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Nardon, Luciara; Aten, Kathryn

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Valuing Virtual Worlds: The Role of Categorization in Technology Assessment

Luciara Nardon
Carleton University
Luciara_nardon@carleton.ca

Kathryn Aten
Naval Postgraduate School
kjaten@nps.edu

Abstract

Virtual worlds offer great potential for supporting the collaborative work of geographically distributed teams. However, reports indicate the existence of substantial barriers to the acceptance and use of virtual worlds in business settings. In this paper, we explore how individuals' interpretations of virtual worlds influence their judgments of the value of the technology. We conducted a qualitative analysis set in the context of a large computer and software company that was in the process of adopting virtual worlds for distributed collaboration. We identified interpretations of virtual worlds that suggest three mental categories: virtual worlds as a medium, virtual worlds as a place, and virtual worlds as an extension of reality. We associated these mental categories with different criteria for assessing the value of virtual worlds in a business setting. This study contributes particularly to the acceptance of virtual worlds but also more generally to the understanding of technology acceptance by demonstrating that the relative importance of the criteria for assessing a technology varies with potential users' interpretations and mental categorizations.

Keywords: *Virtual Worlds, Virtual Collaboration, Virtual Work, Technology Acceptance, Technology Adoption, Categorization, Cognition.*

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1. Introduction

Technology-enabled collaboration has become critical to competitiveness as organizations find that employees can meet their goals only by collaborating with others in distant locations (National Science Foundation, 2008, p. 11). Three-dimensional (3D) virtual environments, or virtual worlds, are computer-generated spaces that can be experienced by many users simultaneously through their virtual representations, which are commonly referred to as avatars (Castronova, 2005). Virtual worlds are created using various toolkits such as Open Wonderland, Open Simm, and Second Life, and they allow users to build and interact with objects in the world and to interact with other users.

In addition to facilitating users' interaction with others, virtual worlds create "a psychological state in which the individual perceives himself or herself as existing within the virtual environment" (Blascovich, 2002, p. 129). Because they facilitate both the exchange of information and the perception of being present with others, virtual worlds have the potential to enhance the capacity of geographically distributed teams to accomplish collaborative work. However, despite this potential and the success of some early adopting organizations (e.g., IBM, Intel, Cisco), working in virtual worlds presents challenges for business organizations. Research has shown that 90 percent of corporate virtual world projects fail within 18 months (Gartner Group, 2008) and that fewer than 10 percent of virtual worlds' initial registrants become active users (Strategy Analytics, 2008).

The slow rate of adoption of virtual worlds by business organizations, despite the technology's potential to facilitate distributed collaboration, suggests that we need a better understanding of barriers to acceptance of virtual worlds by business organizations. Toward this end, we explore users' acceptance of virtual worlds. Specifically, we examine how individuals' interpretations of the technology influence their judgments of virtual worlds' value for work. Our investigation highlights barriers to accepting virtual worlds in business contexts and amplifies understanding of the cognitive basis of individuals' assessments of technologies by illuminating cognitive antecedents to user beliefs about virtual worlds.

Why individuals accept and use technologies constitutes a central question in information systems research (Hirschheim, 2007; Venkatesh, Davis, & Morris, 2007; Venkatesh, Morris, Davis, & Davis, 2003). Acceptance usually refers to an individual's positive attitude towards a technology or intention to use it (e.g., Davis, 1986; Davis, Bagozzi, & Warshaw, 1989). In this literature, technology acceptance and use are viewed as originating in cognition (Orlikowski & Gash, 1994; Compeau, Higgins, & Huff, 1999) or, more specifically, in potential users' beliefs about a technology and their affective responses to using it (Davis et al., 1989; Compeau et al., 1999; Davidson, 2002). A substantial body of research provides empirical support for the basic model outlined above: users' beliefs influence attitudes, which in turn influence use (Compeau et al., 1999; Gould & Lewis, 1985; Venkatesh et al., 2003; Hirschheim, 2007).

Research has demonstrated that the antecedents to individuals' beliefs about technologies are important to understanding technology acceptance (Devetag, 1999; Payne, 2003; Reinicke & Marakas, 2005; Venkatesh, 2000; Venkatesh & Davis, 1996; Venkatesh & Davis, 2000). Venkatesh and Davis (1996) found that individuals' perceptions of ease of use are anchored in their computer self-efficacy. Similarly, Reinicke and Marakas (2005) found general support for the hypothesis that psychological traits (such as locus of control, ambiguity tolerance, risk taking propensity, computer self-efficacy, playfulness, and anxiety) influence perceptions of ease of use and usefulness. Venkatesh (2000) extended Venkatesh and Davis' (1996) work and found support for a model proposing that prospective users' perceptions of ease of use are anchored in traits such as internal control (computer self-efficacy), external control, motivation, and emotion, and that these perceptions are adjusted as users accumulate experience using the technology. The findings of these studies suggest an affirmative answer to the question posed by Venkatesh and Davis (1996): Can our understanding of technology acceptance and use be improved by looking at the antecedents to user beliefs?

Because beliefs are key drivers of user acceptance and use, identifying their precursors "is critical because it will provide leverage points to create favorable perceptions and thus foster user acceptance and usage" (Venkatesh, 2000, p. 343). Furthermore, given the cognitive nature of the constructs that underlie the general model (perceptions, beliefs and attitudes), we can expect cognitive processes to shape their formation. But, surprisingly, with the exception of Venkatesh and Davis (2000), the few studies that have examined the antecedents to user beliefs study individuals' traits without focusing upon the role of their cognitions.

Venkatesh and Davis (2000) extended the technology acceptance model by demonstrating how social influence affects users' perceptions of technologies' ease of use, and how users' cognitive instrumental processes affect their perceptions of technologies' usefulness. Venkatesh and Davis found that users' perceptions of a technology's relevance to their jobs, the quality of output generated from using the technology, and the demonstrability of the results influence technology acceptance. Their study demonstrates the importance of cognitive processes in shaping individuals' judgments of technology. However, studies that explicitly explore cognition and technology acceptance are rare and our knowledge remains limited (Davidson, 2002).

In this paper, we describe our analysis and report findings of a qualitative study of a large computer and software company that initiated a voluntary adoption of virtual worlds in order to accomplish collaborative work. Our analysis of interviews, company documents, and field notes revealed three distinct interpretations of virtual worlds. Some employees understood virtual worlds as a medium (a means or tool one uses to interact with others), some understood virtual worlds as a place (an environment one enters to interact with people and places), and some saw virtual worlds as an extension of reality (an environment one enters to simulate an imagined or real-life experience or to participate in an alternate but nonetheless real experience). These interpretations influenced employees' expectations of the uses of the technology and their judgments of its business value. By demonstrating that the relative importance of the criteria used in assessing a technology varies with potential users' interpretations, our analysis contributes particularly to the acceptance of virtual worlds but also more generally to the understanding of technology acceptance.

In Section 2, we review the role cognition plays in technology acceptance and use. We draw on the consumer behavior literature to discuss how cognition influences judgments of value and outline the conceptual framework that guides our study. In Section 3, we describe our research methodology, which includes the study's setting and our approaches to data collection and analysis. In Section 4, we present our findings. In Section 5, we conclude with a discussion of their implications and the study's limitations.

2. Cognition and Technology Acceptance

Cognitive processes are a key concept in studies of human computer interaction (HCI). A few information systems studies have explored how collective interpretations of technologies influence group and organizational adoption (e.g., Davidson, 2002; Orlikowski & Gash, 1994). However, studies of HCI emphasize how individuals use technologies rather than their intentions to use them, and studies of technology interpretations investigate collective cognition. Neither body of research explicitly considers cognition's effects upon individuals' acceptance of technology. Consumer behavior researchers, on the other hand, have devoted more attention to understanding how cognition influences individual consumers' acceptance of products (Devetag, 1999). This body of research provides useful concepts and a framework for our investigation of the role of cognition in user acceptance of technologies.

