

E-Collaboration and E-Commerce In Virtual Worlds: The Potential of Second Life and World of Warcraft

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ABSTRACT

Virtual worlds can be defined as technology-created virtual environments that incorporate representations of real world elements such as human beings, landscapes and other objects. Recent years have seen the growing use of virtual worlds such as Second Life and World of Warcraft for entertainment and business purposes, and a rising interest from researchers in the impact that virtual worlds can have on patterns of e-collaboration behavior and collaborative task outcomes. This article looks into whether actual work can be accomplished in virtual worlds, whether virtual worlds can provide the basis for trade (B2C and C2C e-commerce), and whether they can serve as a platform for credible studies of e-collaboration behavior and related outcomes. The conclusion reached is that virtual worlds hold great potential in each of these three areas, even though there are certainly pitfalls ahead.

Keywords: e-collaboration; e-commerce; Second Life; user interface design; virtual reality; virtual worlds; World of Warcraft

INTRODUCTION

Virtual worlds can be defined as environments created by technology that incorporate virtual representations of various elements found in the real world. Among those elements are virtual human beings with whom one can interact, virtual physical environments that include land and oceans, and virtual objects like chairs and tables.

Recent years have seen a growing use of virtual worlds for entertainment and business purposes, and a corresponding growing interest from researchers in the impact of virtual worlds on e-collaboration behavior and outcomes (Kock, 2008).

Some virtual worlds, like Second Life, attempt to replicate elements of the real world with practical applications in

mind. Others, like World of Warcraft, are designed with the goal of making people forget about the real world and get immersed in multiplayer games. Users of virtual worlds, sometimes referred to as players or characters, appear to each other as avatars, which are virtual world representations of individuals. Most, but not all, of the avatars have either human or humanoid form; for example, a wolf that walks upright and has hands with opposable thumbs.

The emergence and growing use of virtual worlds begs some interesting questions. Can actual work be accomplished in virtual worlds? Can they provide the basis for trade? Can they serve as a platform for the study of human behavior? This article tries to answer these questions. User interface problems are discussed through a retrospective look at the emergence of online learning courseware several years ago and the discussion of analogies between that and the more recent emergence of virtual worlds. Human evolutionary arguments are put forth for the qualification of the potential of virtual worlds to support modern trade. A discussion of pros and cons to conducting behavioral research in virtual worlds is also presented.

VIRTUAL WORLDS

Virtual reality technologies and artificial worlds created by such technologies may seem now radically new and cutting-edge to many e-collaboration technology users. Yet, Morton Heilig developed an immersive virtual reality technology in the 1950s called Sensorama (see Figure 1), one of the earliest examples of this type of technology. Among other unexpected features for its time, Sensorama simulated odors.

Also, several virtual environments have been conceptualized, designed and used

Figure 1. Sensorama virtual reality system



since the 1960s and 1970s for a variety of purposes, notably for online learning. Those early virtual environments were definitely low-tech when compared with more modern ones, and even modern ones present a great degree of variability in terms of their technology, sophistication and features offered. Strictly speaking, the courseware suites that emerged in the 1990s to support online learning are, in fact, virtual environments, but fall short of the features that characterize virtual worlds.

Virtual worlds are defined here as virtual environments that incorporate most of the elements of the real world, even if those elements are presented in a stylized and somewhat unrealistic manner. Thus, a virtual world would have a terrain, animated things, gravity, and would impose some laws of physics. For example, users could be allowed to fly in the virtual world without the constraints of gravity; but they could also walk, which requires gravity. Two objects would not be allowed to oc-

copy the same physical space at the same time, which is a common requirement for virtual interaction. And so on.

Many virtual worlds exist that can be used through the Internet, each offering different forms of interaction. The underlying technologies are still evolving. Therefore, it is difficult to place virtual worlds into clearly defined categories, and most classifications likely would not be useful for a long time. Still, there seem to be some clear differences between virtual worlds that attempt to replicate elements of the real world to enable concrete applications, and those that are designed with the goal of making people forget about the real world. The former seem to be designed with more practical purposes in mind, such as to facilitate commercial transactions, while the latter are designed to serve as multiplayer computer gaming platforms.

Second Life, developed by Linden Research (also known as Linden Lab), is a good example of a virtual world that attempts to replicate elements of the real world with practical applications in mind. World of Warcraft, developed by Blizzard Entertainment (a division of Vivendi

Games), is a good example of virtual world designed with the goal of making people forget about the real world and become immersed in multiplayer games.

