becoming a significant part of these organizational training programs, and SimTML in particular is gaining popularity [Bernard 2006].

The combination of all of these changes has made training a critical component for today's organizations. Training programs must be flexible and distributed, culturally sensitive and integrating, interactive, effective, and promote problem based experiential learning. The changes have placed new demands on both the content and delivery of organizational training. SimTML tools are proving to support the innovative, flexible, practice based learning programs that organizations require [Bernard 2006].

III. THE EVOLUTION OF LEARNING TECHNOLOGY

SimTML is the product of decades of research and application. Today this technology is a synthesis of research in MIS, computer science, engineering, and psychology. A complete picture of the technology itself, and its potential use and impact on organizations, cannot be obtained with out synthesizing the appropriate literature from these disciplines. An understanding of the current findings together will help move MIS research forward.

THEORETICAL BACKGROUND

The use of information technology in learning environments is not new to the MIS literature. As the literature has evolved there has been a proliferation of definitions of TML, although most areas have a substantial overlap with small variations in the details. Much of the literature has focused on comparing traditional learning environments to those with instructional methods supported by IT [Alavi and Leidner 2001]. The focus of the studies in this area have explored IT enabled instructional methods in traditional settings [Leidner and Jarvenpaa 1993], IT facilitated collaborative learning [Leidner and Fuller 1997; Alavi 1994; Lim et al. 1997; Gemino et al. 2005-6; Benbunan-Fich and Arbaugh 2006], distributed and virtual learning environments [Ahmad 2000; Piccoli et al. 2001; Alavi et al. 2002], and the use and impact of virtual reality on learning [Suh and Lee 2005].

More recent studies are exploring "how" we interact and learn with learning technology. Several recent studies explore independent learning in collaborative web based environments [Gemino et al.,2005-6; Syler et al. 2006], motivation in an e-learning environment [Meissonier et al. 2006], the social dimensions of online learning environments [Arbaugh and Benbunan-Fich 2006], the use of technology by collaborative teams and the impact on experiential learning environments in which students can create their own knowledge [Benbunan-Fich and Arbaugh 2006]. Throughout the evolution of the MIS literature the focus has primarily been, and continues to be, on the comparison of the two environments in educational settings, with student subjects.

SimTML has evolved from related topics in the MIS literature as well. Research on virtual teams and virtual communities inform the design, implementation, and use of SimTML today. Virtual teams (VTs) are "functioning teams that rely on technology-mediated communications while crossing several different boundaries" [Martins et al. 2004, p. 807]; such as time, physical location, and organization. VT's can be assembled for training, although this is not as common as virtual project teams pursuing organizational goals through their activities. SimTML is considered a metaphor for face-to-face interaction [Johnson et al. 2000]. Therefore, the lessons learned from the VT research can inform the creation and use of SimTML by demonstrating how we interact with each other in a virtual team. This knowledge can be embedded in SimTML tools, enlightening the design of APAs so that they support the perception of face-to-face interaction between the user and the technology. The research in this area can also inform the effective creation and development of "learning teams" that use SimTML in their training efforts.

Virtual Communities (VCs) are groups in which "individuals come together around a shared purpose, interest, or goal" [Koh et al. 2007, p. 70]. Simulation-based VCs resemble a physical community however the participants do not gather physically at the same place and time [Talukder and Yeow 2007]. In a VC people come together and individuals can create "a life as a different person, meet and socialize with new friends from all around the world, and visit and explore new places" [van Dam 2007, p.16]. Second Life is one simulation-based VC that has recently received a lot of attention [Mennecke et al. 2007]. Simulation-based VCs often look and feel like normal every day reality, the same is true for interactions with an avatar in a SimTML environment [Steins 2007]. However, unlike SimTML the avatar in a VC represents another individual who is making the decision for what the avatar says and does in the virtual world.

While on the surface simulation-based VCs look and feel much like a SimTML, they each have a different foundation. VCs facilitate social networking, or interaction between two people via an avatar. SimTML is a carefully crafted technology where the interaction is designed so that the

user perceives it to be a lifelike interaction; however the interaction is taking place between the user and technology itself via an APA. The specific goal of SimTML is training and education, and APAs are created to facilitate this goal. The interaction is not spontaneous or dependent on interaction with another individual, although it is crafted to give the user that perception. In a pure VC technology the focus is primarily on social networking. The VC literature informs SimTML by providing insight into how we interact in a virtual world. These insights can be implemented in SimTML tools and facilitate the creation of APAs that can mimic the face-to-face interaction experienced in a VC.

At the very foundation of SimTML is the social presence literature. "Social presence" is the degree to which individuals feel connected to each other, or to an APA, during their interactions with technology. Early social presence studies illustrate the inherent psychosocial nature of human computer interaction and the human tendency to anthropomorphize software [Moon and Nass 1996; Reeves and Nass 1998]. Several studies in MIS have revealed that individuals act mindlessly toward computers [Nass and Moon 2000], apply social rules and expectations while working on computers [Sundar and Nass 2000], and perceive computer personalities as real [Moon and Nass 1996]; even though on an intellectual level individuals will recognize and report that they are dealing with a computer and not another person.