2.1. Mental Models and Human Computer Interaction

Studies of HCI have drawn on the concept of mental models to explore how users understand the functionality of technologies and learn how to use them (Allen, 1997; Payne, 2003; Payne, 2009; Zhang & Li, 2005). Johnson-Laird (1983) has proposed a theory of mental models to explain human deduction. According to his theory, individuals reason by constructing mental models of a situation. These mental models allow the derivation of tentative conclusions, which individuals test by trying to build counter-examples of models in which the conclusion might be false. A conclusion is taken to be correct as long as no counter-examples of models can be found (Devetag, 1999).

HCI researchers have drawn on the concept of mental models to explore how to render technologies more usable (Norman, 2002; Payne, 2003; Payne, 2009; Zhang & Li, 2005). In the HCI literature, mental models are typically portrayed as representations of technology processes (Allen, 1997) and enable users to run mental simulations and form hypotheses about how technologies work (Allen, 1997; Norman, 2002). Users are likely to be dissatisfied with the functionality of a technology if the outcomes they observe fail to match the predictions of their mental model (Norman, 2002).

HCI studies generally seek to improve user interfaces and training. Accordingly, these studies focus on understanding how users hypothesize and learn about technology processes, with emphasis on how individuals use a technology rather than on if they will use it. Whereas the concept of mental models has been used in investigating users' understandings of cause and effect processes, the HCI literature has not explicitly addressed how cognition influences user beliefs, attitudes, and decisions to use technologies.

2.2. Technology Frames and Interpretation

Several studies of organizational adoption of technologies have focused on cognitive processes. These studies generally draw on the notion of a technology frame – a repertoire of knowledge that individuals use to impart meaning and facilitate their understanding of technologies (Davidson, 2002; Orlikowski & Gash, 1994). A technology frame guides individuals' interpretations and assessments by shaping their categorizations of technologies relative to other technologies and their selection of the performance criteria used for evaluation (Acha, 2004; Kaplan & Tripsas, 2008). In other words, a technology frame guides interpretations of "what a technology is and whether it does anything of value" (Kaplan & Tripsas, 2008, p. 293).

Orlikowski and Gash (1994) studied a business firm's implementation of Lotus Notes. They identified conflicting technology frames and argued that incongruence between interpretations of the technology was a barrier to organizational adoption. Similarly, Davidson (2002) found that repeated shifts from one technology frame to another inhibited agreement on what the organization required of a relational database and presented a barrier to its adoption. These studies demonstrate the importance of groups' interpretations in their assessments of technologies.

Interpretations are likely to be particularly important in the case of newly emerging technologies. Emerging technologies are often "equivocal", which means that they allow multiple plausible interpretations (Weick, 1990). For example, virtual worlds have been described as the "information superhighway" (Messinger et al., 2009), "a globally shared playground and workspace" (Messinger et al., 2009), and the "real world without its physical limitations" (Davis et al., 2009). Each of these descriptions implies a different interpretation of the primary use of the technology, which suggests that the criteria most suitable for assessing a technology's value will vary.

Although limited in number, studies of the role of technology frames in organizational adoptions of technology highlight the importance of users' interpretations to understanding assessments, acceptance, and use. However, these studies focus on the lack of congruence between the interpretations of various groups. They do not investigate the cognitive antecedents to individuals' beliefs about technologies. Research on consumer behavior has explicitly explored the role of cognition in individuals' evaluation and decision choices, and is discussed below.

2.3. Consumer Decisions and Judgments of Value

Researchers investigating consumer decision-making have focused attention on the cognitive structures that shape consumers' preferences and attitudes about products. A consumer decides whether or not to adopt a product based on their judgment of its value. Consumer behavior researchers argue that consumer decision-making is linked to knowledge structures known as mental product categories (Gardner, 1985; Devetag, 1999). Mental product categories shape consumers' perceptions. They are built around a prototype or exemplar and include similarly perceived objects and associated knowledge (Cohen & Basu, 1987). When a consumer encounters a novel product, they compare the product to the prototypes in their existing mental categories and classify the new product accordingly (Neisser, 1976; Rosch, 1978).

Research suggests that mental product categories play an important role in shaping consumers' judgments of the value of new products (Fiske, 1982; Lajos, Katona, Chattopadhyay, & Sarvary, 2009; Mandler, 1982; Moreau, Lehmann, & Markman, 2001a). A consumer's judgment of a new product's value is based on their assessment of the fit between their expectations of the product and their perceptions of the products' attributes (Mandler, 1982; Meyers-Levy & Tybout, 1989). A consumer's expectations of a product are triggered by a product mental category. The product mental category allows consumers to make a best guess as to what products in the category have to offer and thus provides a set of expectations about what type and what level of performance they can expect (Sujan, 1985; Rosa, Porac, Runser-Spanjol, & Saxon, 1999). Thus, for example, consumers who categorized digital cameras with film cameras had higher expectations regarding picture quality than consumers who categorized digital cameras with computer equipment (Moreau et al., 2001a).

Consumers are more likely to positively judge a product when it meets the expectations set by the mental product category (Fiske, 1982; Mandler, 1982; Meyers-Levy & Tybout, 1989; Sujan, 1985). Importantly, in consumer settings, a product's membership in a mental product category may be defined not only by the similarity of its features to those in an existing mental category, but also by the degree to which it satisfies a particular goal (Devetag, 1999). For example, a consumer may buy wine to satisfy the goal of giving a dinner party gift. Wine, then, may be categorized with "things to take to a dinner party" in addition to the more features-based "things containing alcohol." This implies that "categorization and evaluation may be intertwined from the very formation of the category" and that subsequent responses to products "may be derived from their identification as a member of a particular category" (Cohen & Basu, 1987, p. 456).

Psychological concepts developed in the consumer behavior literature provided a guiding theoretical framework for this research. This literature highlights the importance of individuals' mental representations as precursors to beliefs and assessments. The consumer behavior literature suggests a cognitive process of technology assessment based on users' mental categories: users' mental categories trigger expectations, which in turn suggest criteria against which a technology is judged.

3. Research Approach

Our research approach is consistent with extant studies of cognition and technology (Bijker, 1987; Davidson, 2002; Orlikowski & Gash, 1994). Because we were concerned with how users' interpretations influenced their judgments of virtual worlds, we adopted an interpretive approach and assumptions. First, we assumed that people act on the basis of their interpretations of the world and, through their actions, enact social realities and endow them with meaning (Berger & Luckmann, 1966; Orlikowski & Gash, 1994; Smircich & Stubbart, 1985; Weick, 1979). Second, we assumed that individuals and groups interpret objects and events by drawing on mental categories, which are implicit guidelines that shape and organize peoples' interpretations and give meaning to objects and events (Weick, 1979; Orlikowski & Gash, 1994). Consistent with these assumptions, we analyzed the data using an inductive, grounded approach (Glaser & Strauss, 1967; Strauss & Corbin, 1990), which allowed our initial analysis and findings to inform and focus subsequent iterations of data collection and analysis (described below).

The setting of this research was a large computer and software company, which relied heavily on a geographically distributed workforce. In fact, on any given day, about fifty percent of employees were working remotely. The company was developing an open source toolkit for creating virtual worlds, and was encouraging employees to use virtual worlds (largely Second Life) on a voluntary basis. The vision for the company's open-source project was to provide a virtual environment "robust enough in terms of security, scalability, reliability, and functionality that organizations can rely on it as a place to conduct real business". At the time of the study, employees were beginning to use the company's own platform and the more established Second Life to support distributed collaboration. The company provided training and an online forum and interest group to support employee use of virtual worlds.

