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Standardization in Virtual Worlds:
Prevention of False Hope and Undue Fear

By Marco Otte and Johan F. Hoorn, VU University Amsterdam

Abstract

New advances in science and technology always come with enthusiasm-inspiring hopes and show-stopping fears. When are such hopes and fears warranted and when are they fictitious themselves? The aim of this article is to see if we can create standards, or protocols, to measure people's hopes and fears during online transactions and connect this to a decision support system that estimates the probability that the user's expectations are right. User and adaptive systems could take measures to deal with the situation, by going ahead if all is clear, taking away undue fear, or downplaying false hopes.

We attempt to do so by theory development through the reconciliation of technology acceptance, hope formation literature, risk perception and problem solving.

We present a framework that we call Your Virtual Future, in which we describe hope and fear formation during future-oriented behavior in virtual worlds. This framework acknowledges the users' experience and knowledge of real and virtual worlds as they are immersed in the contents as well as in the hardware. It accounts for the user's personal capacity to accept delayed gratification and to be able to build up realistic hope. It moreover explains how users select solution paths within the affordances of the virtual world.

We formulate the requirements for standards on undue-fear prevention and justified-hope promotion in virtual worlds – in relation to contents as well as equipment. We suggest that user protocols, the human side of standardization for expectations management, are needed and that technological standards are required to generate a generic interface or shell that serves as a layer to all virtual worlds to tap a user's state anxiety, to feedback regulating instructions, and to automatically self-adapt the system.

Keywords: hope; fear; virtual worlds; protocols; standards; requirements.

Standardization in Virtual Worlds:
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"What is the harm of hope? Undue optimism may mislead some people to develop unrealistic expectations and suffer depression when these expectations are not met." (Young, 1997)

For some, advanced technology marks the beginning of a better future, for others it is the advent of dehumanization and robots taking control. In the early years of videoconferencing, users hoped that virtual contact would equal or even emulate physical presence but nowadays we know that mediated communication is a nice prosthesis for but not a replacement of human-to-human contact (Jeffrey, 2005; Egido, 1988). Violent video games were seen as good for the eye-hand coordination, team building, and even therapeutic tools (Griffiths, 2003) or as the materialization of evil (Bushman, 2004); vide the assumed role of the Doom III game in the Columbine High School massacre. Nowadays we know that certain groups (i.e. young boys with lower social economic status) wish to be like their violent heroes but that the larger group of gamers does not show increased aggressive behavior after playing (Konijn, Bijvank & Bushman, 2007). In other words, with the introduction of advanced technology, users are susceptible to hope and fear, which is sometimes justified and sometimes unrealistic. In addition, these examples also show that hope and fear sometimes are directed at the technological side (e.g., videoconference) and sometimes at the contents (e.g., violent games).

As hope and fear are fundamental aspects of being human (Reading, 2004) that occur in almost every situation, our theory should apply to virtual worlds ranging from business to entertainment and from health to learning applications. An important assumption in this is that people take with them the hopes and fear of the real world to the virtual world and while confronted with its limitations and possibilities, take the thus adapted hopes and fears with them into the next virtual world.

Our contribution is to understand how hope and fear in response to virtual worlds are formed and how to mitigate the effects when hope and fear are false, unrealistic, and undue. We will attempt to put up the requirements for standardization and user protocols in virtual worlds, which should regulate hope and fear from the side of hardware and software (technology) as well as contents. We will see that advanced technology and their contents can serve as the cause of anxiety and anticipation, can strengthen or mitigate these effects, and can be used to prevent or even cure fear and downplay false hopes.

The theories that cater to the issues of hope and fear in relation to technology usually are tripartite: They discern an input (1) and a throughput (2) of (technological) information, outputting a response (3) that can be positive (hope) or negative (fear). Hope is an issue has been left relatively unexplored (Reading, 2004). Fear, on the other hand, is treated on its own (Poulton & Menzies, 2002), in the risk perception literature (Sjöberg, 2000; Reiss, 1991), phobia treatment (e.g. Klinger, et al., 2005; Krijn, Emmelkamp, Olafsson & Biemond, 2004; Lányi, Laky, Tilinger, Pataky & Simon, 2004), and attitude formation (Eagly & Shelly, 1993; Van Overwalle & Siebler, 2005). We wish to integrate these insights into a unified framework to extract requirements of standards in virtual worlds, which should help to prevent the occurrence of false hope and undue fear.