The type of virtual world that is exemplified by Second Life usually contains more human-made elements found in the real world, such as chairs, rooms, buildings, and parks (see Figure 2). Arguably, this type of virtual world is less of a departure from the real world than the type of virtual world represented by World of Warcraft. Also, the elements in the Second Life type of virtual world seem to be easier to reproduce without advanced graphics, which may be one of the reasons why this type of virtual world contains less stunning graphics than the virtual worlds of the World of Warcraft type. Another reason may be simply that video game users expect stunning graphics because they are associated with perceived video game quality. Users in Second Life type virtual worlds appear to each other as avatars, which are virtual world representations of individuals, and most of the avatars have human form. Since users choose the appearance of their avatars, most of the avatars have physical characteristics that many people would consider attractive.

Figure 2. Park scene from Second Life



The type of virtual world that is exemplified by World of Warcraft normally contains fewer human-made elements found in the real world, and a great deal more natural elements such as forests, canyons, rivers, mountains, and waterfalls (see Figure 3). The graphics used are generally of higher quality than in the Second Life type of virtual world, and often evoke fantastic and/or mystic themes. Players interact with each other and with artificial intelligence characters, such as monsters, which they often have to fight for the good of a community in the virtual world or simply to remain alive in the virtual world.

Other examples of virtual worlds that could be loosely placed in the same category as Second Life are Active Worlds, There, and ViOS. Other virtual worlds that could be loosely placed in the same category of World of Warcraft are EverQuest, Guild Wars, and Ultima Online. Still other virtual worlds that do not fit either category, but lean more toward the World of Warcraft type, are Entropia Universe, Red Light Center (modeled after Amsterdam's Red Light District), and The Sims Online.

USER INTERFACE PROBLEMS

The virtual worlds' theme received quite a lot of attention in the 2007 installment of the International Conference on Information Systems held in December, 2007, in Montreal, Canada. This is the most prestigious conference in the discipline of information systems, which is primarily concerned with the impact of technology on individuals, groups, and organizations. Two panels in that conference focused on the discussion of technological aspects and user perceptions of Second Life and World of Warcraft, as well as one or two lesser known multi-user virtual reality environments.

There was a significant contrast between the perceptions of technology designers and users about virtual worlds. Technology designers, including representatives from IBM and Linden Lab, were quite enthusiastic and positive in their discussions of the technologies that enabled the existence of the virtual worlds. That enthusiasm about technological aspects is arguably well founded since virtual worlds are indeed major technological achievements.

Figure 3. Dark forest scene from World of Warcraft



The views from users were quite different, especially when presented by information systems researchers who had conducted apparently disinterested analyses of samples of user perceptions. A constant complaint heard from new users of Second Life is that the interface is rudimentary and the graphics are worse than those found in World of Warcraft and other video games. Users of World of Warcraft, which is much more video game-like than Second Life, also tended to display stronger signs of addiction to their virtual life experiences. Nevertheless, Second Life seems to have many more registered users than World of Warcraft, and concerns about user addiction exist in Second Life as well. Perhaps Second Life has more users because use of World of Warcraft requires purchase of the computer game, while individual use of Second Life is generally free.

It seems from the discussions at the 2007 International Conference on Information Systems that users were much less enthusiastic about the virtual worlds than the technology designers, and that the majority of users had serious problems with the user interfaces. Possibly, the users would have preferred a 1950s Sensorama-like interface updated with today's technology, but it is doubtful that they would be willing to pay what that type of technology would cost now. Other consistent complaints were related to the CPU-intensive nature of the computer programs and the time delays associated with multiple users accessing the systems at the same time over the Internet. Those problems arguably make virtual worlds much less realistic than their designers intended them to be.

Judging from these initial views of Second Life, World of Warcraft and other virtual worlds, it appears that there is a great deal of room for progress in the design of

the interfaces. It is likely that a great deal of that progress will happen in the context of video game design, and then be transferred to virtual world technologies that are not inspired in video games. As the huge success of the Nintendo Wii has taught us, one possible direction for progress is improvement in interactivity support through interface devices whose use are more natural than mice and keyboards. The Wii's remote wireless controller, for example, is a handheld pointing device that detects three-dimensional motion and translates that into game actions.

