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VIRTUAL INTERACTIVE INTERVENTIONS FOR REDUCING RISKY SEX

Adaptations, Integrations, and Innovations

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I met him at a house party given by friends of friends. He was so hot, I was attracted to him immediately. We danced and as we talked about ourselves I found myself more and more attracted to him. After a few drinks I decided to stay at his place for the night. We were naked and I was really caught up in the moment and just didn't want to think about using a condom—or anything else, but a little voice kept saying, "Are you kidding, anal sex without a condom...you know how dangerous that is, tell him you want to play safe, right now."

Most virtual interactive interventions designed to change risky sexual behaviors involve adapting an existing conventional interpersonal or group intervention into a computer-generated version. For example, there might be a classroom-based intervention with modules on learning how to use a condom correctly or how to negotiate safer sex; these modules could be adapted to be conducted virtually (e.g., with video or a game) instead of face to face. Increasingly, however, developments in virtual interactive technologies are enabling features that allow us to move beyond adaptation and inspire theoretically and empirically based intervention integrations and innovations. In such cases, the user can be part of virtual narratives, like the realistic one depicted above in which self-regulation enhancing interventions interrupt and alter more automatic risky decisions.

We begin our chapter on virtual interactive interventions with a definition of the term, and then we provide an example of one such intervention, SOLVE

(Socially Optimized Learning in Virtual Environments). After using this example to illustrate the potential advantages of this approach, we briefly review the work of other researchers in this domain. Because there have been a number of recent reviews of interactive approaches (e.g., Noar, Black, & Pierce, 2009; Noar, Clark, Cole, & Lustria, 2006; Noar, Pierce, and Black, 2010), we focus primarily on those that have been found in randomized trials to be efficacious for reducing risky sexual behavior. We exclude studies that do not evaluate interactive interventions (e.g., Scholes et al., 2003 [subjects' answers to computer-based questions yielded magazine-style printouts, a noninteractive format]), and we exclude digital games that do not simulate an interpersonal communication (e.g., *Pos or Not*, 2009 [users guess whether a photo is of a person with HIV or not]; *Shagland*, 2011 [digital characters chase condoms]). Finally, we conclude our chapter by discussing the effectiveness, dissemination, and cumulative science advancement potential of virtual interactive interventions.

Virtual Interactive Interventions Defined

Virtual interactive interventions are defined as interventions delivered over the Web or a computer (including interactive videos and computer games) that involve a social interaction with real or perceived others with the aim of optimizing users' healthier choices (Appleby, Godoy, Miller, & Read, 2008; Read et al., 2006). Individuals, particularly younger ones, at risk for contracting STIs/HIV may be most responsive to such computer mediated interactive interventions (Appleby et al., 1996; Miller, Christensen, Appleby, Read, & Corsbie-Massay, 2010; Read et al., 2006). Interactivity "can be defined as the degree to which a communication technology can create a mediated environment in which participants can communicate (one-to-one, one-to-many, and many-to-many), both synchronously and asynchronously, and participate in reciprocal message exchanges. With regard to human users, it additionally refers to their ability to perceive the experience as a simulation of interpersonal communication" (Kioussis, 2002, p. 372; see also Noar et al., 2006).

Socially Optimized Learning in Virtual Environments (SOLVE): An Example

Our SOLVE intervention begins by putting the target population—men who have sex with men (MSM)—in an interactive virtual environment in which, unlike with passive media such as videos alone, users' choices affect how the scenario unfolds. The scenarios are designed to simulate typical narratives and choice points (e.g., using alcohol or not, using methamphetamine or not, successfully negotiating safer sex with one's partner or failing to do so) leading up to sexual risk taking (i.e., unprotected anal sex). The sexual scenario begins with preparation for the date (e.g., ensuring condoms are fresh and available). Later, the user seeks a

partner at a club in the “hooking up” phase, when he chats up and ultimately finds an attractive partner. After going home with his partner, the user negotiates safer sex in the partner’s apartment and bedroom before having sex. Building on this narrative base, the intervention components are designed to optimize the learning of self-regulated safer sexual choices in challenging risk contexts.