Theoretical overview

Hope and fear both involve a cognitive process about a future situation that is to be achieved or avoided (Reading, 2004; Snyder, 2002; Marks, 2002; Poulton & Menzies, 2002). Hope is described by researchers as an iterative process of the perception of a probability of achieving a meaningful goal through adapting future oriented behavior (see Figure 1; Stotland, 1969; Averill, Catlin & Chon, 1990; Snyder et al., 1991; Snyder, 2002; Reading, 2004).

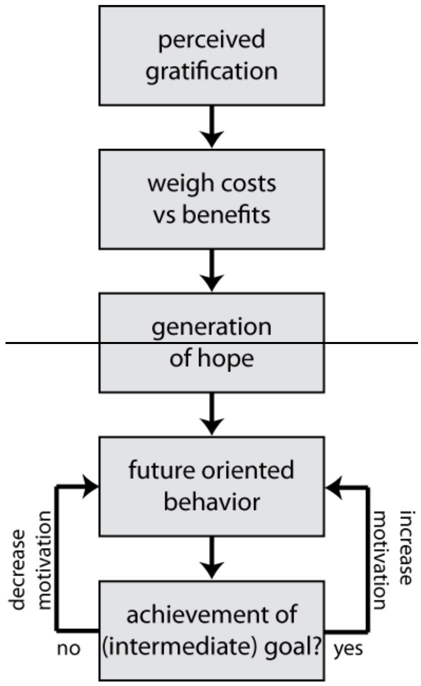

Figure 1. Process of hope generation and adaptation, adapted from Reading (2004, p. 19).

The primary objective of fear is the behavioral avoidance of a perceived danger (Rachman, 1977). In the case of fear we also need to make a distinction between evolutionary or non-associative fear and non-evolutionary or associative fear (Marks 2002; Poulton & Menzies, 2002). Because virtual worlds are not instinctively known as fire or snakes, the identification of associative fear is most important to our present purposes. Associative fear is a fear that needs to be learned. It takes experience, either one's own experience or some one else's, to recognize danger and to experience it as something fearful (Poulton & Menzies, 2002). For instance, culturally pessimistic renditions of robots taking over members of our youth that have become "game junkies" may feed prejudice against virtual worlds and virtual technology.

In both hope and fear situations, then, there is a goal that needs to be reached, an envisioned future situation that does not match the current one. In other words, at the heart of establishing hope and avoiding fear, the user is engaged in problem solving (Snyder et al., 1991; Rachman, 1994; Poulton & Menzies, 2002; Reading, 2004). Perceiving a possibility of solving a problem will increase motivation and drive the future oriented behavior needed to execute the solution (Reading, 2004; Snyder et al, 1991; Snyder, 2002; cf. Ryan and Deci, 2000). On the other hand, if the solution to a problem cannot be found, initial hope can turn into fear (Reading, 2004).

Problem solving is an iterative process that looks at similar past problems and any known solutions that can be applied easily to the new problem—so-called associative problem solving (e.g., Mayer & Wittrock, 2006; Nijstad & Stroebe, 2006). If a problem falls within past experiences, this will lead to an accurate prediction and a high expectancy of the outcome of the future oriented behavior. It generates a sense of autonomy, competence, and a set of possible solution pathways (Averill et al., 1990; Snyder et al., 1991; Castranova, 2007; cf. Self Determination Theory, Ryan & Deci, 2000).