We began the study seeking to understand how employees would use virtual worlds for distributed collaboration. We reviewed company documents, conducted exploratory interviews, and observed team meetings to ground our study in an understanding of the organizational context, which included how virtual worlds were being used. We conducted 10 in-depth telephone interviews of employees with job responsibilities directly related to the development and implementation of virtual worlds and observed weekly project development team meetings held in a virtual world over a period of more than one year. Our initial analysis revealed surprising resistance among employees to the use of virtual worlds as a tool for business collaboration. We found that the pace of adoption was slower than the organization expected, that individual employees were resistant to the use of virtual worlds, and that substantial variation existed among employees' assessments of the value of virtual worlds. This led us to re-focus our research on how employees judge the value of virtual worlds for collaborative work in a business setting.

3.1. Data Collection and Analysis

We collected additional data via an online questionnaire. The questionnaire contained closed and open-ended questions about employees' use and understanding of virtual worlds. The open-ended questions contained no limit on length, which allowed participants to write as much as they desired. Responses to the open-ended questions varied in length from short sentences to a few paragraphs. We solicited volunteers from 1,000 employees with Second Life avatars, and 118 agreed to participate in the study. The participants worked in several different locations and frequently worked in distributed teams. The Appendix summarizes the demographic characteristics of the participants. The questionnaires yielded 78 usable responses. Forty of the participants either failed to complete the questionnaire or did not provide responses to the open-ended questions.

We began our analysis of the data with emergent coding (Corbin & Strauss, 2008) supported by the qualitative data analysis software HyperResearch. Consistent with this approach (Isabella, 1990), we identified potentially important dimensions through our initial research. We then compared and contrasted the data with our evolving theory throughout the data collection and analysis process. Our evolving theory directed our attention to the most important dimensions, while the data simultaneously focused our attention on how well our evolving theory explained the most recently collected data.

We worked as a team to code and analyze the data. We each read and coded the data, and alternated who took the lead at various times throughout the process. We took detailed notes on our impressions and emerging codes, discussed any discrepancies, re-read the data, and refined and revised our coding categories until we had accounted for all of the data. We then created tables displaying the data and codes (Miles & Huberman, 1994). This allowed us to identify relationships between participants' interpretations, mental categories, expectations, and judgments of virtual worlds.

3.2. Interpretations, Mental Categorizations, and Expectations of Virtual Worlds

We first focused on understanding participants' interpretations of virtual worlds. We identified segments of text including descriptions, analogies, visual images, and comparisons. This process resulted in 973 segments of text. We compiled these segments and reviewed the descriptions, which were disassociated from the individual participants, as a whole. We then worked through the text to let coding categories emerge. Participants described virtual worlds "as like" a fantasy world, a game, a tool, a place, and the real world, and the participants assessed virtual worlds by comparing them to other communication mediums (e.g., telephone, Webex, Skype, Facebook), in-person meetings, games, and the real world. Iterating between the data and our evolving ideas, we categorized the text segments into three emergent codes that represented participants' interpretations of virtual worlds. Participants interpreted virtual worlds as a medium, a place, and an extension of real life. Table 1[1] shows examples of participants' descriptions.

Table 1. Examples of Participants' Descriptions of Virtual Worlds

Medium	Place	Extension of reality
"[Virtual worlds] are a many-to-many communication medium that have more immediacy than typed or spoken communication alone, due to the characters (avatars) that people use to represent themselves in this virtual environment." "Virtual worlds are a way of interacting with other people and…a computer automaton." "[With virtual worlds]…a virtual meeting can be held, a presentation can be made, instruction can be given, or two individuals could even 'share' the watching of a movie."	"A virtual world is like a real office environment …you can attend meetings and presentations." "Virtual worlds are a way to interact with people & places without having to travel or even be in the same room." "[Virtual Worlds allow you to] go places you physically are not able to go."	"[Virtual Worlds are like] real life, [except they] are not limited by physical constraints… [You can] do almost anything you can do in real life." "Virtual Worlds [can be] used to do almost anything you can do in real life." "Virtual worlds are just as real as [real life]. The people behind the [avatars] are living breathing people with real emotions. [Avatars] can and do take on their own personality formed from but separate from the person in [real life]."

Next, we re-examined each response by individual for evidence of data suggesting the participant was drawing on a mental category consistent with the three interpretations we had induced. Congruent with the consumer behavior perspective on mental categories, which suggests that a product's membership in a mental category may be based on the degree to which it satisfies a particular goal (Barsalou & Hale, 1993; Cohen & Basu, 1987a), we identified text describing prototypes and exemplars and the perceived advantages and disadvantages of virtual worlds for each interpretation. From these initial coding categories, we induced user expectations. Table 2 shows examples of the text segments in the initial coding categories along with the final induced expectations.

[1] We have made minor corrections to participants' spelling and grammar when we found it necessary to support readability.

Table 2. Examples of Exemplars/Prototypes, Perceptions, and Expectations

	Exemplars/ prototypes	Perceived advantages	Perceived disadvantages	Expectations
Medium	Phone, web conference, WebEx, Facebook, webinars. It's easier for me to use the phone or a web conference technology, and there's a smaller learning curve for other participants.	"They allow you to socialize with coworkers before or after meetings …[unlike conference calls] after the meeting is over, people can sort of say hi to each other, talk amongst themselves, and feel a part of the group." "They are more fun and engaging than conference calls or webinars and I tend to remember what happened for longer periods of time."	"I don't have to teach someone how to use WebEx or Facebook." "Most people have difficulty with the technology, and so they feel more comfortable on the phone." "[There is] limited gain compared to other forms of gathering information and contacts."	Is fun, engaging, easy to use, can talk and hear.
Place	Face-to-face meetings, training, conferences, tours. In virtual worlds one can conduct meetings and training events quickly and without incurring the expense of travel.	"People can attend meetings, events from anywhere, all at the same time." "You can go places you physically are not able to go." "Virtual worlds have the potential to allow meeting participants to exchange ideas without the concern of spreading contagious human viruses, eliminate travel time and costs, and skip the inconvenience of being away from home and family for longer than a normal work day."	"It is not real." "You miss the true experience of being there." "They are not as good as live meetings because the nuances of face-to-face human interaction cannot be replicated in the virtual world."	Can see places, can hear people, can interact with people, can interact with place, can be present with others.
Extension of reality	Simulations, video games. It might be a nice cheap way to simulate some of the things that we have trouble simulating in "first life".	"[Virtual worlds] offer freedom for those who are often inhibited in real life (for several reasons) to be who they wanna be, participate, act, come forth." "Training in dangerous situations can often be done in a media-rich, context-rich environment without the risks real life offers. Mistakes can be made with no consequences, letting virtual world residents learn from them in a way that wouldn't be possible in real life." "[Allow] building of context-rich environments without the huge costs of real life buildings, material, objects."	"No actual work gets accomplished." "They are another form of alienation from one's real body and presence in the world." "[Virtual worlds] are not as interesting as the real world." "My avatar is a representation of me, not really me." "Reality keeps me plenty busy and entertained."	Can see, can hear, feels real, media rich, context rich, can replicate context and situations in a realistic manner.

We then re-read and worked through the data to identify a key defining use and criteria for assessment for each interpretation, which we took as evidence of a mental product category in accordance with the consumer behavior literature. Table 3 shows the defining uses and criteria, which we explain below.

Table 3. Descriptions of Categorizations of Virtual Worlds

Category	Medium	Place	Extension of reality
Interpretation	Virtual worlds are a means or tool one uses to interact with others.	Virtual worlds are an environment one goes to interact with people and places.	Virtual worlds are an extension of real life which one participates in for interacting with people, places and real or imagined situations.
Defining use	Interaction with others, primarily through voice.	Interaction with people (through voice, gestures, and movement).	Interaction with people, place, and situation.
Key criteria	Ease of use.	Ease of use and realism.	Realism of experience.