Advantages and Illustrations of This Approach for Health Communication: Cognitive and Affective Aspects of Decision Making

Virtual interactive interventions can often readily be adapted from effective interventions designed for individual or one-on-one counseling interventions (for reviews, see Fisher & Fisher, 1998, and Peterson & DiClemente, 2000). Interventions whose designs have been guided by theory have been associated with stronger behavioral outcome effects (e.g., Webb, Joseph, Yardley, & Michie, 2010). The three most extensively used theories for Internet delivery (Webb et al., 2010) have been the transtheoretical model (TTM; Prochaska & DiClemente, 1984), the theory of reasoned action/planned behavior (TPB; Fishbein & Ajzen, 1975; Ajzen, 1991), and Bandura’s social cognitive theory (SCT; Bandura, 1989). Related models (e.g., information motivation behavioral skills model [IMB]; Fisher, Fisher, Bryan, & Misovich, 2002) and the AIDS risk reduction model (Catania, Kegeles, & Coates, 1990) incorporate and integrate components from other theories. Although these theoretical approaches differ, collectively they have focused almost exclusively on more deliberative, conscious, and cognitive aspects of behavior change (e.g., changing cognitions and the balance of pros and cons for the behavior, enhancing skills and self-efficacy, enhancing motivation, enhancing intentions to engage in the behavior, etc.). They tend to neglect more affective-based aspects. SOLVE, however, considers both.

In terms of the more cognitively focused theories, SOLVE models how to negotiate safer sex with one’s partner even when he resists condom use (Appleby, Miller, & Rothspan, 1999; Edgar, Freimuth, & Hammond, 1988) and features “guides” who narrate the story of a romantic couple and provide feedback regarding safer sex to the user. Scenes of the couple model how to negotiate safer sex as well as correct condom use in a sex-positive, playful, and erotic way (e.g., “I have condoms, all colors, flavors, and sizes!”). More unique modules (e.g., methamphetamine [MA] and HIV risk), during which MSM learn how to perform refusal skills and in which their beliefs about MA are challenged by the guides, were added because methamphetamine use is associated with increased sexual risk taking in the target population (Appleby, Briano, et al., 2010).

Evaluations of SOLVE show that MSM in the intervention, compared to those in the control group, develop enhanced skills and perceived self-efficacy in negotiating safer sex (Appleby, Miller, & Christensen, 2010). SOLVE also significantly changed key cognitions (e.g., Ajzen, 1991; Ajzen & Fishbein, 1980; Bandura, 1994;

Beck, 1970) that have also been found to predict risky sexual behaviors (e.g., Fisher & Fisher, 1992; Kelly, 1995; Peterson & DiClemente, 2000). For example, guides discuss the consequences of HIV infection (e.g., “Even though there are treatments for HIV, they don’t work for everyone and the side effects are no picnic”) and the link between behavior and immediate and long-term negative outcomes (e.g., “You don’t want to break out in a case of herpes right before your cousin Lupe’s quinceañera”; “You can get HIV whether you’re the top or the bottom”).

Unlike other virtual interactive interventions, SOLVE also addresses the affect-based route to decision making (Bechara, Damasio, Tranel, & Damasio, 1997; Miller et al., 2009, 2010; Read et al., 2006; see Figure 5.1). Given research on state-dependent learning (Bowers & Forgas, 2000), activating sexual arousal with virtual scenarios and choices of sexual behavior (e.g., mutual masturbation, anal intercourse) might better simulate real-life risky sexual decision-making challenges. SOLVE has been designed to do this and, in fact, has been shown to significantly enhance sexual arousal compared to a control (Miller, Appleby, & Read, 2011). Virtual interventions designed to interrupt and change risky behavior under more emotionally similar conditions might then be more effective than interventions not designed for such situations. As we review below, SOLVE also has shown such effects.

A range of emotional obstacles to safer sex in the context of sexual decision making (e.g., sexual arousal, desire for an attractive man) may activate other emotions (e.g., shame) based on prior emotional experience (Damasio, 1994). For example, MSM often experience stigma and shame associated with their sexual