For a novice to virtual worlds, the problem may be too different from past experiences so that existing solutions no longer work and more risky innovative thinking is required to assess possible new solution pathways (Jonassen, 2000; Mayer & Wittrock, 2006; Norman, 2008). The resulting risk perception is influenced by both internal factors (e.g., experience, level of optimism) and external factors (e.g., information from others, culture, technological devices). In unfamiliar circumstances, assessment of possible risks is the weighing of costs and benefits of a possible solution (Lichtenstein, Slovic, Fischhoff, Layman & Combs, 1978; cf. Reading, 2004).

It is important to know that risks can only be assessed after experience is gained regarding the current or similar situation or when others supply information about the riskiness of it (Sjöberg, 2000). Risk assessment of novel situations is therefore a risky business of its own right, as falsely assessing the risks involved bears the danger of having an unrealistic risk perception and expectancy of achieving a goal. This may lead to false hope or even fear (Snyder, 2002; Rachman, 1994). In a virtual world, the artificial environment offers the user a continuous stream of new information, limiting the user's attention to the ongoing problem solving processes (Lang, 2000; Castranova, 2007). Therefore, assessing the risks of possible solution pathways becomes more difficult. Users will become uncertain about the feasibility of solutions and this, in turn, affects the generation of hope and fear.

The de facto standards for assessing user perception of technology are the Technology Acceptance Model (TAM, Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTUAT, Venkatesh, Morris, Davis, G. & Davis, F., 2003). These models look into the perception of usefulness (Do I need this?) and perception of use (Am I able to use this?). Confirmation of the perceived usefulness and use leads to a more positive attitude towards the technology and its capabilities to help the user. Confirmation of the lack of usefulness and use leads to a much stronger and longer lasting negative attitude (Venkatesh & Speier, 1999). This is congruent with the iterative characteristics of hope, fear, and problem solving.

In the UTAUT model (Venkatesh et al., 2003), four aspects are identified as significant for the generation of technology acceptance: performance expectancy (will the system do what I want?), effort expectancy (do the benefits outweigh the effort?), social influence (is the use of this system socially acceptable?), and facilitating conditions (is there help when I am stuck?). The problem with many current and new systems, whether they be hardware or software, is that marketers often claim that the system can work wonders thereby generating a high expectancy, but in reality overstate their claims. These false expectancies will lead to false hope or eventually to fear of use, regardless of whether this is realistic or not.

Your Virtual Future

In Figure 2, we present a framework that we call Your Virtual Future (YVF). It summarizes and attempts to integrate the processes described into the theoretical overview. With the help of this framework, we can identify at which points the user builds up hope and fear when confronted with virtual technology. At these check points we can develop means (protocols, standards) that mitigate hope when it is false and prevent unnecessary fear.