The defining use of virtual worlds for participants interpreting the technology as a medium – a means or tool one uses to interact with others – was interaction, primarily through voice, with other people. For example, one participant explained virtual worlds as "like email/online forums except that they offer more personalized interaction". The prototypical experience was a multi-person spoken interaction such as a telephone or web-based conference call. The specific tools that participants cited as examples included WebEX and Skype. These participants most often associated virtual worlds' advantages and disadvantages with how easy or difficult the technology was to use.

For participants interpreting virtual worlds as a place – an environment one enters to interact with people and places – the defining use was interaction with both people and places through voice, gestures, and movement. The prototypical experience was a meeting or tour, where the notion of location or space was important. People meet or move through a place. For example, participants reported going to places such as "I [virtually] visited the Sistine Chapel" and "I went to a [virtual] stockholder meeting". These participants associated virtual worlds' advantages and disadvantages with both ease of use and the realism with which the technology mirrored a place.

For participants interpreting virtual worlds as an extension of reality – an environment one enters to simulate an imagined or real-life experience or to participate in an alternate but nonetheless real experience – virtual worlds allowed users to interact with people, places, and situations. The key defining use was the ability to interact with people, manipulate "physical" features and characteristics of avatars and places, and experience and create situations. These participants either equated or contrasted virtual worlds with real life, and emphasized the 'reality' of the experience. For example, participants explained that "Virtual worlds are like another world" and "[Virtual Worlds are like] real life". More pointedly, another argued that "Virtual worlds are just as real as [real life]. The people behind the [avatars] are living breathing people with real emotions. [Avatars] can and do take on their own personality formed from, but separate from, the person in [real life]".

The prototypical experience suggested by these participants' responses was varied, but participants often described more innovative uses for which clear replacements did not exist. Some participants emphasized the ability to emulate real life experiences, and others focused on extensions of real life or simulations of things not possible. For example, one participant explained interacting in virtual worlds as "similar to having a live, real-time film animation experience of yourself and those around you". Another explained that "[Its] like stepping into a cartoon or comic book in which you are a character. You can interact with other people and…experience things you may not ever be able to experience in 'real' life". These participants primarily associated virtual worlds' advantages and disadvantages with the realism of the virtual world.

Because this was an interpretive study, the notions of ease of use and realism emerged from the data and reflected the perceptions of the participants in our study. That is, although these terms are used in the literature, we did not begin with the definitions in the extent literature. Rather, the notions were derived from out data. Thus, the ease of use coding category in this study refers not only to how user-friendly participants perceived the technology to be, but also to their perceptions of its accessibility. For example, firewall limitations, hardware requirements, and local infrastructure played a role in participants' assessments of how easy it was to use virtual worlds. In our study, the notion of realism of experience refers to the degree of engagement enjoyed by participants and the associated feeling that an experience is realistic and occurs in a contextually accurate setting. This is consistent with Davis, Murphy, Owens, Khazanchi, and Zigurs' (2009) definition. In our study and extent literature, realism of experience encompasses notions of presence, the sense of being in an environment (Steuer, 1992), and immersion, the degree to which people perceive that they are interacting with their virtual environment (Guadagno, Blascovich, Bailenson, & McCall, 2007).

3.3. Judgments of the Value of Virtual Worlds

In the next stage of our analysis, we focused on understanding how each of the three primary mental categories influenced users' judgments of the value of virtual worlds. Some responses indicated that participants were creating overlapping or hybrid mental categories. For example, some participants that drew on an extension-of-reality mental category recognized that virtual worlds could also be a medium or a place. This finding is consistent with research on consumer categorizations of "really new products", which shows that consumers who confront such products may create hybrid mental categories (Gregan-Paxton & Hibbard, 2002; Gregan-Paxton & Roedder John, 1997; Moreau, Markman, & Lehmann, 2001b). Thus, we chose to focus these analyses on the responses of those that drew on one category. Twenty-two of the participants' responses suggested they were drawing on multiple or hybrid mental categories, which left 56 participants drawing on a single mental category. Twenty-six participants interpreted virtual worlds as a medium, 14 interpreted virtual worlds as a place, and 16 interpreted virtual worlds as an extension of reality.

To ascertain participants' judgments of the value of virtual worlds, we identified and coded descriptions of problems that virtual worlds solved, problems that they do not solve, and statements that indicate a judgment of current or possible future value. Five coding categories emerged: virtual worlds have value for me, virtual worlds may have value for others but not for me, virtual worlds have potential future value, virtual worlds have no value for work, and virtual worlds have no value at all. Table 4 shows examples of quotations that indicate judgments of value. Through further reading of the data, we reduced these categories into "valuable" (valuable to me), "potential value" (value to others or in the future), and "not valuable" (not valuable for work and not valuable at all). This process of data reduction (Miles & Huberman, 1994), allowed us to cluster and partition the data according to our evolving understanding and served to focus our subsequent analysis.

Table 4. Examples of Quotations Indicating Value

Valuable to me	Valuable to others	Future potential	Not valuable for work	Not valuable at all
"I get access to scarce technical expertise. The convenience is tremendous." "[Because of virtual worlds] I avoid using audio-conferences whenever possible and I don't travel much anymore." "We are now participating in a more direct way with peers which we would normally not work with." "Meet people from around the world and at different levels of the organization that I would otherwise never have the opportunity to converse with." "I work in an international team. I have never met any of my colleagues except in virtual worlds. If it wasn't for them, I could not have a social interaction with any of them."	"[Virtual Worlds] can help reduce the need for physical face-to-face meetings." "If you are work-from-home only this [virtual worlds] helps to give you a 'real world' feel in training and conference sessions." "I do feel like virtual worlds can be very cost-effective for holding virtual events - I know many people are doing this." "Virtual worlds are good for education because they use a variety of media such as voice, Instant Messaging chat, documents, 3-D simulations to re-enforce learning."	"Not enough people are using the virtual worlds in my line of work to provide the types of interaction necessary. However as the virtual worlds expand in usage ... [this should improve]." "We're not there yet." "Today virtual worlds feel like a game…it will take 5 years before we really know how to apply them…collaborative environments … should help improve things." "The potential is saving travel costs for internal and some external (partner) meetings, as soon as there is common and widespread use of the software for it, just as it is for browsers today. This can easily take 5-10 years, however, I believe."	"They are amusing and interesting, but for me they have little practical, work related value." "They currently don't solve an urgent business problem for me." "Virtual worlds provide a forum for interacting with others, but in a make-believe or imaginary setting. [I] question whether the experience translates to real world issues and problems." "The biggest use is for flirtatious activities. Thank heavens that a corporation hasn't figured out how to scale and monetize flirting."	"I'm not a fan of virtual worlds." "I avoid virtual worlds now that I have used them. My experience so far has been one of frustration." "I now avoid using virtual worlds because I don't feel they have anything to offer." "I'm skeptical of their real benefit."

4. Findings: Technology Product Categories and Criteria for Judgment of Value

We identified three interpretations and mental categories: virtual worlds as a medium, virtual worlds as a place, and virtual worlds as an extension of reality. The mental categories were associated with different expectations of how virtual worlds should perform, different criteria for assessing virtual worlds, and differing end judgments of their value for work. We found that participants' mental categorizations of virtual worlds influenced their expectations regarding what virtual worlds should do and the key criteria used to assess their value.

As Figure 1 shows, participants assessed the value of virtual worlds based on the fit between their expectations and perceptions of 1) the technology's ease of use and 2) the benefits provided by the realism of experience given a particular category. Importantly, participants' expectations and perceptions regarding ease of use and realism varied according the mental category they used to understand the technology.