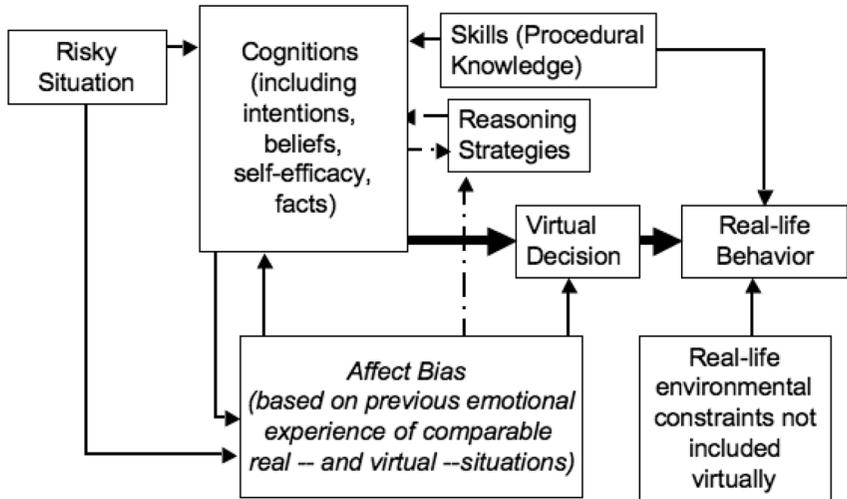


Figure 5.1 SOLVE Conceptual Model for reducing sexual risk taking

orientation (Balsam & Mohr, 2007; Herek, 2002). Such emotions, unaddressed, may more automatically increase the probability of engaging in sexual risks (Appleby, Briano, et al., 2010; Tangney & Dearing, 2002). To reduce stigma associated with MSM's sexual orientation, SOLVE interactive video interventions offer two innovative design features: (1) they are "sex positive" and (2) they incorporate strategies (see narrative self-regulatory circuitry in the next section) designed to change self-regulation capacity to reduce sexual risk taking (Read et al., 2006). In SOLVE, MSM's feelings of shame were significantly reduced by the intervention (the first intervention to do so). Furthermore, changes in shame significantly predicted reduction in unprotected receptive intercourse over three months (Christensen, Miller, & Appleby, 2010).

Narrative Self-Regulatory Circuitry

To enhance self-regulation, guides respond immediately if users make a risky choice in the narrative (e.g., unsafe sex). Guides provide what developmental psychologists, based on the work of Vygotsky (Berk & Winsler, 1995), refer to as scaffolding, or the temporary support that the teacher provides to the learner until that learner can self-regulate his or her own learning. The guides in SOLVE do this virtually through an Interrupt–Challenge–Acknowledgment–Provide (ICAP) sequence. That is, they *interrupt* more automatic risky choices, *challenge* those choices and beliefs, reward safer decisions, and use appropriate loss- and gain-framed messages to focus MSM on considering the future consequences of their actions (Appleby et al., 2005). Guides then *acknowledge* MSM's emotions, motives, and beliefs that may be conflicting (e.g., desire and shame). Here guides may read the affective cues of self and other; interpret and make inferences about cause, effect, or intent of one's own or the other's behavior; and clarify self and other goals, emotions, and beliefs. Then, guides *provide* a reframing of the situation and a set of strategies that grapple with conflicting beliefs, emotions, and motivations and help keep MSM safer (Read et al., 2006).

Users can then choose to make the same decision or an alternative less risky choice, and those decisions are recorded by the program. At the end of the intervention, guides provide a recap of individual MSM's choices with positive reinforcement for safer choices. For risky choices, they provide alternative scenes to model how safer choices could have been made. In short, SOLVE affords theory-based intervention integration across both cognitive and affective-based theories of decision making to better optimize risk reduction.

Virtual Interventions: Engaging and Responsive

Virtual environments can be particularly engaging (e.g., Woolf-King, Maisto, Carey, & Vanable, 2009) and can enhance intervention effectiveness (Zhang, Zhou, Briggs, & Nunamaker Jr., 2006). In some virtually interactive interventions (e.g.,

Read et al., 2006), users do not merely observe the actions of others and make choices regarding what intervention components to see in what order (as in Downs et al., 2004); instead, they make a series of choices that affect actors' behaviors and how the scenario unfolds. Users identify with the characters and come closer to owning the decisions. This significantly enhances participant engagement in the intervention compared to a condition in which MSM passively observe characters modeling choices, without making active choices for the characters (Miller et al., 2009).