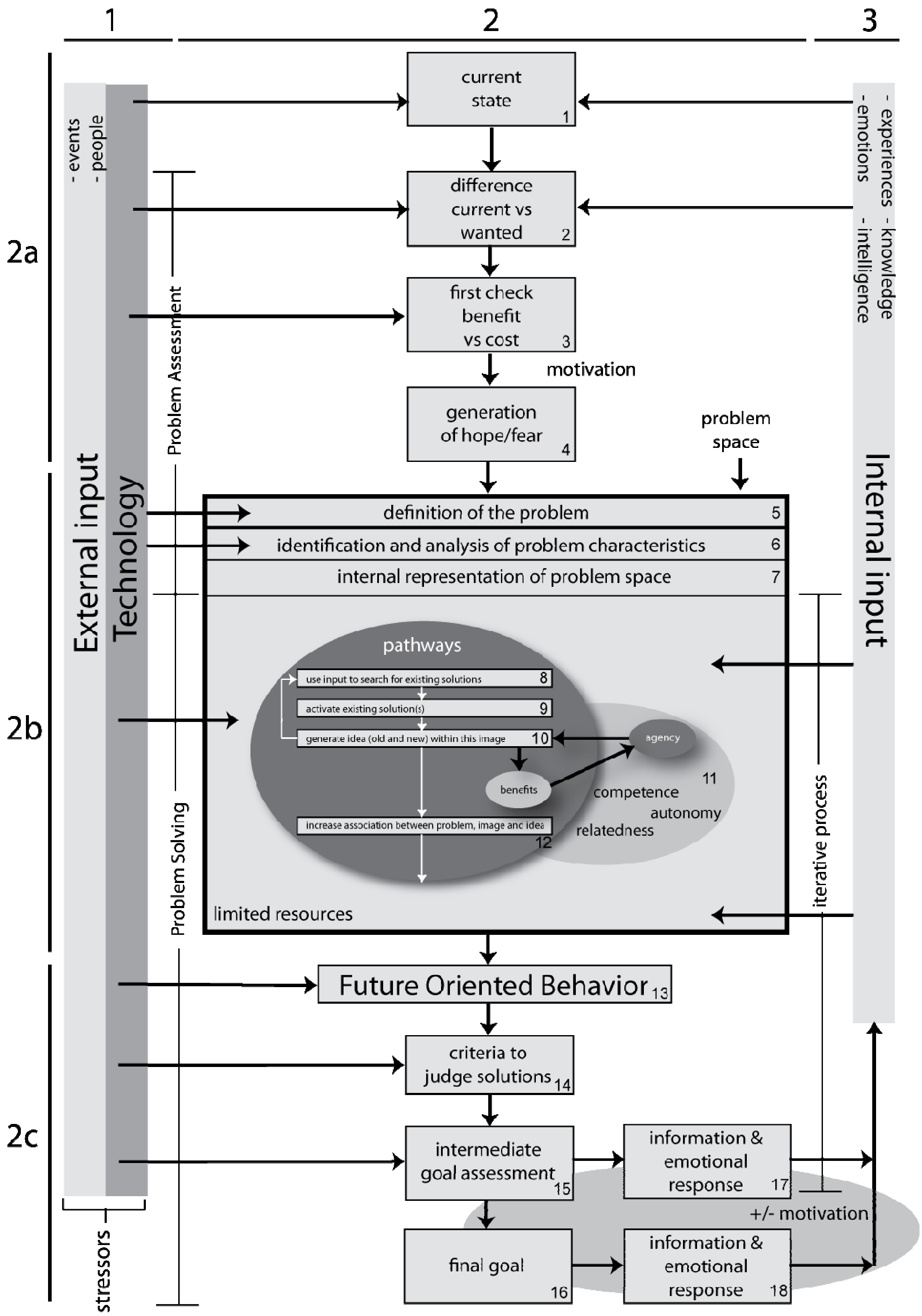

Figure 2. Your Virtual Future.

YVF follows a double threefold structure. In the middle is the main process of hope and fear (column 2), flowing from the sub-process of hope and fear generation (row 2a), through to the problem solving stage (row 2b), and then to the resulting future oriented behavior, its results, and its evaluation (row 2c). At both sides of the central process are the external input factors (column 1) and internal input factors (column 3) which affect the central process at multiple stages and can be affected themselves through feedback loops.

The main process of hope and fear starts when the user knows that she or he will enter or has entered a virtual world with a certain task in mind. At that moment the current situation (2a1) will start to deviate from the wanted situation. A good example is that the user may feel that the represented situation is not realistic enough (e.g., not lip sync, awkward biomechanics, communication barriers). This will strongly depend on external (1) and internal (3) inputs at that moment. The external inputs can be in the form of people (both in actions and in communication towards the user), instruction of use of the system, or events or objects in the current (virtual) environment. The internal inputs consist of, among other things, relevant experiences, emotions, knowledge, and cognitive capabilities.

For example Second Life has an intricate monetary system that allows users to buy and sell objects, land, scripts, and convert the virtual money back to physical money. OpenSIM has no monetary system at the moment.[1] Although both virtual worlds appear to be quite similar the user, the difference in affordances confronts the user with different sets of action possibilities. Because users transfer their hopes and fears from one world to the other, travelling from Second Life to OpenSIM, the latter decreases hope of making money and increases fear of loss of control due to the missing affordances of financial transactions.

