

ORIGINAL ARTICLE

Socially Optimized Learning in a Virtual Environment: Reducing Risky Sexual Behavior Among Men Who Have Sex With Men

Stephen J. Read¹, Lynn C. Miller², Paul Robert Appleby¹, Mary E. Nwosu¹,
Sadina Reynaldo³, Ada Lauren¹, & Anila Putcha¹

1 Department of Psychology, University of Southern California, Los Angeles, CA 90089-1061

2 Annenberg School For Communication, University of Southern California, Los Angeles, CA 90089

3 Acute Communicable Disease Control Los Angeles County Department of Public Health, 313 S. Figueroa Street, Los Angeles, CA 90012

A socially optimized learning approach, which integrates diverse theoretical perspectives, places men who have sex with men (MSM) in an interactive virtual environment designed to simulate the emotional, interpersonal, and contextual narrative of an actual sexual encounter while challenging and changing MSM's more automatic patterns of risky responses. MSM assume a character's identity and are scaffolded in their decision-making and relearning process by supportive, and often humorous, peer coaches who encourage situated learning of self-regulatory and behavioral skills, and tailor and frame their responses to be responsive to the men's behavioral choices. In a longitudinal design, participants were randomly assigned to receive either an interactive video (IAV) intervention with peer counseling or to a peer-counseling-alone control. Compared to the counseling alone, men who also received the IAV reduced risky anal sex behaviors and increased protected anal sex behaviors.

doi:10.1111/j.1468-2958.2006.00001.x

AIDS remains a serious health threat nationally and globally. In fact, the prevalence of new cases of a variety of sexually transmitted diseases (STDs) is increasing among men who have sex with men (MSM) presumably because of higher proportions of unprotected anal intercourse (K. K. Fox et al., 2001). A new generation of gay men, who did not experience firsthand the initial impact of the AIDS epidemic, as well as an older generation who did, are now in danger of exposure in this "second wave" of STD/HIV infection (K. K. Fox et al.; Wolitski, Valdiserri, Denning, & Levine, 2001).

Corresponding author: Stephen J. Read; e-mail: read@usc.edu.

Thus, the need for effective behavioral interventions to prevent HIV infection is more essential than ever.

A variety of factors may have contributed to increases in risky sexual practices, including initial optimism about antiretroviral drugs (Kelly, Hoffman, Rompa, & Gray, 1998) and “AIDS fatigue” or “AIDS burnout” from years of practicing safer sex (K. K. Fox et al., 2001; Wolitski et al., 2001). Whatever the causes, men are “tuning out” and prevention efforts are losing ground. It has been argued that this is due, at least in part, to “outdated or overly simplistic safer sex messages for MSM” (for a review, see Wolitski et al., 2001, pp. 883–884).

To keep pace with changes in HIV-related trends and successfully compete for the attention of MSM in an MTV generation, HIV interventions need to incorporate youth-oriented or hip multimedia and technological innovations, such as interactive video (IAV). IAV is a computer application that combines audio, video, text, graphics, and animation, where an individual has the ability to control or react to such media. In fact, interactive media, compared to noninteractive media, have been found to enhance transfer of learning (Moreno, Mayer, Spires, & Lester, 2001) and to be effective in promoting both alcohol (Reis, Riley, Lokman, & Baer, 2000) and asthma education (Bartholemew et al., 2000; Lieberman, 1995). IAVs have also succeeded in enhancing self-regulation, including diabetes self-management (Brown et al., 1997), self-maintenance of healthful diet change (Brug, Campbell, & van Assema, 1999; Campbell, et al., 1994; Kreuter & Strecher, 1996; Winett, Wagner, & Moore 1991), and smoking prevention (Tingen, Grimling, Bennett, Gibson, & Renew, 1997).