Virtual interventions also are responsive to users, primarily through tailoring of program responses to user input. Tailored interventions (see chapter 8 of this volume) have been shown to be more effective than nontailored interventions (Salovey, 2005). Virtual environments can make it easier to tailor responses not only to a given individual's preexisting characteristics (e.g., Kiene & Barta, 2006; Mackenzie et al., 2007) but also to their prior behavioral responses within the virtual intervention itself (Read et al., 2006). In addition, in interactive technologies, optional mentoring is possible when the user desires it. This allows the user to ask for advice or seek out help when making decisions about safer sex or alcohol and drug use, for example, further tailoring the experience to the user's needs. In SOLVE, this optional mentoring was available at a variety of choice points (e.g., whether to get alcohol, whether to buy methamphetamine, deciding what type of sex to have, deciding how to negotiate safer sex).

Achieving a Better Understanding of Active Change Components

With multicomponent interventions, researchers typically use a randomized controlled trial (RCT) to assess how the overall intervention compares to a control condition. These studies are called *summative assessments*. But, in developing an intervention, it is often difficult to test which components are likely to be effective or not, for whom, at which point, and under what circumstances. Virtual interactive interventions can address this need by using small portions of the interactive narrative and systematically manipulating intervention messages and components to assess users' behavioral intentions. For example, in SOLVE, we recently tested and found that the effectiveness of a message depended on whether the user's immediately preceding choice was risky or safer (Christensen, Miller, Appleby, Read, & Corsbie-Massay, 2009).

Improved Intervention Delivery and Dissemination

Virtual interactive interventions have greater potential for improved delivery and dissemination. In terms of delivery, for example, interventionists do not need to be trained and available to perform the intervention; this can greatly reduce costs of implementation. Additionally, virtual interactive interventions afford exactly

the same responses given user choices for each user, enhancing the fidelity and reducing errors in intervention delivery or “slippage in message delivery” that can happen with HIV counselors (Appleby et al., 1996). Once the virtual interactive intervention has been developed, it can be rapidly disseminated to clinics (e.g., via DVD) or even more rapidly disseminated over the Web (Webb et al., 2010) to a given individual within or outside of a clinical context.

This means that at-risk individuals who typically cannot or do not frequent clinics or other sites of traditional intervention delivery (e.g., rural populations and MSM who choose not to socialize in the mainstream gay community) can still receive interventions and do so at their convenience. The Internet is a safe environment in which to learn about sexual negotiation skills, facts about HIV prevention, and risk factors associated with HIV such as the use of methamphetamine (Appleby, Miller, et al., 2010). A variety of interactive interventions involving changing risky sexual behavior are already being delivered and evaluated over the Web (Noar et al., 2006). Interactive interventions offer great promise for combining interpersonal efficacy with mass media’s reach (Cassell, Jackson, & Chevront, 1998).

Are Virtual Interactive Interventions for Reducing Risky Sex Effective?

A recent meta-analysis of Internet use to promote changes in health behavior found 85 studies in which interventions were Web delivered, experimentally tested, and included a behavioral outcome (Webb et al., 2010). This study found small but significant effects. Only two of the studies included sexual outcome variables, however, and only one of those examined behaviors. Noar et al. (2006) identified 21 interactive safer sex websites; however, it is unclear if these sites have been evaluated for their efficacy.

Regarding sexual decision making, recent reviews of evaluated virtual interactive interventions indicate that these interventions can be efficacious (e.g., Noar et al., 2009). Interventions tested for efficacy have been applied to a variety of target populations, including younger adolescents (e.g., Downs et al., 2004; Lightfoot, Comulada, & Stover, 2007), older adolescents and adults (Bull, Pratte, Whitesell, Rietmeijer, & McFarlane, 2009; Redding et al., 2004; Roberto, Zimmerman, Carlyle, & Abner, 2007), college students (Kiene & Barta, 2006), at-risk females ages 13–35 (Peipert et al., 2008; Scholes et al., 2003), and prison populations (Martin, O’Connell, Inciardi, Surratt, & Maiden, 2008). Interventions also have been developed around HIV status and for MSM. For example, Gilbert et al. (2008) developed an interactive intervention for HIV-positive individuals, and Rosser et al. (2010) developed an intervention for HIV-positive and HIV-negative MSM. Finally, our SOLVE research teams developed and evaluated two interventions for HIV-negative MSM. The first team created an interactive CD-ROM appropriate for a general MSM sample (Appleby et al., 1996; Miller & Murphy, 1999; Read et al.,

2006). The second team created three DVDs: one targeting African American MSM, another for Latino MSM, and the third for Caucasian MSM (Appleby et al., 2008; Miller et al., 2010). We briefly describe the efficacy of a sample of these sexual decision-making interventions below.