Of course, the user needs to detect this deviation before she or he can act upon it (2a2).

The user will make a preliminary assessment of the benefits and the costs (2a3) of using the system, for example, for training purposes. This assessment leads to the generation of either hope or fear (2a4). Depending on the previous steps, this hope or fear can be unrealistic. For example, people fear that the magnetic markers of a Polhemus system send ‘bad currents’ into the brain. The arrows between columns 1 and 2 and 3 and 2 show the points at which both internal and external information can affect this formation process. From that moment on, the iterative process of hope and fear starts. It starts by actually acknowledging that there is a problem and precisely defining what the problem is (2b5). Once the problem is clearly defined it must be analyzed and divided into sub problems (2b6). This definition of the problem results in the setting of one or more sub-goals that need to be achieved to solve the problem.

These actions lead to a mental representation of the problem(s) in a so-called problem space (2b7). The problem space has all the information needed to start working on the possible solutions. The user seeks the memory for past experiences that are the same or similar to the current problem (2b8). Previous solutions are retrieved from memory (2b9) and if none are available, the user creates new solutions based on solutions of old problems that are more remote.

[1] http://opensimulator.org/wiki/Money: retrieved 15-09-2009

The generated ideas or solution paths are then viewed in the light of the current problem (2b10). The user assesses the risk (would this solution work?). Success and failure are set by weighing costs against benefits and by the user feeling competent and autonomous enough (2b11) to implement the solution. If the solution is deemed unfeasible, the process of finding solutions starts anew. Once a pathway is selected, it is connected to the problem and the current situation, stored in memory (2b12) and the solution is executed. Just as in the formation section of the process, the entire problem solving process can be affected by both external and internal input.

The implementation of the solution is what is called Future Oriented Behavior (2c13) and is a characteristic of all the processes involved in hope and fear. After working a while on the selected solution pathways, the user will look for results and check these results against the progress made towards the goal (2c14). If the results concern a part of the total problem, then an intermediate assessment will be made about the results and will lead either to a positive assessment (one step closer to the goal – inspiring hope) or a negative assessment (stagnation or worse, one step further from the goal – inducing fear) (2c15). If the solution actually represents the last solution pathway planned, then the new current situation will be compared to the envisioned final goal(s) (2c16). Both the intermediate and final assessments of results will lead to a feedback that informs the user about the successfulness of the chosen solution pathways, enhanced with the emotional response to it (2c17 & 2c18). This will affect the user's perception of agency and competence, which will in turn affect any ongoing problem solving processes and provide new or adjusted information for the next round of hope or fear generation. Again, external and internal information can influence the intermediate steps and have an effect on hope and fear.

Towards requirements for the regulation of hope and fear

At the points where there is a horizontal connection between external input (1) and the main process (2) or internal input (3) and the main process (2) (Figure 2), there are possibilities to influence hope and fear formation. It is at these points that the user generates some form and level of expectancy about using the virtual technology and its effects on achieving the user's goals or not. And it is here that the management of the user's expectations during interaction is of high importance (Boehm, 2000).

A behavioral protocol or technical standard should support setting, capturing, and influencing the users' expectations when these expectations are false. In Figure 2, these three actions can be applied at any of the connections between the main process (column 2) and the external input (column 1). Figure 3 illustrates this process of expectation management.

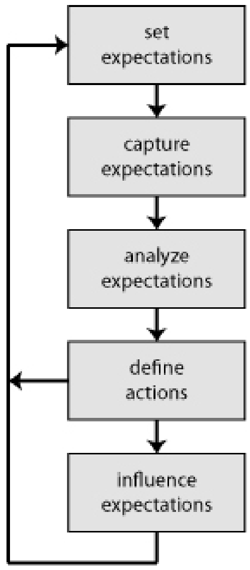

Figure 3. Managing expectations

A virtual-world system should provide the following features to manage user expectations and regulate hope and fear. First, it should be possible to capture the user's set of expectations before actual use of the machine. Standard ways of doing so include running a small query or providing a customization wizard. However, an approach that is less boring to the user and more in line with the virtual experience is that of offering association games that measure attitudes (e.g., implicit Measurement through Games (iMG)),[2] here towards the virtual hardware and software.