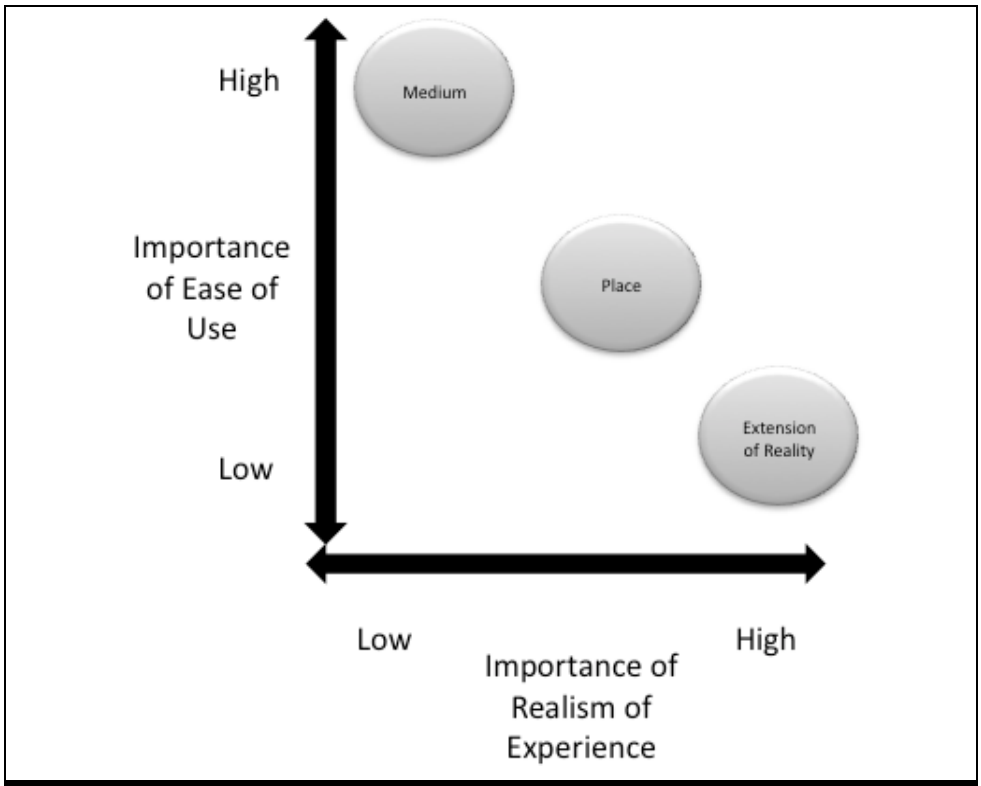

Figure 1. Categories and Criteria for Judgment

For example, participants who drew on the medium category (26 people) consistently mentioned sound quality as a concern. These participants more frequently mentioned the technology's ease of use (16 times) as an important criteria and less frequently mentioned factors associated with the realism of the experience (1 time). However, participants who drew on the extension of reality category (16 people) more frequently mentioned the variety and richness of multi-media. These participants more frequently mentioned the importance of the realism of the experience (9 times) and less frequently mentioned ease of use (5 times). These participants also frequently indicated a willingness to accept steep learning curves and technical challenges. Participants who drew on the place category (14 people) were concerned with both ease of use and the realism of experience (5 and 6 times, respectively). For example, one of our participants explained that his decision regarding whether to travel to a meeting or use virtual worlds depended on how far he had to travel to get to the meeting place. This participant preferred face-to-face meetings but was willing to use virtual worlds when travel reached a threshold of difficulty, which implies a tradeoff between how easy it was to travel, the difficulties of using virtual worlds, and the realism of the experience.

We found that participants' judgments of the value of virtual worlds in a business context varied with their mental categorization. In general, participants who categorized virtual worlds as a medium were somewhat ambivalent about its value. Although slightly less than half of these participants judged virtual worlds as valuable in a business context, almost 20 percent judged virtual worlds as having no business value. Participants who categorized virtual worlds as a place judged the technology most favorably. Sixty-four percent of these participants judged virtual worlds as valuable to them right now. Those who categorized virtual worlds as an extension of real life were polarized. Slightly less than a third judged the technology as valuable to them and half judged virtual worlds as having no value or even place in a business context. Table 5 shows the judgments of value associated with each category. We discuss the role of the three categorizations and associated criteria in participants' judgments below.

Table 5. Categorizations and Judgment of Value								
	Valuable		Potential value		Not valuable		Total	
Medium	12	46%	9	35%	5	19%	26	100%
Place	9	64%	5	36%	0	0%	14	100%
Extension of reality	5	31%	3	19%	8	50%	16	100%
Total	26	46%	17	30%	13	23%	56	100%

4.1. Virtual Worlds Judged as a Medium

Participants who categorized virtual worlds as a medium demonstrated uncertainty about the value of using virtual worlds based on the cost of learning to use the technology and the high level of involvement required. As one participant noted, “The major problem with virtual worlds is determining when one should use them over simply web-based sharing”. For those participants who categorized virtual worlds as a medium, the key perceived advantage over alternatives was the affordance of a higher level of interaction and engagement. In particular, virtual world meetings and events allow one to “visualize who's around during an event watching a presentation and interact with people you know” and engage in “side conversations that a simple conference call doesn't allow”. One participant explained that “Virtual worlds allow you to socialize with coworkers before or after meetings. On a telephone conference call, when the meeting is over, it’s over and everyone hangs up. In Second Life, though, after the meeting is over, people can sort of say ‘hi’ to each other, talk amongst themselves, and feel a part of the group”.

However, some participants noted that increased engagement and interaction is not always an advantage. As one participant explained, “the richness of the experience had its drawbacks though. We had to devote more attention to the meeting and could no longer multi-task (read email intermittently during the meeting). For well-run meetings, this is ok, because we should pay attention, but if I have to attend a meeting that is poorly run, I prefer a less-rich interface so I can at least multi-task while the meeting wastes my time!".

The major drawback of virtual worlds cited by participants who categorized them as a medium was that virtual worlds are relatively harder to use than the telephone and other conferencing tools. One participant explained that “I don't have to teach someone how to use WebEx or Facebook”. Another echoed the concern that “It's easier for me to use the phone or a web conference technology, and there's a smaller learning curve for other participants”. Another participant went further by asserting that “Virtual worlds are not as good as telephone conferences because most people have difficulty with the technology, and so they feel more comfortable on the phone”. Thus, one participant concluded that virtual worlds offer “limited [benefits] when compared to other forms of gathering information and contacts”.

These participants found little value in the unique affordances of virtual worlds, such as the feeling of immersion provided by the 3D nature of the space and the use of avatars. As one participant explained, “I don't know what the advantage is beyond WebEx…What do the avatars add? If a distributed team can share a terminal window why do you need an avatar?” Another echoed this concern: “Two dimensional virtual worlds are simpler to use, provide faster response time than three dimensional worlds, with no real loss of experience. The personalized visual avatar in 3D is cute, but because it is not real it does not add value”.

The categorization of virtual worlds as a medium triggered expectations associated with the prototypical experience of a conference call and directed attention to features associated with availability, ease of use, and low technological requirements. The stringent hardware requirements and steep learning curve of virtual worlds do not fit the expectations associated with the prototypical experience because virtual worlds are much more difficult to use than a telephone. Additionally, this category directed attention to other features such that sense of immersion and

realism are not salient and less important. The prototypical experience of a conference call did not trigger expectations of immersion or realism. For participants who drew on this categorization, ease of use and familiarity are relatively more important than the realism of the experience. These participants judged virtual worlds as only moderately valuable. Participants who categorized virtual worlds as a medium and who judged virtual worlds as not valuable perceived the technology as more difficult to use than available alternatives.