CAN ACTUAL WORK BE ACCOMPLISHED IN VIRTUAL WORLDS?

Several organizations have set up shop in Second Life, and even allow users to buy products and services there using Linden Dollars, the local currency used by Second Life users that is exchangeable by US Dollars. In fact, the designers of Second Life seem to have had support for e-collaboration and e-commerce in the back of their minds when they developed the initial set of features and rules that regulate user interaction. As one can imagine, not everything is possible in Second Life. For example, there are some limits to the size and appearance of avatars, even though users are given many choices. Also, characters in Second Life cannot give themselves just any type of superpowers, even though they can do some supernatural things like flying. All of this begs the question as to whether actual work, which would also include commerce-related work, can be accomplished in virtual worlds like Second Life.

Gary Anthes wrote a very interesting article for Computerworld, an information technology industry magazine, on his expe-

periences in Second Life (Anthes, 2007). What makes the article unique and particularly useful for the discussion presented here is that it is written from the perspective of someone who was looking at the potential of Second Life to serve as an actual e-collaboration and e-business tool. That is, the article looked into whether actual work and commerce could in fact be accomplished in Second Life, and the possible implications for real organizations.

The main conclusion that one can infer from that article is that Second Life is still far from reaching the point at which it will serve as an effective e-collaboration tool for organizations, if it ever reaches that point. Several problems are raised, some of which are related to the design of the virtual environment and many to the way in which organizations use the environment. For example, new users have some obstacles that they need to overcome in order to experience the full interactivity features of Second Life.

Newbies are required to start out doing four simple exercises in a place called Orientation Island. Well three were simple and one was impossible. (Anthes, 2007, p. 31)

After new users overcome the initial obstacles faced at the orientation stage, if they go through the full orientation stage at all (they can skip the full orientation), there are other difficulties related to the use of certain interaction features. As anybody who has participated in Web-based text chat rooms can attest, new users often have a hard time sending their comments to the right people. Often comments are sent to the whole group when they are intended to only one individual or two. The same problem occurs in Second Life.

Many in the audience [of a presentation] apparently didn't realize that the [Second Life] text-chat function allows a user to chat with just one person or with everybody at once. As a result, there were frequent interruptions ... as well as all kinds of random comments. (Anthes, 2007, p. 32)

Additionally, organizations have apparently made mistakes in the establishment of their virtual presence in Second Life, some of which are very basic mistakes. For example, Second Life allows users to jump out of it and into plain Web sites, as long as hyperlinks are properly inserted into it. After all, Second Life runs on an operating system window that can be minimized while its user shifts his or her attention to programs running on other windows or does other things. This is a feature that can be used by companies to turn an interesting experience in Second Life into a business transaction enabled by a plain e-commerce Web site whose hyperlink is strategically inserted in Second Life. However, that is not always done properly.

I walked into a huge, round auditorium called IBM Theatre I. The seats were all empty, and the stage was bare save for a big whiteboard with some semi-interesting techno-items written on it, each followed by an ordinary Web address. Problem was, the addresses were grayed out, and when I clicked on them, nothing happened. (Anthes, 2007, p. 34)

There are many gems in Anthes' article, which is a relatively long one for an industry magazine. The article also contains inserted in it a rebuttal by Ian Lamont, who agrees with the problems yet is much more enthusiastic about Second Life's future potential. Toward the end of the article,

Anthes makes a suggestion that goes to the heart of the problems that many users likely experience in their interactions with companies with a Second Life presence. Following that suggestion could potentially go a long way toward improving their customers' experience.

Each major company location in SL should be staffed by a real person, at least during business hours. (Anthes, 2007, p. 37)

What about World of Warcraft and related virtual worlds? Since they were designed as computer games their potential in their original form to support e-collaboration and e-commerce is much more limited, with some exceptions such as brand development and other selected marketing applications. Nevertheless, a recent event in World of Warcraft points at its potential as a simulation environment that could have real world benefits. The event was the accidental spread of a virtual plague, called the Corrupted Blood plague, which very closely resembled a real world epidemic. Characters affected by the virtual disease, which was contagious, had their abilities impaired in a way that mimicked what would happen if they contracted a disease in the real world. After Blizzard Entertainment contained the disease and confined it to a specific virtual region, researchers started looking at the potential of World of Warcraft for the study of human behavior in response to epidemics. The interest comes in part from recent real world epidemics, such as the severe acute respiratory syndrome (SARS) outbreak in 2002 and 2003, and the apparent lack of preparedness by governments and other organizations in dealing with those epidemics (Ho & Su, 2004).