More recent studies, primarily in the computer science and engineering literature, have addressed social presence in a simulation setting. These studies have explored the impact of social norms, such as gender, interpersonal distance, and eye gaze, embedded in avatars [Blascovich 2002; Yee, et al. 2007]. Other studies have explored the role of emotions and feelings in a simulated environment as an important component of SimTML [Stover 2007]. The results have supported the notion that our social norms and interactions in a simulated environment mimic those in the physical world [Yee et al. 2007], and that embedded feelings and emotions in APAs creates an effective learning environment [Shellman and Turan 2006] by enhancing believability, realism, empathy, and attachment to the APAs [Marsella and Gratch 2001].

SimTML synthesizes years of research in MIS, computer science and engineering, and psychology. As a result it is proposed here that SimTML is the next step in the exploration of the use of technology in learning environments. The use of NVC traits in the APAs differentiates SimTML from previous studies in the MIS literature. In the following section SimTML, and specifically the use of NVC as a basis for our interaction, is explored in detail.

IV. SIMTML: AN EFFECTIVE LEARNING TOOL

SimTML is increasingly popular in practice, once thought to be too complex, and reserved for computer geeks, computer simulation technology is moving from the "edges of the work experience to the heart of it" [Hapgood 2001, p 1]. In spite of its popularity, SimTML technology and its application in practice have largely been ignored by MIS researchers.

The use of NVC traits in avatars sets SimTML apart from the familiar quantitative simulation programs popular in finance, accounting and economics. Lifelike APAs allow SimTML to explore "soft skills" such as leadership, cultural awareness, and negotiation [Core et al. 2006] and facilitates experiential or problem based learning that promotes learning via interacting with deep cognitive processes [Wang and Tzeng 2007].

In this section "how" we interact with SimTML technology via NVC in APAs, and the resulting deep cognitive interactions, are presented. First, NVC in relation to APAs is discussed. Next, APAs and their role in training technology is presented. Lastly, the role of SimTML and its APAs in experiential or problem based learning is discussed.

NVC IN SIMTML: LIFELIKE INTERACTION WITH AVATARS

"Human emotional behavior, personality, and body language are the essential elements in recognition of believable synthetic characters" [Su et al. 2007, p. 281], such as APAs in a simulation environment. APAs are lifelike characters that provide contextual advice and feedback throughout a learning episode [Lester and Stone 1997; Moreno 2004; Su et al. 2007]. These lifelike autonomous characters provide rich learning environments by creating rich face-to-face learning interactions resulting in increased motivation and engagement of the learner [Johnson et al. 2000].

NVC takes place whenever one person influences another through facial expressions, gaze, gesture, posture, nonverbal vocalizations (tone, pitch, etc.), clothes, or other aspects of appearance [Su et al. 2007] and may be intentional or unintentional [Guye-Vuilleme et al. 2005]. It has long been proposed that that as much as 93 percent of our communicative effort is through NVC [Mehrabian 1968]. These channels of communication have evolved over the long history of human existence. Through the use of these channels individuals have an innate capacity to perceive various kinds of behaviors. Since it is such a fundamental aspect of communication, and one of the most efficient ways to convey emotions, NVC is critical in creating a lifelike interaction in a simulation environment [Guye-Vuilleme et al. 2005].

APAs can interact with learners on a deep cognitive level, taking advantage of the ubiquity of NVC in human interaction. Agents can present a more lifelike interaction if they convey believable personalities, emotions, and behaviors.

Personality "distinctively characterizes an entity…and is represented by coherent and unique responses . . . both externally and internally" [Su et al. 2007, p. 283]. Internal responses include mood and emotional state, while external indicators include external responses such as how we act, or our general disposition [Su et al. 2007]. We convey internal and external responses through nonverbal behaviors, such as open or closed body posture, eye contact, and turn-taking behavior during a conversation.

Emotion is an important component of communication and strongly impacts our NVC when interacting with others. Emotion is communicated through facial expressions, gaze, gestures, and verbal pitch, both intentionally and unintentionally. The NVC related to emotions reveal a considerable amount of information about a person's emotional state [Marsella and Gratch 2001]. Understanding emotions allows us to view the world from different perspectives by participating in the values, feelings and perceptions of others [Stover 2007]. This is an important component in learning, especially in different cultural settings. Emotions and mood are communicated through NVC and display our attitudes and interpersonal relationship with another [Su et al. 2007]. Examples of open, warm, liking emotions include: a forward lean, smiling, open body posture, facing the other person, close interpersonal distance, and assuming similar postures. The NVC elements associated with disliking emotions include; slumped postures, gazing around the room, hands on hips, closed body posture, and body rigidity [Su et al. 2007]. If a person is drumming their fingers on a table, looking at their watch, with slumped posture while gazing around the room during a presentation or conversation, they are displaying NVC elements associated with dislike.

Behaviors are the way in which we indicate our mood or mental state. Behaviors are conceptual and include intention, reasoning, desire, verbal, and nonverbal expressions such as gaze, touching, gestures, posture, and facial expressions [Su et al. 2007]. Postures and gestures are behaviors that can display intensity of emotions, interest, and define the length of an interaction.

NVC, embedded in APAs, which convey personality, emotion, and behavior result in believable agents that enhance the SimTML environment. APAs facilitate active participation by the learner rather than simply being a passive observer in the learning process. The use of locomotion, gaze and gestures can focus a learner's attention [Johnson et al. 2000]. The use of gaze by APAs has been shown effective in regulating turn taking [Cassell et al. 1994]. Head nods, facial expressions, and other nonverbal cues that are a natural component of human dialogs, provide

useful feedback without disrupting the learner's train of thought. The presence of lifelike agents increases motivation and attention to the task [Johnson et al. 2000].