Second, analysis of the user data should be done automatically and fast so that the system can provide proper feedback and influence the attitudes. This feedback should be based on the difference between the attitudes and expectations obtained from the user and the range of possibilities that the system actually has. For instance, with transparent goggles you can augment the room with virtual entities, but they do not replace reading glasses. So if hopes are high that current systems support visual correction, the system should reply "Not right now but maybe in the future." This way, we set the user's expectations about the current state of the system (Figure 2, point 2a1).

Third, while the user interacts with the virtual world, the system should be capable of measuring the user's hopes and fears online. To achieve this the system should be capable of detecting the temporary sub goals the user is likely going to set for task execution, estimate the users expectations about action possibilities and affordances of the available features of the system, and be able to measure the user's affective states. Task analysis should provide a database of sub goals at each task that can possibly be performed with the system. Small choice experiments place the user for decisions that show the system whether s/he is still on the right track. For instance, the system can tell the user to get to a location in Second Life as fast as possible. If the user then starts to walk all the way to the destination, the system knows the user has no knowledge about the affordance of flying there. Meanwhile, affective states may be measured online through brain-computer interfaces (e.g., arousal), respiration, or galvanic skin

[2] http://www.camera.vu.nl/research/intmethods/img.html

response. This is perhaps easier for measuring fear (serotonin level, pupil size, sweat) than for hopes.

Fourth, virtual worlds should become adaptive interfaces that provide unobtrusive feedback to prevent the user from undue fear and false hopes with regard to the system. In Van Vugt et al. (in press), we found that self-similarity of embodied agents enhanced the effects of helpful or unhelpful affordances of the agent. Self-similarity increased the willingness to use an agent, provided that the agent's advice and efficiency was good. If affordances were poor and obstructed successful task completion, users—particularly men—did not want the agent to be self-similar and preferred dissimilar agents.

In using Your Virtual Future as a framework, then, avatars could be modeled after the user's physical appearance with (Web) cameras or archived photos. Accordingly, the user's performance is measured by the number of correctly executed computer tasks. A brain-computer interface could sample error-related negativities (ERNs), negative peaks in the EEG activity within 100 ms after performing an action, indicating that the user realizes s/he has made a mistake. When the user makes mistakes above an empirical threshold value, the humanoid interface could morph back into dissimilarity. If the error rates decrease, the face of the user is once again morphed with the face of the embodied agent. This can be done in various gradients, modeling the agent after the user's appearance at the rate of the successful use of the application. In other words, feedback is provided without the user consciously noticing it.

If the user is doing fine, high hopes about his or her performance and that of the system are rewarded by self-similarity. Disappointment and fear of failure is mitigated by dissimilarity, because mistakes are not the user's 'fault' but attributed to the system, who will promise to do better next time and provides the user with suggestions for better performance.

Fifth, to measure the user's changes in hope and fear we need robust ways to send and retrieve information between the real, physical world and the virtual worlds in which the user is participating. The less intrusive the measurements are, the better it would be. The monitoring equipment, the software that controls these devices, and the software that controls the interaction with the virtual world and the virtual world itself all need to be able to communicate to make the needed flow of information possible.

Towards an experimental setup

To illustrate a way of testing the effects of technology on hope and fear imagine an experimental set-up that consists of two apparently similar virtual worlds in which the user will participate in buying and selling items through a virtual auction house. Both virtual worlds can be equipped with a varying set of helpful and obstructive affordances that help or hinder the user at accomplishing the predefined tasks. We expect that a virtual world with more helpful functionality will increase the user's hopes, where as a virtual world with more obstructing functionalities increases a user's fear.

By letting the user migrate between two virtual worlds and at the same time alternating through the possible combinations of the helpful and obstructive affordances (see Table 1), the user is confronted with different situations, and thus different problems, to achieve the predefined goals.