4.2. Virtual Worlds Judged as a Place

Participants who categorized virtual worlds as a place judged the technology as valuable. These participants considered meeting in a virtual worlds as a replacement for being somewhere with someone and they were excited about the potential of virtual worlds to reduce travel by replacing face-to-face interactions. For example, one participant described virtual worlds as "a way to interact with people and places without having to travel or even be in the same room". Another suggested that "A virtual world is like a real office environment except that they exist on the Internet as a meeting space". This categorization contrasts with the notion of space usually attributed to virtual organizations. For example, in a study of metaphors of virtuality, Schultze and Orlikowski (2001) found that virtuality is usually associated with space, as opposed to place, which is more commonly associated with traditional ways of organizing. The notion of place implies that people and things are co-present and engaged in face-to-face relations (Schultze & Orlikowski, 2001). Prior to the emergence of virtual worlds, the notion of virtuality was often dissociated from place. Virtuality, operating both everywhere and nowhere, implied an alternate or substitute.

This group consistently emphasized sense of presence in the context in their assessment of the value of the technology. They described the key to creating a successful virtual world as "designing a virtual world where one 'feels' as if one is there with the other participants". Participants argued that virtual worlds could be improved by increasing the level of realism of the experience in order to maximize the sense of presence in a location. For example, one participant reflected that "If it were possible to create characters in the virtual world that look just like their creators, it would be easier to recognize people and to feel like you're actually spending time together. If we could create a replica of our campus at work, we could give tours to visitors or remote employees through the virtual world. Or how about virtual cubicles for employees who work from home? You could walk over to the neighboring cube to ask a quick question". Some went as far as to suggest that, in the future, virtual worlds "need to be much more interactive. I can't take them seriously while accessing them through a computer screen. They have to be much more of an encompassing experience, like I am actually there, not living through a character".

Participants who categorized virtual worlds as a place found that virtual worlds bring important advantages to collaborative work in organizations. They often associated the advantages of virtual worlds with less physical travel, and cited examples such as saving time, reducing cost, and decreasing the organizations' carbon footprint. These participants also mentioned the benefit of decreasing geographical barriers and facilitating access to expertise and talent. One participant summarized this well by stating that "I can hold an event in Second Life for 1/10th the cost and 1/300th the carbon-footprint of a real-world event, while delivering to participants 100% of the information content and 99.9% of the social, networking and community benefit of the real-world iteration. Virtual worlds have the potential to allow meeting participants to exchange ideas without the concern of spreading contagious human viruses, eliminate travel time and costs, and skip the inconvenience of being away from home and family for longer than a normal work day". Idealistically, "Virtual worlds could make the world an even smaller place if people from different countries begin to interact with each other, share ideas, build things together".

However, many participants found that, despite the potential of virtual worlds to replace face-to-face interactions, the technology still falls short of achieving this goal. One participant commented that "It is not real. People might present themselves differently than they are in the real world and there is no way for me to check this". Another added that "They are not as good as live meetings because the nuances of face-to-face human interaction cannot be replicated in the virtual world". And another,

reflecting on the potential of virtual worlds to replace physical visits to a place, said, “You miss the true experience of being there”.

In summary, participants who categorized virtual worlds as a place called attention to affordances related to sense of presence. These participants were willing to accept some learning and technology requirements in order to gain richer interaction. Realism was expected only to the extent that it allowed people to act naturally and increased the sense of presence by supporting behaviors similar to those encountered in face-to-face meetings. They considered the costs associated with learning a new tool relative to the costs of traveling and the benefits of opportunities opened by minimizing geographical constraints. Participants viewed these costs more favorably than participants who categorized virtual worlds as a medium. However, their expectations for presence and richness of the experience were higher. These participants expected less realism compared with participants who categorized virtual worlds as an extension of reality.

4.3. Virtual Worlds Judged as an Extension of Reality

The judgments of participants who categorized virtual worlds as an extension of reality were polarized. When individuals categorized virtual worlds as an environment for simulating or participating in real or imagined situations, there was less agreement on the value of the technology. This group included participants who were the most excited about the technology and also those who were fearful of it and highly negative.

Participants who emphasized the positive aspects of an alternative reality noted that virtual worlds allow “a nice cheap way to simulate some of the things that we have trouble simulating in ‘first life’" such as “training in dangerous situations…without the risks real life offers. Mistakes can be made with no consequences, letting virtual world residents learn from them in a way that wouldn't be possible in real life”. Virtual worlds support “learning in risky situations” and the construction of “context-rich environments without the huge costs of real life buildings, material, objects”. One participant said that, "[people should] think a little differently – the real world isn't the only world – if you can't do it in the real world, it doesn't mean you can't do it”.

These participants discussed the opportunities to explore topics, perspectives, and behaviors in ways not possible in real life. One participant argued that “Virtual worlds encourage you to be creative and even reinvent yourself if you're so inclined. Within virtual worlds you can experience things you may not ever be able to experience in ‘real’ life”. Another participant, providing an example of experiencing something one may not be able to in real life, said that “You can explore the world from the point of view of a young lesbian woman even through you might be an old straight man. You can explore other religions, attend live rock concerts, and interact with live art exhibits”. Some participants viewed this use positively: “[Virtual worlds] offer freedom for those who are often inhibited in real life (for several reasons) to be who they [want to] be, participate, act, come forth”, which makes “meeting new people in virtual worlds [less] intimidating and less judgmental”. Some found that this type of exploration makes work more fun: “It feels like a bit of a fantasy, separation of oneself, which helps to make your job not so monotonous”.

However, other participants indicated that these affordances do not provide value to collaborative work and may even be dangerous. One participant explained that “There is currently no compelling reason for me to use these worlds. I am much more interested in reality than in virtual reality. Only my fantasy life stands to be enhanced by virtual reality and the technology”. Others strongly opposed the use of virtual worlds. They argued that “[Virtual worlds] are another form of alienation from one's real body and presence in the world”, and that “It's just an illusion, one more temporary pleasure, a disguise, fleeing from what one is really is, one more ‘fun’ that won't make you happier but [will lead to]…even more craving. This is fleeing from...oneself”. Some participants indicated that virtual worlds are dangerous in the sense that users “may get addicted and become disjointed from the real world”.

The key challenge identified by participants who categorized virtual worlds as an extension of real life is that employees of business organizations may not have a need for an augmented or simulated

reality to complete work tasks. Reflecting on what prevented them from making greater user of virtual worlds, many noted the greatest barrier is "the real world", and suggested that the virtual environment did not solve their current problems and only offered entertainment. As one participant explained, "Reality keeps me plenty busy and entertained".

In summary, the realism of the experience was the principal criterion on which to judge virtual worlds for participants who categorized virtual worlds as an extension of real life. Participants explained realism of experience as the ability to immerse oneself in the environment and feel as though what is taking place is real regardless of whether or not the scenario mirrors an actual or possible experience. Participants varied greatly in their evaluation of the desirability of realism. For some, greater realism implied greater functionality and thus greater value. However, for others, greater realism was threatening. Generally, participants who categorized virtual worlds as an extension of reality and judged virtual worlds as valuable emphasized the benefits of simulating things not possible in real life. Participants who categorized virtual worlds as an extension of reality and judged virtual worlds as having no value emphasized the threat of alienation from real life.

Overall, our findings indicate that the criteria against which the value of virtual worlds was assessed varied according to participants' mental categorizations of virtual worlds and this in turn influenced participants' assessment of value. In particular, our findings show that users' mental categorizations influenced their expectations and the relative importance of ease of use and the realism of experience provided by virtual worlds.

5. Discussion and Implications

A potential user's categorization of an emerging technology serves to focus their attention on particular aspects of the technology and to trigger expectations about how it should be used and how it should perform in these functions (Rindova & Petkova, 2007; Rosa et al., 1999). In the case of virtual worlds, the relative importance of ease of use and realism of the experience varied as potential users' mental categories directed their attention to particular uses of the technology. For example, when individuals categorized virtual worlds as a medium used for conferencing with remote participants, they assessed the technology's value against expectations of sound quality and ease of use. The value of contextual information and immersion was discounted. Additionally, when individuals categorized virtual worlds as a medium, they perceived the technology as difficult to use and the cost of learning as excessive. However, when individuals categorized virtual worlds as an extension of reality used for emulating and simulating things difficult, dangerous, costly or impossible in the real world, they perceived the technology as easy to use. Learning to use a virtual world is less difficult, for example, than learning to fly a rocket and land on the moon.