Virtual environments involving interactive media are also apt to be far more engaging and involving than traditional passive instruction, such as lectures or films (Moreno et al., 2001). Novelty (C. S. Green & Bavelier, 2003; Silvia & Eichstaedt, 2004) and interactivity (Biocca, 2002; Slater, 2002) enhance attention, and attention is a critical first step in communication interventions (McGuire, 1989). But IAVs are capable of being much more than attention-grabbing new media. Such virtual environments afford the communication tools for exceptional and broad state-of-the-art theoretical integration and model testing for understanding and optimizing what, from the vantage point of health promotion, ultimately matters: optimizing individuals’ ability to self-regulate (see also Bandura, 2005) and sustain more adaptive and healthier behaviors.

Socially optimized learning in virtual environments:

How might we optimize self-regulated learning and behavior change?

Why do individuals engage in risky behaviors (e.g., unprotected sex) that can have serious long-term costs, such as contracting HIV? We would argue that one useful way to think about why individuals engage in risky behaviors is to view what is happening as a failure of effective self-regulation (see also Bandura, 2005). Below, we consider a series of questions. What is self-regulated learning? What is it about

self-regulation that past interventions have not adequately considered (e.g., emotional regulation and the role of emotions during decision making)? How might IAV and its components (e.g., narrative, interactivity, scaffolding, and responsive coaches) support risk reduction beyond typical one-on-one HIV prevention interventions? We address each of these questions below.

In doing so, we lay the theoretical groundwork for socially optimized learning in virtual environments (SOLVE) that attempts to optimize self-regulation *in interactive virtual environments* by having participants assume the role of “actors” in socially engaging and emotionally realistic narratives, while being scaffolded through the process and risky decision points by responsive and accepting virtual counselors (L. C. Miller, Graesser, Read, Picard, & Johnson, 2005).

What is self-regulated learning?

A self-regulated learner has been described as someone who sets goals, plans, organizes, monitors progress, and evaluates how they are doing (Gaskill & Hoy, 2002). Crick and Dodge (1994) suggest that self-regulation depends upon understanding and the accurate labeling of emotions, thoughts associated with them, and what these mean for motives, goals, problem solving, decision making, and behavior. Links among these components and their emotional meaning (e.g., good or bad) are facilitated in social interaction (e.g., with caregivers, coaches, peers) through, for example, coconstruction of narratives about what has happened (K. Nelson, 1993). Over time, self-regulated learners actively instruct and reinforce themselves, gaining confidence and self-efficacy in their ability to understand and succeed in achieving their goals, while reducing and avoiding social and physical harm (Gaskill & Hoy). Self-regulation can therefore be viewed as the emergent outcome of a recursive and dynamic system of components (Carver, 2004; Joseph & Strain, 2003; Lemerise & Arsenio, 2000; L. C. Miller, Bettencourt, DeBro, & Hoffman, 1993; Read & Miller, 1989; Stuss, Gow, & Hetherington, 1992) whose linkages depend on active interaction and socially facilitated processes.

Most theory-driven communication prevention research in the health domain has focused on intervening to change important, but more cognitive and skill based, self-regulatory components likely to impact sexual risk taking (e.g., skills and perceived self-efficacy in negotiating safer sex, cognitions, perceived costs and benefits of engaging in the risky behavior) (e.g., Ajzen, 1991; Ajzen & Fishbein, 1980; Bandura, 1986, 1994; Beck, 1970; DiClemente & Peterson, 1994; W. A. Fisher & Fisher, 1992). These theory-based components can significantly reduce risky sexual practices (for reviews, see DiClemente & Peterson; W. A. Fisher & Fisher). For example, for MSM, Kelly (1995) has argued that critical risk-reduction training involves teaching behavioral skills (such as condom use and assertiveness skills) for dealing with obstacles and problems and self-management skills for managing cognitions and behaviors relevant to risky situations (Beck; Prochaska & DiClemente, 2002), as well as encouraging the formation of a strong behavioral intention to use safer sex behaviors when appropriate (Ajzen).¹ However, in these approaches,