Lifelike APAs that display believable NVC can facilitate learning in a SimTML environment. In their seminal article Johnson et al. [2000], describe the key benefits provided by APAs in a simulation environment.

- Interactive demonstration via APAs results in an active, experiential, problem based environment for the learner.
- APAs provide navigational guidance by teaching the learner where things are and how to get around a complex work environment.
- APAs provide nonverbal feedback on the learner's actions and can influence the student, making a strong impression on them.
- Conversational signals, such as pitch, head nods, and changes in facial expressions, help regulate the flow of the interaction.
- APAs convey and elicit emotion by appearing to care about a learner's performance, by acting enthusiastically or concerned the agent can take advantage of the learner's inherent psychosocial interactions and of our tendency to anthropomorphize software [Reeves and Nass 1998].
- APAs can play a double role as both as instructor and teammate.
- Adaptive pedagogical interactions can answer questions, generate explanations, and ask probing questions of the learner, providing a dynamic face-to-face learning environment as opposed to deliberate, sequential, or preplanned contexts that exist in traditional training methods.

The use of APAs in a lifelike environment results in an interactive TML tool that can trigger profound insights for long-term thinking, link actions to affect in the learning context, turn mistakes into learning elements, allow situated learning (closer to work context), enhance user responsibility, and increase comfort level, and ease of use with relation to time and distance demands of the learning environment [Karapidis et al. 2006].

SIMTML: WHERE ORGANIZATIONAL TRAINING NEEDS AND TECHNOLOGY MEET

SimTML has enormous potential as an effective learning instrument in today's organizational environment. SimTML technology can provide the innovative, culturally sensitive, distributed, interactive, experiential problem-based learning tools that organizations seek. SimTML technology facilitates situational learning. In situational learning the learners can learn in their work context, with a problem at hand, rather than having to travel to a learning environment, retain the relevant information, and apply it to their work.

The lifelike environment of SimTML, and the interaction with APAs, allows the learner to be as close to reality as possible. "Simulation exercises are fun and engaging and allow the learner to internalize knowledge by applying new skills in a risk free environment . . . dramatically increasing motivation, retention, and providing a high return on training investments" [Karapidis et al. 2006]. SimTML technology has the potential to learn with the user, the result is that the real and the virtual environment of the user change simultaneously, resulting in a more efficient and learner-oriented training tool.

While increasingly popular, SimTML is in the early stages of use in organizations. The technology is exciting and holds great potential to provide flexible, effective, problem based, cost efficient alternative to traditional training tools. However, planning must go into integrating simulation technology into an organizations overall training program. Evaluation methods are necessary for successful utilization of simulation tools.

In the next section experiential problem-based learning is discussed. Savery and Duffy's [1996; 2001] instructional principles for problem-based learning are presented. The application of these principles to the use of APAs in a SimTML environment is offered as the foundation for an effective set of principles for organizations to use when purchasing and integrating simulation tools into their training environment.

V. SELECTION PRINCIPLES FOR BUSINESS SIMULATION TRAINING TOOLS

Selection and evaluation of TML are important organizational activities. In this section selection principles for SimTML are offered to help organizations select, manage, and evaluate this technology as a component of organizational training programs.

Experiential problem-based learning is a common focus for training programs. The SimTML selection and evaluation principles are based on this paradigm. A description of experiential problem-based learning begins the following section.

GENERAL INSTRUCTIONAL PRINCIPLES FOR LEARNING

Progression from participation to reflection about the connections made in a learning environment characterizes the process of problem based experiential learning [Houde 2007]. "Problem-based experiential learning programs in practice are directly linked to a company's top strategic business priorities, and have stood the test of time as an effective learning philosophy that results in keeping team members engaged, contributing, learning, and collaborating" [Meister 2007]. SimTML supports problem-based learning through the presentation of a lifelike environment and natural communication with APAs [Sklar and Richards 2006].

Learning systems have undergone a demonstrable shift from those based on instructivist theory to constructivist concepts and practices, particularly as they relate to problem-based, or experiential learning [Friendman and Deek 2002; Savery 2006]. Experiential problem-based learning environments are a common topic in the education literature [Smith 2005; Savery 2006]. In their seminal paper Savery and Duffy [1996; 2001) propose general instructional principles for learning under the constructivist perspective. These principles have been influential and continue to be widely accepted in the education and management literatures. Given their continued acceptance, Savery and Duffy's [2001] are appropriate for use here as the foundation for the development of problem-based instructional principles for SimTML.

Savery and Duffy [2001] describe constructivism as the philosophical view of how we come to understand or know, and provide three primary propositions to illustrate this perspective. Savery and Duffy's propositions are supported by SimTML, and include:

- Understanding occurs through our interactions with the environment, we cannot discuss what is learned separately from how it is learned and we understand through content, context, activity and goals of the learner.
- Cognitive conflict or puzzlement is the stimulus for learning and determines the organization and nature of what is learned.
- Knowledge evolves through social negotiation and through the evaluation of viability of individual understanding.

The constructivist approach can be described as emphasizing the values of collaboration, personal autonomy, reflectivity, active engagement, personal relevance, and pluralism [Savery and Duffy 2001; Savery 2006]. These are in stark contract to the traditional educational values of reliability, communication and control as often seen in the case study method often utilized in traditional business training.