Our study contributes to knowledge of technology acceptance by investigating the cognitive antecedents to users' beliefs. Our study is conducted in a previously understudied context, virtual worlds. This context allows us to extend existing research by focusing on individuals' perceptions and judgments of a technology for which the defining business use and value are as yet not clear.

Existing research assumes a relative agreement on the purpose of a technology and the general criteria with which it will be evaluated. For example, the technology acceptance model (TAM) (Davis, 1986; Davis et al., 1989) posits that an individual's acceptance of a technology is influenced by his or her perceptions of 1) the technology's usefulness, defined as the extent to which a person believes the technology will enhance his or her job performance, and 2) ease of use, defined as the extent to which a person believes that using the technology will be free of effort (Davis, 1989). A large stream of research supports the conclusion that individuals' perceptions of ease of use and usefulness are important predictors of technology acceptance (see Venkatesh et al., 2003, and Venkatesh et al., 2007, for reviews).

Our study extends and complements this research by focusing on the antecedents of ease of use and usefulness, which are of significant theoretical importance given their key role in determining acceptance and use (Venkatesh & Davis, 1996). We contribute to the technology acceptance

literature by demonstrating that individuals' interpretations and mental categorizations influence their expectations regarding the technology, the relative importance they place on ease of use and usefulness, and their judgment of the technology's value. In our study, participants' discussions of the usefulness of the technology were often associated with the realism it afforded. Our findings are consistent with the tentative conclusion of Gefen and Straub (2000), who propose that users' perceptions of ease of use may be influenced by the nature of the task. Our study lends support to Gefen and Straub's (2000) conclusion and, in addition, provides an explanation: users' mental categorizations trigger different expectations and criteria which in turn result in different assessments of value. Future research on virtual worlds should explore this relationship in depth.

Our study also contributes to research on the adoption of collaboration technologies. Studies on group support systems and the resulting technology transition model (TTM) (Briggs et al., 1998; Briggs, de Vreede, & Nunamaker, 2003) build on and extend TAM by focusing on the period of time that starts when some people in the organization express interest in using a new technology and that ends when a community of users has become self-sustaining. The model posits that acceptance of a technology is the result of the magnitude and frequency of the perceived net value of a proposed change, moderated by the perceived net value associated with the transition period itself. Although TTM was derived from field experiences with group support systems, the theory is useful for predicting the adoption of collaboration technologies. We contribute to the literature on the adoption of collaboration technologies by suggesting that users' categorizations of a technology are an antecedent of perceived net value. In other words, users' perception of the value of a technology will be influenced by their mental categorizations.

In our study, 46 percent of participants found that virtual worlds were valuable to them (see table 5 above). This is a relatively high number if we consider the observed limited use of virtual worlds. Although our focus was on understanding the antecedents to beliefs and attitudes, and although our data is insufficient to test inferences about the actual use of virtual worlds, we speculate that a key barrier to adoption is the limited acceptance of virtual worlds by peers. The defining use of each of the three categorizations of virtual worlds – medium, place, and extension of reality – emphasizes interaction with others (with differences in terms of the content and extent of the interactions). However ,as one participant explained, "Without those 'others' [using virtual worlds] there will not be much of an interaction". For example, according to one participant. "[There are] not enough people using virtual worlds in my line of work to provide the types of interaction necessary". Another participant agreed: "Many of the people I need to interact with aren't in virtual worlds". Expressing more extreme concerns, some participants noted that virtual worlds were poorly perceived by others. One participant suggested that "Other people at [the company] think they are silly, a waste of time, [they] don't want to learn them." Another participant agreed: "Some managers do not see the benefit and think it is a game and do not allow it during business hours". Yet another participant said that "Customers are not comfortable using it as a meeting alternative. [It] has a stigma of being a game". Thus, consistent with studies of network effects on technology diffusion (Wattal, Racherla, & Mandviwalla, 2010), even if an individual perceives the virtual worlds as easy to use and useful, its benefit is limited if others with whom they needs to communicate are not active users. This suggests that virtual worlds' adoption must happen at the group or organizational level.

Literature on technology adoption by groups (TAG) suggests that group adoption is the result of a process of communication and negotiation in which members' *a priori* attitudes toward the technology, majority subgroup's opinion, high-status members' opinions, conflict, and technology characteristics influence the group's adoption decision (Sarker, Valacich, & Sarker, 2005). We contribute to the TAG literature by demonstrating the importance of individuals' categorizations and interpretations in shaping this process. Groups of individuals must agree on what the technology is and what it is for in order to come to an adoption decision. This argument is consistent with studies of technology framing (Orlikowski & Gash, 1994; Davidson, 2002), which suggest that incongruent technology frames are a barrier to adoption. Together, these findings suggest that technology adoption by groups or organizations requires a common understanding of what the technology is and what it is for, or, in other words, group technology adoption likely requires that the technology fits in a commonly held mental category.

This study also has important implications for practice. Millions of dollars have been wasted on unsuccessful technology implementations (Hirschheim, 2007; Venkatesh et al., 2003). Perceptions of ease of use and usefulness have been found to be a key predictor of technology acceptance and use (Davis et al., 1989; Venkatesh et al., 2003; Venkatesh & Davis, 1996). Understanding their antecedents will support more successful implementations of new technologies. Managers attempting to implement novel technologies in organizations should be aware that how employees categorize and interpret technologies will likely influence their expectations and consequent judgments of the technologies' value.

The knowledge that categorizations influence perceived ease of use and usefulness opens opportunities for training and communication interventions to manipulate mental categorizations and interpretations and consequent perceptions of a technology. For example, Moreau et al. (2001a) found that the category in which consumers expected to locate a product in a store influenced their expectations and preferences. Consumers looking for digital cameras in the camera aisle reported higher photographic performance expectations than those shopping in the computer aisle. Research suggests that mental categorizations can be influenced through education and presentation (Gregan-Paxton & Roedder John, 1997), which suggests that organizations may be able to support more successful implementations by influencing individuals' mental categorizations.

Additionally, research suggests that the challenge of comprehending a new innovation is a key factor in slow adoption rates. For example, Keller, Sternthal, and Tybout (2002) explain that consumers had difficulties categorizing the first PDA's and argue that this difficultly contributed the failure of the product. Drawing on familiar concepts to explain a new technology can facilitate users' comprehension (Gregan-Paxton & Roedder John, 1997). This suggests that managers may be able to support the acceptance of new technologies by actively promoting the creation of new mental product categories and employing analogies to educate users as to what the technology is and the benefits it offers.

Organizations attempting to implement technologies need to be aware of the categorization suggested in their communications and select appropriate examples and analogies when explaining technologies. Given that mental categorization will guide users' expectations, there must be a match between the intended use of the technology and the suggested categorization. For example, an organization intending to use virtual worlds as a simulation tool should not describe the technology in terms of web-based communication affordances but in terms of its ability to simulate experiences not possible otherwise.

Interventions aimed at influencing categorization and interpretation may yield more benefits than efforts aimed at improving interface design or adding technology affordances. As long as there is no clear agreement regarding what a technology is and what it is for, the criteria for judging its value will vary. The criteria may be inconsistent across users because the priority given to different affordances will vary based on how individuals categorize the technology.