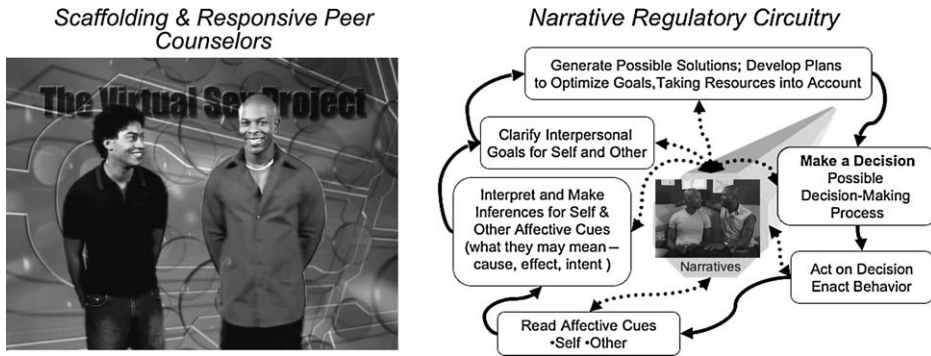


Figure 1 Using a SOLVE approach to HIV prevention.

Note: SOLVE places MSM in an interactive virtual environment designed to simulate the emotional, interpersonal, and contextual narrative of an actual sexual encounter while challenging and changing MSM's more automatic patterns of risky responses.

a focus on affect during the decision-making process has typically been secondary at best.

Why might emotions during decision making matter for HIV prevention?

As suggested in Figure 1, at the point of making a potentially risky decision, emotions and awareness of them are an important step in the process of self-regulation (Crick & Dodge, 1994). Emotions are evoked adaptive mechanisms that provide signals, often not consciously (Zajonc, 1980) as to what and who to attend to and what is happening or what might happen to one's goals: They are considered central to decision making (e.g., Damasio, 2003; Roseman, 2001; Scherer, 2001; Simon, 1967). At the point of a risky decision, one's emotional state (e.g., sexual arousal, fear) is likely to influence what then takes place (e.g., what cognitions, goals, problem-solving strategies get activated).

Both positive and negative emotions clearly play a role in attending to and encoding health messages (see Hale & Dillard, 1995; Monahan, 1995), but we have not considered how the mapping between the emotional context in which interventions occur (e.g., sexual arousal evoked by an engaging narrative) and the emotional context of real-life risky choice points impacts risky decision-making and behavioral outcomes.

Although other emotions may be present during decisions involving sexual risks, sexual arousal will be among the most constant of these emotional states. Work on state-dependent encoding and learning (Bower & Forgas, 2000) suggests that it might be possible to more automatically activate, retrieve, and use safer sex strategies if individuals learned these strategies while at least mildly sexually aroused.² That is, training and decision making leading up to safer choices under similar emotional conditions of encoding might be what is needed to enhance subsequent retrieval of cognitions, goals, and problem-solving skills in similar emotional contexts of risk.

How might IAV enhance HIV risk reduction?

Virtual environments can provide the elements needed (e.g., narrative, interactivity, scaffolding, and responsive coaches) to create a state of emotional absorption similar to that in leading up to sexual decision making in real life.

Narrativity. Narratives provide an organizing device connecting emotions, beliefs, goals, problem solving, decision making, and outcomes that can facilitate self-regulation and the formation of individual and cultural belief and behavioral patterns (P. J. Miller, 1994, 1995; Nelson, 1993; Nelson & Behler, 1989). We refer to this system as the *recursive regulatory narrative circuitry* (see Figure 1).

Stories and narratives are everywhere (Schank & Abelson, 1995). They are the “stuff” of entertainment (Bryant & Zillman, 2002; Zillman & Vorderer, 2000). Narrative is the way we make sense of sequences of everyday actions (L. C. Miller & Read, 1991a, 1991b; Read, 1987), and according to Schank and Berman (2002), to hear a story is to learn and to be changed. Such a view ties narrative to memories, with emotion driving the impact of narrative (Brewer & Pani, 1996; Oatley, 2002; see also Vorderer, Wulff, & Friedrichsen, 1996). Both personality theory (Bowlby, 1969, 1970, 1980, 1982; McAdams, 1988) and work by neuroscientists on brain organization and mechanisms (Damasio, 2003) suggest that individuals’ personal and cultural narratives about self, others, and how they chronically respond in a range of situations are fundamental to self-regulation (Bowlby, 1969, 1970, 1980, 1982; McAdams) and are often not conscious (Crowell, Fraley, & Shaver, 1999; Main, Kaplan, & Cassidy, 1985).