Table 1. Overview of the possible conditions between two virtual worlds with helpful and obstructive affordances. Virtual World 1 is kept constant while Virtual World 2 systematically varies as an experimental condition.

	Helpful	Obstructive
Virtual World 1	Yes	Yes
Virtual World 2	No	No
	Yes	No
	No	Yes
	Yes	Yes

	Helpful	Obstructive
Virtual World 1	No	Yes
Virtual World 2	No	No
	Yes	No
	No	Yes
	Yes	Yes

	Helpful	Obstructive
Virtual World 1	Yes	No
Virtual World 2	No	No
	Yes	No
	No	Yes
	Yes	Yes

	Helpful	Obstructive
Virtual World 1	No	No
Virtual World 2	No	No
	Yes	No
	No	Yes
	Yes	Yes

The first moments after changing from one virtual world to the other probably will be crucial in determining hope and fear. Hope that was established in the helpful VW1 can be shattered within minutes after entering the VW2. The differences between the two virtual worlds can be created in the hardware and/or software. For example, whereas in one virtual world the user has to deal with a bare bones transaction system, the other virtual world might offer the user an appraisal system that helps in setting the best (high profit, high success rate) price. Another example could be to offer a tactile feedback system (rumble) to indicate an important change in the auctions. Or the system offers an extensive history of sales that helps the user to determine when to buy and when to sell. Taking it one step further, a user could use a stereoscopic head-mounted-display device with head tracking to be able to look around in the virtual world and so get optimal access to all the relevant information displayed on multiple virtual screens, while in the other virtual world s/he has to settle for a standard wide-screen physical monitor which requires much panning around to see the same information.

Conclusions

The hope of reaching a future goal or avoiding a fearful situation involves an iterative process in which many internal and external influences play a role. Once hope or fear are attained by assessing the perceived feasibility of the goal in terms of benefits, costs, risks, and personal capacities, solutions must be found to overcome the discrepancy between the current and desired or current and feared situation. The problem solving leads to the future oriented behavior that is needed to achieve goals.

Problem solving leans heavily on past experiences to come up with known and trusted solutions. Currently, only a happy few has ample experience with virtual worlds, and the problems with which novices see themselves confronted may be too different from their past experiences to be easily solvable. The unfamiliarity of novices with the technology may lead to an unwarranted trust in new technology or to unrealistic fear that comes from technophobic pessimism

We have attempted to set up a framework that combines all these processes into one framework: Your Virtual Future. The framework shows the main process of hope and fear formation and the possible points where internal and external influences might affect it. These are also the points where we expect it is possible to influence the users' perceptions of the future and regulate any undue fears or false hopes.

To do so, behavioral protocols and technical standards should facilitate setting, capturing, and influencing the users' expectations. For this, a virtual world system should facilitate: 1) capturing the users' expectations before entering the virtual world, 2) analyzing these data and providing feedback on unrealistic expectancies, 3) continuously measuring the users hope and fear by comparing the users' decisions to predefined ones, 4) giving unobtrusive feedback to prevent or mitigate false hope and undue fears, and 5) being able to handle the flow of diverse information between the physical and virtual worlds.

With the current state of technology and knowledge it should be no problem to capture, analyze, and respond to the users' expectancies before she or he enters the virtual world. It will be interesting to see what unrealistic expectancies users have of virtual world technology and determine what lies at their basis. The same goes for the continuous measuring of a user's actions, and comparing these against a predefined set of actions.

More works needs to be done in combining current BCI work with an unobtrusive feedback system to guide the user from unrealistic hopes and fears. What user reactions are usable? How high must the threshold be before feedback is rendered? How much feedback is needed to achieve the mitigation of unrealistic hope and fear? What are the effects of too little or too much feedback, if any? Finally, to make such a system generally applicable, the underlying technologies must be able to communicate with each other, something that is not easily accomplished at the moment. Initiatives to alleviate this problem are currently underway in projects such as the Metaverse1.[3]

[3] http://www.metaverse1.org

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