Finally, categorizations and interpretations are likely to begin to form before organizational implementations. For example, individuals began using Facebook and the virtual world Second Life for entertainment purposes before business organizations implemented these same tools to support work tasks. Even those who do not interact personally with a technology are likely to have encountered descriptions in the media. In the absence of experiences, images and ideals promoted in the discourse will shape views of new objects and events (Schultze & Orlikowski, 2001). Virtual worlds have repeatedly been the topic of articles in such prominent outlets as *The New York Times*, *Business Week*, and *The Economist*. These interactions, whether in person or through the media, likely influence potential users' interpretations, categorizations, and assessments of virtual worlds. Thus, organizations seeking to implement novel and emerging technologies should have an understanding of employees' perceptions of how and to what purpose a technology will be used prior to implementation efforts. This is particularly true for collaboration technologies in which groups of users need to agree to adopt a technology. Without an explicit effort to come to an agreement regarding what the technology is and what it is for, it is likely that users may form diverging opinions of the desirability of the adoption of the technology, which could slow or hinder the adoption process.

Our research design poses some limitations. We explored the cognitive processes behind potential users' judgment of technology, and our findings are based on an interpretive study conducted in the context of one organization. A qualitative, interpretive study is ideally suited to this purpose because it allows us to access the meanings participants assign to virtual worlds (Orlikowski & Baroudi, 1991). However, interpretive studies are based on researchers' interpretations of responses and thus have limited generalizability to other contexts. The value of interpretive studies lies in exploring subjective and intersubjective meanings and their impact and in making generalizations to theory rather than predicting specific outcomes. Thus, although participants in our study who categorize virtual worlds as a place judged the technology as more valuable than those using other categorizations, we cannot make definitive claims about the relationship between a particular category and a positive judgment. Future research is needed to explore other contexts and organizations, and should also employ other research approaches to investigate categorizations and judgments of value.

Moreover, our study focused on users' interpretations of virtual worlds and has not fully explored the influences of the technology itself, or virtual worlds as an IT artifact, in this process of categorization and interpretation (Orlikowski & Gash, 1994). For example, it is possible that users most familiar with World of Warcraft, a virtual world used primarily for playing and entertainment, categorized and judged virtual worlds differently than those with experience primarily with Wonderland, a virtual environment designed for business applications. Additionally, given the rapid development of virtual world technology, it is possible that the evolution, elimination, and elaboration of features in subsequent versions of virtual worlds' software has influenced (and will influence) users' experiences and categorizations. Future studies need to investigate the relationship between the properties of virtual worlds and categorizations and interpretations of the technology.

In addition, our sample comprised individuals that had a Second Life avatar, but had different levels of experience. We did not explore the link between experience and categorization nor did we explore the mental categorizations of individuals with no experience with virtual worlds. Future research should explore the impact of experience on categorizations. In particular, future research is needed to understand the initial categorizations of non-users who have no first-hand experience with virtual worlds. As we discuss in prior sections, the process of interpretation may begin prior to actual experience as potential users interact with the technology through discourse. Additionally, future research should explore the relationships between different levels and types of experiences and the development of users' mental categorizations over time.

The process of categorization and emergence of "general" or collective product categories occurs over time. Our study was limited to a fairly short time period and our questionnaires were administered at a single point in time. Given the emergent nature of virtual worlds, we expect that interpretations and categorizations of the technology will change as users become increasingly familiar with the technology and a common technology frame emerges. Changing categorizations are likely to influence the development path of technologies by influencing technologists' attention, users' judgments, and investors' decisions (Kaplan & Tripsas, 2008). "Because IT artifacts are designed, constructed, and used by people, they are shaped by the interests, values and assumptions of a wide variety of communities of developers, investors, users, etc" (Orlikowski & Iacono, 2001, p. 131). Future longitudinal studies should explore the emergence, evolution, and diffusion of technology categories as well as how individuals' categorize and re-categorize technologies as they develop over time.

We focused the later stages of our analysis on individuals that drew consistently on only one categorization of virtual worlds throughout the questionnaire. However, some of our participants drew on multiple categorizations. We speculate that as individuals shift between categorizations, their criteria for assessing as well as their judgment of value of technologies may change. In other words, individuals that draw on both medium and place categories may judge virtual worlds more favorably when the place categorization is more salient. Future research should investigate the conditions under which different categories become salient and the implications of multiple categorizations on judgments of the value of technologies.

Finally, most studies of IS technology adoption assume an assessment based on the presence or absence of positive characteristics such as function and ease of use. However, technologies may also be perceived as risky (Gregory, Flynn, & Slovic, 2001). Studies of technology and risk perception are typically conducted in the context of science-based technologies such as nuclear power and genetically modified food (e.g. Jasper, 1992; Kasperson, Jhaveri, & Kasperson, 2001; Krimsky, 1992). However, virtual worlds present some similarity to these technologies. The responses of some participants indicate great apprehension about the technology. This apprehension suggests that the possibility of negative outcomes, not just the absence of positive outcomes, may influence potential users' judgment of certain technologies. Further research is required to understand how perceived risk of negative consequences might interact with potential users' categorizations to influence judgments of technologies.

6. Conclusion

Virtual worlds offer great potential for supporting the collaborative work of geographically distributed teams. However, reports indicate the existence of substantial barriers to the acceptance of virtual worlds in business settings. In this paper, we explore how individuals' interpretations of virtual worlds influence their judgment of the value of the technology. We conducted a qualitative analysis set in the context of a large computer and software company that was in the process of adopting virtual worlds for distributed collaboration. We identified three mental categories used by participants to understand virtual worlds: virtual worlds as a medium, virtual worlds as a place, and virtual worlds as an extension of reality.

We found that these categories influenced potential users' expectations of how and to what end virtual worlds are best used and should perform. Participants' categorizations of virtual worlds influenced the criteria they used for assessing the value of virtual worlds in a business setting. This study contributes particularly to the acceptance of virtual worlds but also more generally to the understanding of technology acceptance by illuminating the antecedents to users' beliefs about technologies.

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Appendix

Table 6. Participant Demographics

		Number	Percent
Gender	Male	89	75%
	Female	29	25%
	Total	118	100%
Age	25-35	18	15%
	35-45	38	32%
	45-55	41	35%
	55-65	21	18%
	Total	118	100%
Functional area	Accounting/Finance	2	2%
	Human Resources	9	8%
	Legal	1	1%
	Marketing	15	13%
	Operations	8	7%
	Research	2	2%
	Services	32	27%
	Software Design	21	18%
	Other	28	24%
	Total	118	100%
Role	Executive	4	3%
	Manager	26	22%
	Supervisor	11	9%
	Individual Contributor	76	64%
	Other	1	1%
	Total	118	100%
Experience with virtual worlds	Less than a month	8	7%
	1-12 months	41	35%
	1-2 years	41	35%
	More than 2 years	21	18%
	No response	7	6%
	Total	118	100%
Frequency of use of virtual worlds	Daily	10	8%
	2-3 times a week	13	11%
	Once a week	9	8%
	2-3 times a month	16	14%
	Once a month	14	12%
	Less than once a month	45	38%
	Never	7	6%
	No response	4	3%
	Total	118	100%

About the Authors

Luciara NARDON is an Assistant Professor at the Sprott School of Business, Carleton University. She holds a Ph.D. in international management and strategy from the University of Oregon. Her research explores the role of culture and cognition in management practice, with particular emphasis on identifying skills and processes required to succeed in a global environment, which includes global leadership, cross-cultural communication, international assignments, and technology mediated work. She is currently in the editorial board of the *Journal of World Business*. She has taught graduate and undergraduate courses in Belgium, Brazil, Canada, Denmark, and the United States. Prior to her academic career, Professor Nardon worked in control systems and strategic planning for companies in Brazil, Portugal, and the United States.

Kathryn ATEN is an Assistant Professor in the Graduate School of Business and Public Policy at the Naval Postgraduate School in Monterey, California. She earned her Ph.D. in management at the University of Oregon. Her research explores the processes and mechanisms that shape the early emergence, acceptance and adoption of technologies. Her research is grounded in her experience working for innovative companies including, Apple, Patagonia, and International Game Technology. She has taught undergraduate and graduate courses in management, business policy and strategy, entrepreneurship, and technology and innovation.