Narrative is a fundamental concept across cognitive (e.g., Schank & Abelson, 1995; Graesser, Singer, & Trabasso, 1994), social (Read, 1987; Read & Miller, 1995), emotional (Damasio, 2003; Stein & Levine, 1991), and communicative (e.g., Bryant & Zillman, 2002; W. R. Fisher, 1987; Gerbner, Gross, Morgan, & Signorielli, 1994; L. C. Miller & Read, 1987; Singhal & Rogers, 1999; Slater, 2002; Vorderer & Knobloch, 2000) domains. For example, communication scholars have examined the role of narrative’s persuasive impact on a variety of health domains (M. C. Green & Brock, 2005; M. C. Green, Strange, & Brock, 2002). Over decades, the potential of soap operas for mass behavior change has become increasingly clear (Sabido, 2004; Singhal, Cody, Rogers, & Sabido, 2004). Narratives may be so powerful, in part, because they afford appropriate social models (Bandura, 1977; Piotrow, Kincaid, Rimon, & Rinehart, 1997; see also Slater) with whom we can emotionally identify and forge parasocial relationships that vicariously guide our own behavior (Bandura, 2005; Sabido).

Narratives can also tie things together and enhance internal coherence (Graesser, Olde, & Klettke, 2002; L. C. Miller & Read, 1991a, 1991b) and may also enhance their impact on decision making (Pennington & Hastie, 1992) and memory (Graesser & Ottati, 1996; Rubin, 1995).

In many ways, narratives may be so powerful because they serve as a kind of self-regulatory “glue” (L. C. Miller et al., 2005) helping to more automatically and coherently guide our behavior, discriminate across contexts—including emotional cues and their meaning—and keep us focused on what to expect, what goals are likely

to be activated, and what we should do next (e.g., problem solving and decision making). Yet, detailed sexual narratives that include emotional arousal are not part of standard HIV interventions.

Interactivity. IAV, unlike TV soap operas, are nonlinear and interactive narratives: Such interactivity may further enhance our sense of “being there” physically as well as socially (Biocca, 2002). Interactivity requires that participants take a more active and agentic role, beyond mere observation, in the decision-making process.

Our IAV takes MSM on an interactive virtual date that portrays a physically, socially, and emotionally realistic sexual interaction similar to one they might encounter in their own life. It includes those features that have been identified as central to changing risky sexual behavior. It provides both modeling and directed practice of the cognitive and behavioral skills needed to successfully negotiate safer sex. Participants, in the guise of their video character, negotiate safer sex with the other character in the video.

Participants may, as a result of making decisions in interactive environments that impact virtual outcomes, feel like they have already engaged in the desired behavior and experienced its effects: Such media may come closer to blurring the boundaries between actual experience and imagined (virtual) experience. As Oatley (2002) notes, in referring to the work by Goffman (1961), “fun only occurs when we engage ourselves fully.” IAV, like games, “are those kinds of stylized encounters in which, if we do engage ourselves we may expect to have emotional experiences that will be fun. And, at that moment in which we immerse ourselves in the role, the role transforms us, makes us into a version of itself” (p. 51).

In virtual environments, interactivity is possible within a more realistic and emotionally and visually engaging situated sexual narrative. As in other forms of entertainment education (EE) (see Slater, 2002, for a review), one can provide a wealth of situational cues (both visual and acoustic), similar to those in real-life contexts, that could be associated with risk-reduction behavior in the IAV. Choices associated with these situated cues could enhance associative learning (e.g., when I encounter this cue or activate this emotion [e.g., sexual arousal], I also activate the goal of protecting myself) and might enhance subsequent reduction of risky sexual practices in similar real-life situations (L. C. Miller et al., 1993).