Savery and Duffy [2001] offer seven instructional principles that encompass the constructivist approach. These principles emphasize learning for the sake of learning and not focusing on a

single "assignment;" supporting learner ownership of the problem, engaging the learner in authentic tasks that include cognitive challenges; creating a learning environment in which the learner becomes an effective thinker in the particular domain of interest; encouraging social interaction; and through training developing the skills of reflection leading to self regulation and independent thinking.

It is suggested here that the principles offered by Savery and Duffy [2001], when incorporated with SimTML will result in powerful principles that can assist organizations in their selection and incorporation of SimTML. Savery and Duffy's [2001] instructional principles are presented in Table 1.

The instructional principles to support problem based learning offered by Savery and Duffy [2001], when integrated with considerations related to purchasing and implementing an APA based simulation tool in an organization's training program, reveal what a company should look for in a simulation tool. The result of this integration is a set of principles for selection of SimTML tools. These principles are described in further detail in Table 2.

Table 1: Instructional Principles for Problem-Based Learning [Savery and Duffy 2002].

Instructional Principles	**Description**
1. *Anchor all learning activities to a larger task or problem.*	Learning must have a purpose beyond its assigned task and encourage learning which enables the learner to be able to function more effectively in the world.
2. Support the learner in developing ownership of the overall problem or task.	The learner must buy into the problem rather than simply focusing on passing a test or putting in their time.
3. Design an authentic task.	The environment should engage learner in activities which provide cognitive challenge, and require thinking consistent with the cognitive demands for which the learner is being prepared to operate in.
4. Design the task and the learning environment to reflect the complexity of the environment the learner will be working in after the learning program.	Rather than simplifying the task for the learner, seek to support the learner in a complex environment.
5. Give the learner ownership of the process used to develop a solution.	Learners must have ownership of the processes of solving a problem as well as having ownership of the problem itself. The learner should have the ability to choose a problem solving strategy rather than following a particular problem solving methodology.
6. Design the learning environment to support and challenge the learner's thinking.	The goal is to support the learner in becoming an effective worker and thinker; the teacher assumes the roles of consultant and coach.
7. Encourage testing ideas against alterative views and alternative contexts.	Knowledge is socially negotiated. Learning communities, where ideas are discussed and understanding is enriched, are critical to effective learning.
8. Provide opportunity for, and support, reflection on both the content learned and the learning process.	Support the development of self-regulation and independence by supporting reflective thinking.

Table 2: Principles for Selection of Problem-Based SimTML Organizational Training Tools.

Instructional Selection Principles	**Description**
1. Anchor learning activities to a larger task by providing a rich face-to-face learning environment supported by APAs in a SimTML environment.	APAs should emphasize learning for learning's sake and motivate and engage the learner in a problem based, experiential learning environment that reflects the organization and society.
2. The SimTML environment and APAs should support the learner's ownership of the task.	APAs should coach and consult the learner away from viewing task as fulfilling a requirement or filling time.
3. The SimTML environment and APAs should support the completion of authentic tasks.	APAs should engage the learner in a cognitively challenging task that requires thought processes and activities consistent with the demands and activities of the organization.
4. The SimTML environment and the APAs should reflect the complexity of an authentic environment.	The learner should be engaged in a simulation environment that reflects the level of complexity in the organization.
5 The APAs should encourage ownership of the process used to develop a solution to the task.	APAs, through both verbal and nonverbal feedback, should encourage the learner's ownership of the solution and provide feedback on problem solving strategies.
6. The SimTML environment and APAs should challenge the learner's thinking.	APAs should assume the role of consultant and coach, value the learner's thinking, and not direct the learner.
7. The SimTML environment and the APAs should encourage testing of ideas against alternative views and contexts.	APAs, through verbal and NVC, should encourage examination and reflection of alternative views and contexts.
8. The SimTML environment and APAs should support reflection on both the content learned and the learning process.	APAs should model reflective thinking throughout the learning process and support the learner in reflection about strategies on learning as well as what was learned.

These principles for selection and implementation of problem-based business SimTML tools are proposed to serve as a guide for the growing number of organizations turning to SimTML to train their employees. However, issues of selection go hand in hand with evaluation. Once the technology has been selected and implemented it is important to evaluate the success of the tool. In the next section evaluation criteria are presented for these simulation tools.

VI. EVALUATION OF BUSINESS SIMULTATION TRAINING TOOLS

Evaluation of training programs is an important component of an organization's training plan. The management, use, and evaluation of information technology in an organization are critical elements of all IT investments including SimTML. "Unless technology investment is clearly linked to a defined behavior change, it will go off track sooner or later . . . the behavior change must be measurable and directly linked to a strategic change goal of the organization" [Aldrich 2004, pg. 229].

Transfer is the evidence that what was learned in a training program is actually being used for the job for which it is intended [Olson 1998]. SimTML programs can facilitate transferable and

adaptable skills because learners can experiment, make errors, and learn from feedback on complex tasks in complex environments [Hesketh and Frese 2002; Sklar and Richards 2006].