Forestalling sexual debut in adolescents through interactive interventions has met with some success. Downs et al. (2004) evaluated the impact of a stand-alone interactive video (IAV) STD intervention on adolescent females. Comparing intervention to control participants, they found that those in the IAV condition were more likely to be abstinent in the first three months following the intervention, experience fewer condom failures in the next three months, and be less likely to have been exposed to an STD six months after enrollment. Roberto et al. (2007) reported similar effects for an intervention tested in two public schools (one intervention and one control). Results indicated that students in the experimental school were less likely to initiate sexual activity and had greater condom negotiation self-efficacy. (Because individual participants were not randomly assigned to condition, however, questions about the independence of these data points within the two schools and the interpretation of these findings must be raised.) Studying somewhat older participants, Kiene and Barta (2006) found that sexually active undergraduates in the interactive intervention versus control condition reported significantly more condom use over four weeks.

For about-to-be-released prison populations, Martin et al. (2008) found that an experimental DVD-delivered HIV prevention intervention resulted in significantly more protected sex 90 days postintervention among experimental group participants than standard intervention control group participants. Gilbert et al. (2008) designed an interactive “video doctor” for HIV-positive patients that was found in an RCT over three and six months to reduce patients’ numbers of sexual partners.

For SOLVE among MSM populations, Read et al. (2006) found that, compared to MSM who received standard-of-care one-on-one counseling only, MSM in an experimental group who also received the CD interactive video (SOLVE-IAV) reported more protected and less unprotected anal sex over three months. More recently, funded by the National Institute of Allergy and Infection Diseases (NIAID), we developed three separate DVD interactive videos (one for each risk population of African American, Latino, and Caucasian MSM) and tested them for efficacy in an RCT over three months (Appleby et al., 2008; Miller et al., 2010). Results showed that the videos reduced unprotected receptive and insertive anal sex over time, but only for younger (18–24) and not older (25–30) MSM. Rosser et al. (2010) conducted an RCT of an interactive intervention targeting MSM (HIV-positive and HIV-negative) over the Web and found that at three months (but not subsequently) there were significant differences between the intervention and control group in the number of men with whom research participants had risky sex. These findings suggest that interactive interventions can reduce risky

sexual behaviors in high-risk populations, including prisoners and MSM, and that, for the latter group at least, they can be efficaciously delivered via the Web.

Contexts for Virtual Interventions for Reducing Risky Sex

Virtual interventions have been tested for efficacy in a variety of contexts. Some interventions have been tested in a controlled laboratory setting (Kiene & Barta, 2006; Miller et al., 2010). Others have been tested in various field settings such as school environments for adolescents (Lightfoot et al., 2007; Roberto et al., 2007), health care settings (Appleby et al., 1996; Bull et al., 2009; Downs et al., 2004; Gilbert et al., 2008; Peipert et al., 2008; Read et al., 2006; Redding et al., 2004), and prison settings (Martin et al., 2008). Increasingly, researchers have not only recruited participants for laboratory and field studies over the Web but also have conducted interventions over the Web as well (e.g., Bull et al., 2009; Davidovich, 2006; Rosser et al., 2010).

Most virtual interventions were designed as stand alone interventions (e.g., Bull et al., 2009; Davidovich, 2006; Downs et al., 2004; Gilbert et al., 2008; Kiene & Barta, 2006; Lightfoot et al., 2007; Martin et al., 2008; Miller et al., 2010; Rosser et al., 2010). Some interventions, however, were tested as part of a total package of components or as supplements to existing approaches (Appleby et al., 1996; Miller & Read, 2006; Peipert et al., 2008; Read et al., 2006; Redding et al., 2004; Roberto et al., 2007). Finally, most of the virtual interventions we reviewed were compared with control groups (Davidovich, 2006; Gilbert et al., 2008; Kiene & Barta, 2006; Lightfoot et al., 2007; Miller et al., 2010; Roberto et al., 2007; Rosser et al., 2010) or standard-of-care controls (Appleby et al., 1996; Bull et al., 2009; Downs et al., 2004; Martin et al., 2008; Peipert et al., 2008; Read et al., 2006; Redding et al., 2004).