The prominent emergence of virtual worlds such as Second Life and their rapidly

growing user base does not necessarily imply that they have an immediately practical e-collaboration appeal. For a virtual world to have a practical e-collaboration appeal, meaning that actual work can be done in the virtual world, the benefits of e-collaborating through the virtual world must outweigh the costs. Possible benefits are time and dollar savings due to the reduced need for physical transportation to meeting sites. Possible costs are reduced communication fluency and increased communication ambiguity due to cumbersome interfaces and interaction delays.

Past experience tells us that if a virtual community of users is created around a technology and grows beyond a critical mass, then practical e-collaboration applications will follow. One example is the Internet and e-mail, which were initially difficult to use and had little business appeal. Their use is now ubiquitous in business. Any virtual world that attracts a large number of users on a global scale will eventually have a business impact, even if for no other reason than its marketing appeal. This will, in turn, lead to technological improvements that will eventually make e-collaboration through virtual worlds attractive as the benefits of e-collaboration outweigh the costs.

THE FUTURE OF VIRTUAL TRADE: B2C OR C2C?

One of the interesting characteristics of virtual worlds is that they enable interaction between individuals who may be physically far apart from one another (e.g., individuals located in different countries) in a common virtual environment. Those individuals interact as if they were in the same place at the same time, which is sometimes referred to as real-time interaction. Whenever individuals can freely interact in this fashion, one can

reasonably expect something to happen. That something is not necessarily falling in love or getting into conflict, although those things may happen as well. That something is a human universal called trade.

A propensity to engage in trade is a human universal in the sense that it is observed in human groups in a wide variety of cultural and physical contexts. In fact, some anthropologists believe that trade is a key element of all human cultures. This means that trade is observed even among non-urban human groups that can individually produce all that they need for their survival. There are many examples of non-urban groups that specialize in the production of items that are consumed by other groups, and that are exchanged by other items produced by the other groups. (The technical term used to refer to this type of exchange is *bartering*, This term is used to indicate any form of trade where money is not used). In non-urban cultures, the reason for this phenomenon seems to be alliance formation rather than the utilitarian need for the items that are traded (the Ricardian model of trade), which in turn reduces the chances of violent conflict among the trading groups (see, e.g., Chagnon, 1977).

In our evolutionary past, this would have increased the reproductive success of the individuals of the groups that engaged in trade compared to groups that did not engage in trade. Violent conflict among any two groups could lead to multiple deaths in both groups. Any environmental element that creates a differential impact on reproductive success also creates the opportunity for genes coding for a related trait to evolve. The trait in this case would be a trading instinct, or a propensity, to engage in trade. The idea here is that all human beings may share genes that induce

them to engage in trade. This would explain why, for example, often people buy things that they do not need. Meg Whitman, the long term senior management leader of eBay, has said that trade is in the human DNA. She might not have meant it in the way just discussed here, but that statement is certainly consistent with the notion that trade may well be an evolved mechanism that increased the reproductive fitness of those human ancestors who possessed it.

Trade in virtual worlds is essentially a more sophisticated version of e-commerce, which can be roughly categorized into two main types: business-to-consumer (B2C) and consumer-to-consumer (C2C). There is a growing trend for both B2C and C2C trade to take place on the Web, and many companies have emerged and done quite well in terms of revenues and profits by providing the infrastructure on which e-commerce can take place. Good examples are Amazon, Craigslist, and eBay.

Virtual worlds have the potential to be the new infrastructure providers for B2C and, particularly, C2C. Virtual worlds are likely to be particularly effective at promoting C2C trade because they are exceptionally effective at putting individuals who are geographically dispersed into virtual contact with each other. That, in turn, has the potential to support the growth of virtual worlds, by bringing in users interested in trade who would not otherwise join them, in a closed feedback loop process. Processes that benefit from self-reinforcing feedback loops often experience exponential growth. In this respect, Second Life and similar virtual worlds are perhaps better positioned than their World of Warcraft type counterparts, since the former have apparently been designed to support virtual trade and work involving geographically dispersed individuals.