There have been several attempts to establish criteria for evaluating learning objectives [Bloom et al. 1956; Wolfe and Roberts 1986] and assessing transference and levels of learning [[Kirkpatrick 1998]. Many of the evaluation criteria have focused on a specific level of analysis [Schumann et al. 2001]. For example, Bloom's Taxonomy [1956] is a widely accepted framework for the purpose of establishing learning objectives [Schumann, et al. 2001]. Bloom's taxonomy has been applied to e-learning with "game like" simulation tools [Wang and Tzeng 2007]. Kirkpatrick [1998] developed a widely used framework to evaluate the effectiveness of training programs, especially in a corporate environment [Schumann et al. 2001]. These early works have provided a solid foundation for the evaluation of training programs both at the level of learning objectives and levels of learning and transference. Building on this foundation several frameworks have been offered to examine the learning objectives and levels of learning in a business SimTML environment [Wolfe and Roberts 1986; Wolfe 1990; Wolfe and Roberts 1993; Schumann, et al. 2001; Hesketh and Frese 2002].

Table 3: Four Phases for Simulation Training Tools Implementation and Evaluation

Phase	Implementation or Evaluation Activities
Phase 1: Training Needs Assessment	a) Determine present and future task requirements. b) Compare task requirements to current organizational and employee skill levels. c) Identify cognitive processes required in practice to ensure skills can be transferred beyond the learning environment to the organizational context.
Phase 2: Training Plan and Training Methods Assessment	a) Compare training methods supported by APAs and the learning context. b) Potential training methods include: behavior modeling (observation, role play, and feedback), action training (task bound exploratory and action learning), rules vs. examples in training (optimizing combinations of rule based and exemplar training), learning to learn (memorizing, understanding, doing).
Phase 3: Issues in Training	a) Assessing the individual's conceptualization of learning (learning orientation vs. performance orientation). b) Facilitate self management. c) Ensure transfer (flexible modes of training) to achieve organizational training goals. d) Align training behaviors and reward system.
Phase 4: Simulation Training Evaluation	a) Reaction (measurement of participant's learning experience in the SimTML environment). b) Learning (measurement of the degree of change regarding learner's attitude, knowledge and skill improvement as a result of the learning experience in a SimTML environment). c) Behavior (measurement of the degree to which learners have changed their behavior outside of the SimTML environment). d) Results (measurement of the degree to which the output of the learner's participation in the business SIMTML environment results in workgroup or organizational improvement).

Hesketh and Frese [2002] offer a set of criteria for evaluation of simulation tools in a work setting. They focus on three levels of training and transference; needs assessment, training plan and methods, and lastly evaluation. Schumann et al. [2001] offer a framework for evaluating simulations as training tools by expanding on both Blooms Taxonomy and Kirkpatrick's evaluation framework for evaluating the effectiveness of training programs. Their framework has been use to examine simulation tools in entrepreneurship training [Fregetto 2005], and ethical dilemmas embedded into simulation training technology [Schumann et al. 2006].

The framework offered by Schumman et al. [2001] includes four levels of evaluation; reaction of learner; learning related to change in attitudes, degree of increased knowledge or skill; behavior change outside of the learning environment. The result of evaluation is the degree to which the output of an overall workgroup or organization improves.

It is suggested here that, when integrated, the frameworks offered by Hesketh and Frese [2002] and Schumann et al. [2001] provide a comprehensive framework for assessing relevant levels of the effectiveness of the use of business simulation training tools, and the impacts of these tools on organizations. The synthesis results in the following four phases for implementation and evaluation of simulation training tools: (1) organizational training needs assessment; (2) organizational training plan and training methods assessment; (3) organizational issues in training; (4) training evaluation. Details for each phase are included in Table 3.

In the following section several popular SimTML programs are discussed. From this discussion Virtual Leader, a popular SimTML organizational training tool, is offered as an exemplar in the area of the use of APAs embedded in simulation technology employed in organizational training programs. The success of Virtual Leader provides insight into how we interact with SimTML, the impact of NVC elements, and how these programs are successfully employed in organizational training programs.

VII. SIMTML PRODUCTS FOR ORGANIZATIONAL TRAINING

> Simulations are hard . . . they force us to innovate. . . challenging us to create… *but the good news is they work"*
>
> *C. Aldrich (2005, pg. 268)*

Simulation training has been commonplace in the aviation industry and military for years, with tremendous success [Raybourn et al. 2005]. SimTML in organizational contexts is still fairly new; however the number of products on the market is growing. There are a number of simulation programs that focus on soft-skills. "BaFa BaFa" is a cultural sensitivity simulation game that has been widely used since the 1970's [Shirts 2002]. However, it lacks the computerized sophistication and use of APAs, of some of the newer games on the market. Change Pro Simulation (http://www.learningways.com/changepro.html) is an online simulation tool that helps managers increase their ability to implement change. Entellium (http://www.entellium.com) offers an online customer service management simulation tool. However, neither Change Pro Simulation nor Entellium focus on NVC traits as a differentiating factor that leads to the success of their product.

Simmersion LLC (http://www.simmersion.com) offers SimTML, often tailored for specific clients, that employs APAs in a lifelike environment. The focus of their product is lifelike characters in a lifelike setting, and their APAs are designed with special attention to NVC traits. While effective in the area's of miliarty and law enforcement training, Simmersion does not address the training needs of a typical organization.