Virtual Interactive Narratives and Intelligent Agents: New Enabling Technologies

For the most part, virtual interventions for HIV delivered via computer or over the Web have included separate video clips or two-dimensional images. Until recently, with few exceptions (e.g., SOLVE), they have excluded extensive rich embedded sequential interactive video narratives or complex three-dimensional environments simulating the risk-taking or risk-promotion narrative. However, over the past five years, technological developments have rapidly changed the virtual interactive intervention landscape. For example, we have been funded by the California HIV/AIDS Research Program (CHRP) to use the Internet to reach MSM and test the effectiveness of SOLVE interactive videos (Appleby, Miller, et al., 2010; Miller et al., 2010; Miller & Read, 2006; Read et al., 2006) delivered over the Web. The approach involves converting existing interactive videos from

our DVD intervention into a virtual interactive intervention for Web delivery using Flash and Actionscript technology that affords playback on a variety of operating systems and browsers.

Another development involves simulating and delivering rich interpersonal narratives for promoting behavior change, using one of a number of available game engines or integrated environments for simplifying the development of a game. Game engines include an engine for rendering two- or three-dimensional graphics and can include a physics engine (for detecting and responding to objects colliding) and other engines for developing and incorporating other key elements of the game (e.g., sound, scripting, animation, artificial intelligence of the agents). Some game engines (e.g., UNITY) can be used across a variety of platforms (e.g., Windows, Mac, iPhone, iPad, Wii, Android smartphones), enhancing the potential for dissemination.

Within such games, users can choose or design an avatar to represent themselves (see Fox, this volume). Recent work (e.g., Yee, Bailenson, & Ducheneaut, 2009) suggests that users given more attractive avatars may feel more desirable and comfortable seeking intimacy within a virtual environment and this effect may carry over into real life. Research also suggests that participants allowed to choose their own avatar (Lim & Reeves, 2006), especially customizable attractive ones (Yee & Bailenson, 2007), might be more engaged. That was also our approach in developing a SOLVE game using intelligent technologies (SOLVE-IT). In some interpersonal interventions, users can interact with other avatars (who may represent real or virtual others). The actions of other avatars can be driven by (1) a human operating online (e.g., in a multiplayer game), (2) rules (e.g., if x does this, this character does y), or (3) virtual realistic intelligent avatars (agents) whose decisions are autonomously driven by the agent's (avatar's) underlying AI/computational model (e.g., specification of the agent's motives and representations of self and others and how these will drive decisions).

One of the most extensively used multi-agent-based simulation environments with intelligent agents is PsychSim (Marsella, Pynadath, & Read, 2004; Pynadath & Marsella, 2004, 2005). Using this environment and adaptations to it, a researcher can construct scenarios wherein a diverse set of entities interact and communicate among themselves. Each entity has its own goals and policies of achievement, relationships with other entities (e.g., liking, distrust), private beliefs, and recursive mental models, or "theory of mind," about self and other. Researchers can manually perturb the simulation by changing the models or specifying actions and messages for any entity to perform. A human user can be substituted for an agent. This creates a highly adaptive test bed for readily personalizing the game to a given user and, with a sufficient animation budget, potentially providing an almost infinite number of interpersonal challenges from different other virtual MSM. The simulation can also be readily modified (e.g., by adding new interventions, agents, props) to improve that game or develop new games.

Virtual Interactive Narrative Game Applications

These interactive stories with realistic intelligent agents are designed to scaffold the user in learning how to make better decisions and better cope with real-life situational challenges. For example, Carmen's *Bright IDEAS* (Marsella, Johnson, & Labore, 2003) uses interactive stories to teach problem solving skills to mothers of pediatric cancer patients. *FearNot!* (Paiva et al., 2004) provides a virtual environment for children exploring ways to cope with bullying. Mitchell, Parsons, and Leonard (2007) use a virtual café populated with conversational agents to teach social skills to children with autism spectrum disorder. Brosnan, Fitzpatrick, Sharry, and Boyle (2006) train children via story design in virtual environments to better cope with depression or anxiety disorders. Most of these interventions have been found to effectively change desired behavior and/or appear promising, based on pilot work (for more on digital games, see Lieberman, this volume).