One of the reasons why virtual worlds may be particularly appealing as enablers of trade is that they offer a more natural environment than existing Web sites for C2C trade, which is a mode of e-commerce that has been experiencing significant growth recently. If human beings possess a trading instinct, as discussed earlier, then the genes that evolved to code for that instinct did so in what is referred to by evolutionary psychologists as the environment of our evolutionary adaptation (Barkow, et al., 1992; Buss, 1999). In that environment our ancestors interacted face-to-face, since there was no e-mail, instant messaging, or videoconferencing in the Pleistocene or before that. Therefore, one could reasonably expect that the trading instinct will operate more effectively in a face-to-face-like environment today. Second Life provides a more face-to-face-like environment for interaction than Amazon, Craigslist or eBay. Of course, those companies can set up shop in Second Life and get ready for the opportunity that will face them as the self-reinforcing feedback loop process gets started. If the line of reasoning presented here is correct, that would be a wise line of action.

Another interesting conclusion that one can infer from the discussion presented here is that trade growth in virtual worlds is likely to be moderated by human intervention in the form of virtual sales representatives. As pointed out in Gary Anthes' article discussed earlier, it may be quite frustrating for a potential buyer to visit a company-sponsored area in Second Life and not find a sales representative avatar there to help the potential buyer.

The reason is probably analogous to the reason why people generally dislike emoticons when they are used in e-mails to express emotions. In the same way that

emoticons are a poor approximation of facial expressions, often perceived as idiotic and/or mocking little faces, a company branch in Second Life without helpful sales representatives is a poor approximation of a real company branch.

Our species evolved a very complex web of facial muscles, probably more complex than that of any other species (Bates & Cleese, 2001; McNeill, 1998). Nearly all of the evidence available suggests that the complex web of muscles has been evolved almost exclusively for communication through facial expressions in various situations. Given this, poor approximations of faces (e.g., emoticons) are likely to be particularly frustrating because of the significant amount of information given off by, and likely sought from, real faces. If the hypothesis that our species also evolved a trading instinct is correct, then one would expect trade in virtual worlds to depend not only on the existence of an environment that is similar to the real world, but on human interactions that are also similar to those found in the real world where our human ancestors lived. In that ancient world one would not exchange spears for bananas by following instructions on a cave painting. One would likely interact with another ancestral human who would extol the qualities of his or her bananas, sort of like a virtual sales representative would do in a virtual world, and ask pointed questions about the quality of the spears.

Hence the need for virtual sales representatives that act like real human beings, that is, that have real human beings behind them. This would be necessary, at least initially, as users become familiar with the virtual world, after which experienced users would likely be willing to engage in trade without virtual human intervention, much like users do today through Web sites

designed for e-commerce transactions. Virtual sales representatives entirely created by artificial intelligence software are not likely to do very well in that respect. The famous Turing Test suggests that human beings are exceptionally good at recognizing artificial systems trying to pass as real human beings. Another implication of this discussion is that, at least initially, C2C trade may become a stronger driver than B2C trade in the establishment of virtual worlds as mainstream trading environments.

STUDYING HUMAN BEHAVIOR IN VIRTUAL WORLDS

As mentioned earlier, the 2007 International Conference on Information Systems had several presentations and panel discussions that focused on virtual worlds and their impact on various aspects of human behavior. Several researchers hailed virtual worlds as new and promising tools for research on human behavior in those presentations and discussions. However, in the questions and answers period that followed those presentations and discussions, virtual world users in the audience noted that, particularly in Second Life, all avatars look like beautiful people in their 20s and 30s. It was pointed out in follow-up discussions that quite a lot of deception may be going on in virtual worlds. That creates a problem for researchers, who often want to find out if there are correlations between certain types of behavioral patterns and demographic variables such as age, gender, income and country of origin. Even if virtual world users were willing to disclose demographic information about them, probably many would be inclined to lie a bit about that information.

Another difficulty of using virtual worlds to conduct behavioral research is

that the multitude of possible effects on individual behavior may make isolation of specific effects difficult. Much of human technology interaction research is conducted through controlled experiments for exactly that reason. In controlled experiments, the investigators focus on one or a few particular independent variables, such as communication media naturalness (Kock, 2005), and then randomly group the subjects they are studying (i.e., the human participants in the experiment) into conditions associated with those variables. The goal is usually to isolate the effect of the independent variable (or variables) on an important dependent variable. One example of important dependent variable would be an individual's satisfaction with a trade interaction conducted in the virtual world. By employing this procedure, the investigators can study in a focused manner the effect of the independent on the dependent variable, much in the same way that pharmaceutical drug researchers do. Drug researchers often isolate the effect of certain drugs by randomly assigning their study subjects to control (placebo) and treatment (drug) groups.