Simulearn's Virtual Leader (http://www.simulearn.net) is a management leadership program that places the user in a lifelike environment. NVC is the foundation for the programs APAs. The user interacts with the APAs in meetings, presentations and other situations that resemble real-world business situations. Virtual Leader has been widely used in organizations. They have a

client list that includes Intel, Kimberly Clark, and Johnson & Johnson, and has grown from only five clients in 2002 to over 140 today [Jana 2006]. Virtual Leader has been tested by a number of organizations. As a result, Virtual Leader can be considered an exemplar in the SimTML industry, and an appropriate choice to examine the role of NVC in APAs, the impact on organizational training, and exploration of the selection and evaluation of SimTML in organizations.

In the following section Virtual Leader will be described in detail as an exemplar in the industry. The program will then be evaluated with the selection and evaluation criteria offered in this paper.

SIMTML IN ACTION—SIMULEARN'S VIRTUAL LEADER

Simulearn's Virtual Leader is a leading simulation based management training program. Firmly grounded on the use and implementation of NVC embedded in APAs, Virtual Leader is gaining popularity in organizational training programs. It is a leadership training tool that is based on leadership and management principles and skillfully incorporates NVC channels in APAs.

Testaments to the effectiveness of Virtual Leader include the increasing coverage it is receiving in practitioner oriented journals, and increased use in organizations. Virtual Leader was recognized by the practitioner journal Training and Development Magazine (T+D), and was the winner of their annual award for Best Online Training Product in 2004 and 2007. Virtual Leader is accredited by the Project Management Institute. And, the program is widely used in many academic institutions, including; Stanford, Yale, West Point, Tulane, Penn State, University of Pennsylvania, and North Carolina State University.

Virtual Leader is a business SimTML that teaches leadership skills. "It simulates a series of meetings in which the player has to manage a complex network of interpersonal relationships in a work setting. . . . players are scored based on how well they complete business goals while maintaining relationships with customers and co-workers." [Becker, 2002, p. 1] It is based on two core ideas: the principle of three-to-one leadership and the conviction that meetings are the quintessential forums for leadership interaction in business [Lowell, 2003]. The three-to-one leadership assumption assumes that leaders use the principles of power, tension, and ideas to motivate individuals and groups to productively do the right work [Lowell, 2003]. Virtual meetings provide the forum for which the principles of the three-to-one leadership are implemented, practiced, experienced, and used by the learner.

Virtual Leader employs complex artificial intelligence in its character behavior, emphasizing NVC. The result is a realistic collaborative simulated environment where something as seemingly innocent as an APA at a table twiddling a pen can be a vital clue that the tension level in the workplace has gone below the productive zone [Becker 2002]. A screen shot of the user interface is included in Figure 1.

Virtual Leader enhances the learner's ability to learn by providing a problem based learning environment that allows practice and experience with leadership skills in a safe environment that facilitates discussion and exploration. Through interaction and manipulation of the APAs, Virtual Leader provides background materials, guides the learner through theories and content, and allows for realistic problem solving in a realistic and complex environment. Throughout the interaction Virtual Leader provides indirect nonverbal feedback along with the dialog between agents. The program provides feedback throughout the learner's interaction and a summary of how the learner used key core principles to manage the expectations of a meeting in which she or he interacts with APAs or animated colleagues in a simulated collaborative environment.

A recent study using Virtual Leader quantifies anecdotal evidence of Virtual Leaders success. This study is summarized here as evidence of the success of SimTML programs. The study was carried out at a division of a Fortune 100 company that had identified the need for its managers to relate better across departments, achieve desired meeting outcomes, use time more productively, and build healthier relationships; in other word to create influential leaders [Aldrich 2005].

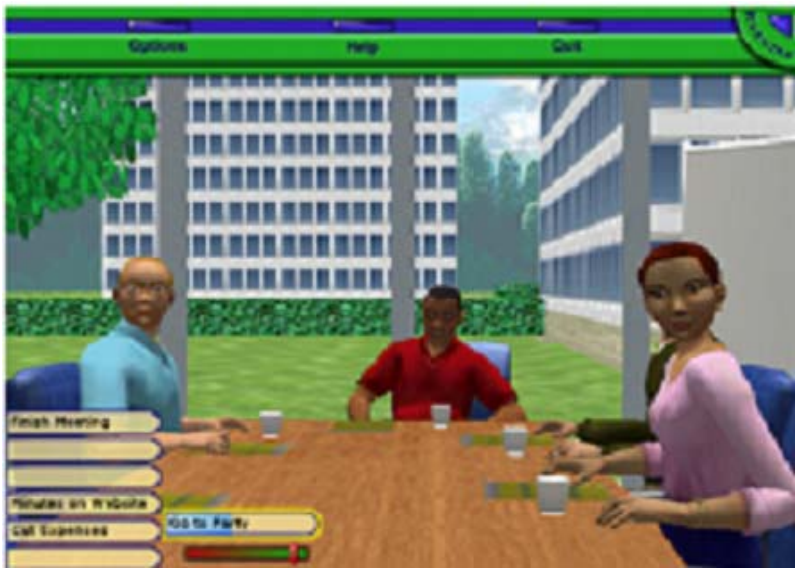

Figure 1. Virtual Leader User Interface: Leadership Training in a Virtual Meeting.

In this study a pre-assessment was conducted involving the participants, their peers, subordinates and supervisors, all of which completed extensive questionnaires about the learner's performance. The managers were then introduced to Virtual Leader and were required to spend eight two-hour lab sessions on the simulation over four weeks. After completion the participants were assessed, both on business and performance change (something the organiza tion rigorously tested) and a second evaluation was performed. The business results were significant. The participants who went through the coaching/simulation program improved their teams' relative performance rankings an average of 22 percent.