SOLVE: Narrative Self-Regulatory Circuitry and Scaffolding

To illustrate the potential of intelligent technologies, let us again consider SOLVE as an example. Currently, we are using UNITY to develop an NIMH-funded HIV/AIDS prevention intervention, SOLVE-IT, using 3-D animated intelligent agents (Miller et al., 2010). This technology enables a more rapid dissemination across platforms over the Web. It also affords risky MSM an opportunity to learn how to make safer choices while enjoying fun dates with their choice of attractive partners. The game starts with the user's choice of and customization of his avatar (e.g., by ethnicity, skin tone, eye color, clothing), followed by that player in his apartment getting ready to meet his friend at a party. The user meets his virtual future self (VFS), his chosen avatar made to appear a few years older. The VFS becomes the user's mentor; its goal is to aid the user in optimizing his self-regulated decisions (because "your decisions affect me").

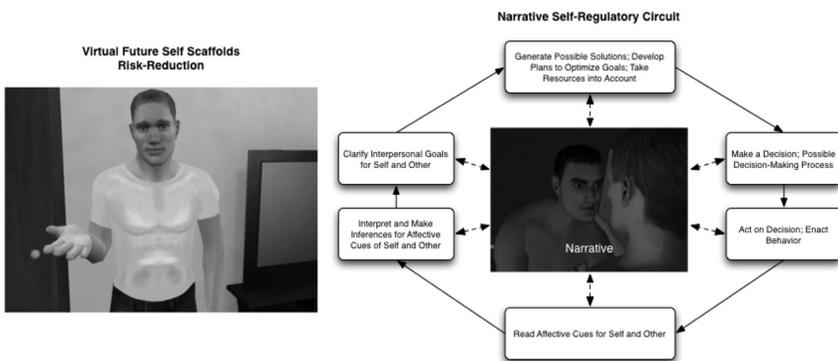


Figure 5.2 Narrative self-regulatory circuitry using a virtual future self in SOLVE-IT

Before going out on his date, the user can take condoms; if he forgets, his VFS reminds him and debunks reasons he might have for not taking them and rewards him when he takes them (this and other choices are recorded and can affect later experiences and feedback).

At the house party the user makes decisions about alcohol (and how much to drink); if the user drinks too much, his VFS may interrupt him with an alcohol intervention message. He stays and starts to make out with the host of the party during which the VFS interrupts to remind him to negotiate safer sex before going to the bedroom. The action proceeds to the bedroom where the realistic three-dimensional animated characters make sexual decisions regarding the type of sex (e.g., oral, mutual masturbation, anal) and whether the sex is protected or not. If and when the user chooses not to use a condom during anal sex, the guides interrupt with an ICAP message. At the end, the VFS recaps the user's choices and responds to them with reward (if the choices were safe) or alternatively describes what he did and why those decisions can lead to negative consequences.

At the second level of the game, the user is at a club in which he seeks out another partner and has new challenges in terms of negotiating safer sex. At the end of the game, if the user made risky choices, he is shown alternative ways he could have responded and how that could have resulted in safer—but still hot—sex. Character choices in negotiating safer sex in the living room and in the bedroom are driven by PsychSim (and the intelligent agents' underlying goal settings). Thus, the action could proceed quite differently if that character's goals were differentially set—providing more and different challenges to the user. With greater funding for the creation of more animation and additional three-dimensional environments, researchers can develop simulations that offer the user more challenges across a broader range of situations, and the user could play multiple versions of the game without repeating similar interactions, thus increasing his exposure to challenging situations and safer ways of handling them.

Another potential advantage of games with intelligent agents is that it may be possible to use PsychSim and related computational models to model the user's own choices throughout the game. That would enable researchers to better predict and anticipate the choices of a given user with different partners and across different situations. With better prediction of how a given user might take risks within a virtual environment, it might be possible to design better interventions within the game for that user. This is important because even in our earlier work using interactive video choices (e.g., Miller et al., 2009, 2010), we found that MSM's virtual interactive choices were predictive of their future similar choices (e.g., regarding alcohol, sex, etc.). If we can increasingly better change more of MSM's virtual behavior, our research suggests we may be better able to increasingly change similar real-life risky choices. That is, emerging intelligent technologies (IT) could afford a cumulative test

bed for testing and advancing health communication theory and our interventions' effectiveness. Such a pipeline from IT test bed to rapid dissemination of improved interventions is an exciting possibility for health communication researchers.

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