On the other hand, virtual worlds can be quite useful tools for research that requires more realistic scenarios than those normally used in controlled experiments. One example is the study of large-scale human behavior in response to a disease outbreak or an environmental disaster. What differentiates this type of investigation from the controlled experiment form discussed above is that the researchers are interested primarily in large-scale group responses. In these types of responses, the characteristics and behavior of one individual, or of small groups, are not of major importance. One useful analogy is the modern study of the behavior of investors in certain markets

in response to macroeconomic changes, such as changes in a country's government-regulated interest rates. In many cases, these types of studies can be credibly done even if the researchers disregard individual differences.

This is not to say that controlled experiments cannot be done in virtual worlds. They can as long as certain precautions are taken. For example, a researcher can assemble a group of human subjects prior to them creating their avatars, and collect reliable demographic information from each of them. Then each subject would create a unique avatar in a controlled manner (e.g., no major changes in appearance compared to the real world), and have his or her behavior studied over a period of time in particular circumstances in the virtual world that also contain controlled elements (e.g., virtual crowding or information overload levels). The researcher could create sub-environments where different subjects' avatars would interact randomly; assigning different individuals to sub-environments and then comparing behavior patterns observed in each sub-environment.

CONCLUSION

As we look at the user interface problems of emergent virtual worlds, it is instructive to also look back at the early versions of online courseware like Blackboard and WebCT. Many of the problems with early online courseware suites were interface-related, and some of those problems led to dire predictions about the demise of online instruction and of the companies behind it. Those predictions were made by those at one end of a spectrum of enthusiasm regarding online learning - the very negative end of the spectrum. At the other, positive end of the spectrum, there were those who

felt that online learning tools were going to revolutionize education, changing it dramatically and forever. That, in turn, led some successful enterprises to be established and flourish over the years, such as for-profit educational institutions like the University of Phoenix. It also led to some miserable failures in similar areas, such as various fully-online branches of traditional not-for-profit universities.

And where are we today with online learning? Well, after all the hype in the 1990s, the main trend seems to be to use it to deliver selected courses online and to augment more traditional forms of instruction in other courses. Most university classes are still taking place face-to-face with a slowly growing proportion of them taking place online. There are clear tradeoffs for students and instructors, and more growth is seen in contexts where the cost/benefit ratio is low; for instance, among working students in areas where high bandwidth Internet access is available.

Several empirical studies suggest that it is more cognitively demanding to interact online for both instructors and students. That is, interacting online requires more mental effort and can often lead to mental fatigue faster than face-to-face interaction. Nevertheless, online instruction also gives students who work full time, live in rural areas, or suffer from physical disabilities the opportunity to obtain the education they need to improve their professional and personal lives. Also, in spite of cognitive demands, there is evidence that learning performance is not significantly affected, either positively or negatively. This no-significant-difference effect probably is a result of compensatory adaptation to the less natural online learning media (Kock, et al., 2007).

It is difficult to predict the impact that virtual worlds will have on individuals, groups, and the society as a whole in the future. One possibility is particularly enticing though, and is related to the potential of virtual worlds to contribute to world peace. As mentioned earlier, a propensity to engage in trade appears to be a human universal, a social instinct evolved in part to reduce the chances of violent conflict among the trading parties. Trade also often has a utilitarian purpose, which is to enable the economic production and consumption of goods and services at cost and quality levels that would not otherwise be possible.

From an international trade perspective, this can lead to two main benefits: a reduction in the likelihood that individuals from different trading nations will be willing to engage one another in violent conflict; and, possibly, better and cheaper products and services. Yet the trading instinct evolved in our evolutionary past, when our ancestors communicated primarily through natural face-to-face interactions. Thus, one would expect that its social catalyst effect will be realized if modern humans: (a) trade on a one-on-one basis (i.e., in a C2C mode) or in small groups; and (b) interact through communication media that have levels of naturalness that are similar to face-to-face interaction. As user interface problems are gradually resolved, virtual worlds will provide those natural communication media, and may, in turn, help promote world peace through C2C trade.

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