Measurements were also taken at the level of the individual learner; this was completed on a nonsubjective metric on volume of successful client jobs completed. Upon completion of the program participants were rated by their superiors, peers, and also gave a self report. These ratings included indicators of positive change, including; contribution, cooperation, and connection. An average increase of 16 percent indicates that the individuals significantly improved their value to the organizations, while strengthening their relationships with peers, supervisors and subordinates (Table 4).

Equally as important as the increase in positive behaviors and skills was the finding that the participants also experienced a cessation of negative behaviors. Again, ratings were collected from supervisors and subordinates as well as an individual self report. The factors considered in rating negative behaviors included superiority, domination and withdrawal. Overall there was a 41.5 percent decrease in negative behaviors (Table 5). This was unprecedented in the company's 15-year history.

In the following section Virtual Leader is evaluated with the principles for selection and evaluation of SimTML tools.

EVALUATION OF VIRTUAL LEADER USING THE SIMTML SELECTION & EVALUATION PRINCIPLES

Evaluation is an important part of any organizational training program. The selection and evaluation principles for SimTML offered in this paper were used to evaluate Virtual Leader's role in organizational training in the study presented above. Details of the selection and evaluation principles and the compliance of Virtual Leader to each are presented in Table 6 and Table 7.

Table 4. Analysis of Increase of Positive Behavior—Virtual Leader [Aldrich 2005].

Positive Behavior: Services Beyond Self.				Difference	
		Pre	Post	Scores	% Increase
Contribution	Self	69.2	81.1	11.9	17.2%
	Superiors	61.3	72.5	11.2	18.3%
	Peers	63.9	75.5	11.6	18.2%
	Subordinates	69.4	77.6	8.2	11.8%
Cooperation	Self	75.8	86.3	10.5	13.9%
	Superiors	65.2	86.2	21.0	32.2%
	Peers	68.3	77.0	8.7	12.7%
	Subordinates	71.8	82.8	11.0	15.3%
Connection	Self	72.6	82.14	9.8	13.5%
	Superiors	69.2	77.6	8.4	12.1%
	Peers	69.7	80.0	10.3	14.8%
	Subordinates	76.8	85.8	9.0	11.7%
Avg. Increase					**16.0%**

Table 5. Analysis of Reduction of Negative Behaviors [Aldrich 2005]

Negative Behaviors—Self Beyond Service				Difference	
		Pre	Post	Scores%	% Decrease
Superiority	Self	15.8	9.4	-6.4	-40.5
	Superiors	12.8	7.8	-5.0	-39.1
	Peers	21.6	10.4	-11.2	-51.9
	Subordinates	13.2	4.6	-8.6	-65.2
Domination	Self	16.1	13.6	-2.5	-15.5
	Superiors	15.4	10.0	-5.4	-35.1
	Peers	20.1	10.4	-9.7	-48.3
	Subordinates	17.3	6.6	-10.7	-61.8
Withdrawal	Self	22.1	15.9	-6.2	-28.1
	Superiors	18.7	12.5	-6.2	-33.2
	Peers	19.6	15.5	-4.1	-20.9
	Subordinates	16.7	7.6	-9.1	-54.5
Avg. Decrease					**-41.2**

Table 6. Virtual Leader and Compliance with the Instructional Principles for SimTML Tools.

Instructional Selection Principles	**Virtual Leader (VL)**
1. Anchor learning activities to a larger task by providing a rich face-to-face learning environment supported by APAs in a SimTML environment.	VL provided a problem based environment where the learner practiced leadership skills with APAs which motivate the learner by providing an interactive environment.
2. The SimTML environment and APAs should support the learner's ownership of the task.	VL supported the learner in taking ownership of a task by allowing adjustments in the levels of conflict as well as the feedback, both verbal and nonverbal.
3. The SimTML environment and APAs should support the completion authentic tasks.	VL engaged the learner by providing interaction with the APAs in a lifelike environment, and by providing challenging tasks that go beyond linear case based learning.
4. The SimTML environment and the APAs should reflect the complexity of the authentic environment.	VL engaged the learner by providing a simulation environment that reflected the level of complexity that the learner was being prepared to operate in.
5 The APAs should encourage ownership of the process used to develop a solution to the task.	VL provided both verbal and nonverbal feedback regarding the learner's problem solving strategies.
6. The SimTML environment and APAs should challenge the learner's thinking.	VL placed the learner in the leadership role and the APAs provided feedback facilitating reflection about outcomes, and allowing for the opportunity to reflect, learn, make changes, and try new problem solving approaches.
7. The SimTML environment and the APAs should encourage testing of ideas against alternative views and contexts.	The APAs encouraged examination and reflection of alternative views and contexts through their verbal and nonverbal reactions to the learner's actions.
8. The SimTML environment and APAs should support reflection on both the content learned and the learning process.	The APAs modeled reflective thinking throughout the learning process and supported learners in reflection about strategies on learning as well as what was learned.

VIII. DISCUSSION

This introduction of SimTML to the MIS literature is offered in hopes that the research will move forward to exploring this important technology that is being used in organizations today.

This paper contributes to research by introducing the concepts of the use of NVC traits embedded in TML tools. The introduction of NVC traits in a TML environment provides a lens for examining "how" we interact with learning technology through our natural tendency to rely on these traits in our interactions with both people and computers. Through this lens we can gain insight into how we interact with learning technology, the interaction of the technology with organizational processes and structures, and how interaction with this technology is unique and provides learning opportunities that organizations could not achieve in the absence of the TML tools.

In addition the literature in a number of MIS research streams that are relevant to SimTML are synthesized with relevant literature in psychology, computer science, and engineering. The result is the introduction of SimTML as a new form of TML that can redirect MIS research, moving the discipline away from simply tweaking environments in comparative studies. The introduction of the simulation literature from other disciplines is significant given that other disciplines have moved beyond simple comparison research and are examining TML applied in organizations,

examining both how we interact with TML and the impact on the organization. As a discipline we are uniquely qualified to examine the use of SimTML tools in organizations, however to date the examination of this phenomena has been left to other disciplines.

Table 7. Applying Evaluation Criteria for SimTML Tools to Virtual Leader Example.

Phase	Evaluation of Virtual Leader (VL) Activities
Phase 1: I Training Needs Assessment	d) VL was incorporated into training program to achieve established organizational outcomes. e) VL task requirements were comparable to current organizational and employee skill levels. f) VL places learner in a lifelike situation, requiring manipulation of some aspect of their environment that is comparable to the organizational context, facilitating transference.
Phase 2: I Training Methods Assessment	c) Problem-based learning in VL is facilitated by the APAs and the learning context. d) VL leader employs a variety of training methods including: behavior modeling (observation, role play, and feedback), action training (task bound exploratory and action learning), optimizes a combination of rule based and exemplar training, and facilitates learning to learn (memorizing, understanding, doing).
Phase 3: Issues in Training	e) VL Assesses the individual's conceptualization of learning through learner actions, and APA feedback. f) VL facilitates learner self management through setting levels, making behavioral changes and receiving feedback from the APAs. g) VL facilitates transfer (flexibility in modes of training) to achieve leadership skills, relate better with co-workers, make better use of time, and build healthy relationships. h) In the Fortune 100 example, VL was successful in aligning training behaviors and reward systems as evidenced by the objective evaluation of the use of VL.
Phase 4: Simulation Training Evaluation	e) The learning experience in VL environment was measurable and positive for both the organization and the learner. f) The learners in the VL environment showed measurable improved knowledge. g) The learners in the VL environment showed measurable positive change in attitude. h) The learners in the VL environment revealed measurable transference from the simulation environment to the workgroup or organizational improvement.

In response to the call for greater depth and breadth of research in the area of TML [Alavi and Leidner 2001] this paper deliberately avoided the traditional comparison approach to studying the phenomena. Instead a more abstract and reflective approach is taken by synthesizing the literature from other disciplines that have examined the organizational impact of these tools and introducing those concepts to the MIS literature. It is hoped that this introduction will facilitate reflection about the introduction of this very special and evolving technology, as well as the changing environment of organizational training, and lead to future development of these ideas.

In an attempt to close the gap between research and practice, Virtual Leader, a popular SimTML organizational training tool was evaluated in an organizational context to achieve the goal of this paper. Namely, to introduce to the literature an examination of the use of these popular tools in practice and to increase our understanding of how TML tools can provide improved training and learning opportunities for organizations that cannot be achieved in the absence of these tools.

The study of Virtual Leader, especially when evaluated by the selection and evaluation principles for SimTML tools, provides insight into *how* we interact with TML. The examination and evaluation of Virtual Leader illustrates that NVC traits embedded in APAs as presented in the SimTML tools described in this paper, helps further our understanding of the earlier literature which proposes that we perceive computers as having real personalities [Moon and Nass 1996; Reeves and Nass 1998], to which we apply social norms [Sundar and Nass 2000]. The application of NVC adds further insight into how we interact with learning technology. The environment provided by Virtual Leader, given the use of its sophisticated APAs, illustrates that these TML tools can provide a metaphor for face-to-face learning environments and can facilitate learning in a way that cannot be achieved without the technology. This is achieved by providing a safe place to engage in practice and problem solving activities in an environment in which the user will not be inhibited by other people in the room, or other associated external factors. The APAs engage the learner, support ownership of the task at hand, provide complexity and an authentic learning environment, challenge the learner's thinking, and encourages both problem solving and reflection.

Other advantages offered by SimTML include the potential distributed nature of SimTML. This facilitates learning when and where the learner is, and when they have the time and opportunity to use the program. SimTML also facilitates situated learning, when it benefits the learner the most, namely when an issue or a problem presents itself, and when the learner can apply what s/he learns to a current task.

Lastly, the growing trend by organizations to employ problem based learning as opposed to case base learning was addressed. SimTML tools naturally facilitate problem based learning as they encourage the learner to practice, try new problem solving approaches, correct mistakes, all while receiving interactive feed back by the APAs.

The current work represents a step in furthering our understanding of how we interact with TML, and the organizational structures and processes needed to best utilize and incorporate these tools into an organization's training program. The traditional approach of a comparison study, often used in an educational context, was deliberately avoided in order to gain deeper insight into the phenomena of TML used in practice. As well as to facilitate a different view of investigations into how we interact with the technology and how it fits into organizations. Future studies might benefit from an empirical examination of SimTML tools, and specifically Virtual Leader, as well as the selection and evaluation principles offered here.

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