Situated implemental intentions. Gollwitzer’s work (Gollwitzer, 1990; Gollwitzer & Moskowitz, 1996) on implementation intentions, although not specifically focused on HIV prevention, suggests that going through this realistic concrete simulation should greatly enhance transfer to real life. An implementation intention is a specific intention about when, where, and how to approach and achieve a goal. Essentially, the individual, in a given situation, activates an “if, then rule”: “When these situational conditions are met, I will initiate behavior x.” Such intentions form linkages between specific situations and the appropriate behavior; behavioral control depends, then, on the activation of situational cues previously associated with subsequent action. Prior work indicates that when individuals form a specific

implementation intention (e.g., When we're in a private place [my bedroom, his bedroom, my living room, etc.] and we are ready to have sex, I will take a condom out and initiate putting it on), the goal achievement (e.g., staying safe, avoiding HIV) is far more likely when faced with the appropriate situation. These learned implemental intentions may be especially likely to activate learned responses in risky contexts if they are learned within and linked to a larger connected network of situated and emotional associations that are typically found in real life unfolding sexual encounters and narratives.

IAV affords messages tailored to behavioral choices. Health messages can be differentially framed in terms of the benefits to be gained from enacting the behavior (i.e., a gain-framed message) or framed in terms of the losses one might incur if one does not enact the recommended behavior (i.e., a loss-framed message). Consistent with predictions from prospect theory (Tversky & Kahneman, 1981), gain-framed messages tend to be more effective when individuals are risk-averse and loss-framed messages tend to be more effective when individuals are risk-seeking (Rothman & Salovey, 1997).

These considerations suggest that when individuals are clearly about to take a sexual risk (i.e., they have already indicated a risky choice), an interventionist might be most effective if he or she interrupted the decision with a loss-framed message. To help the client connect the risk point with the need for safer sex to be activated at that decision point, guides and characters could demonstrate how this could be interjected into the narrative, including it in a way (e.g., sexy, playful) that was compatible with the predominant emotion (e.g., sexual arousal). But when individuals are not taking risks, the appropriate message might either be gain framed or there might be no explicit message at all.

Unfortunately, HIV counselors do not typically (e.g., in standard HIV interventions) provide message feedback congruent with the nature of clients' more or less risky sexual choices on a date. But IAV and SOLVE applications can do so.

Scaffolding and responsive counselors promote self-regulation

Work by Nelson (Nelson, 1993; Nelson & Behler, 1989) on story-making processes and P. J. Miller (P. J. Miller, 1994, 1995; P. J. Miller, Fung, & Mintz, 1996) on culturally specific narratives suggests that parents scaffold children's representations and memories of events by stimulating and cocreating children's recounting of stories or "conarratives" about them. The nature of the emotional relationship between caregiver and offspring is key to understanding and enhancing self-regulation (N. A. Fox & Card, 1999; Slade, 1999; Vaughn & Bost, 1999). When caregivers are available and responsive, they foster a positive attachment that enhances self-regulatory and exploratory processes (for literature reviews, see Cassidy & Shaver, 1999; Calkins & Howse, 2004).

Similarly, there is considerable evidence that one of the best predictors of behavior change in psychotherapy is the positive nature of the relationship with the

therapist (Blatt & Zuroff, 2005). Interestingly, therapeutically scaffolding the construction of new ways to frame old narratives and promoting a more conscious understanding of client's thoughts, feelings, and motives in particular encounters are central to some types of therapies aimed at changing adult couple and family behavior and facilitating problem solving (for a review, see Byng-Hall, 1999). For MSM, peer counselors who are "opinion leaders" may be especially effective in changing norms, values, and risky behaviors (Kelly, 1995; Kelly, St. Lawrence, Betts, Brasfield, & Hood, 1990), especially if they do so in a more positive, humorous, and upbeat manner (O'Quin & Aronoff, 1981).

Virtual scaffolding and responsive counselors

In our IAV, participants do not simply assume the role of a character as part of the unfolding sexual narrative. They are also given advice and possible tactics to use in negotiating. Included in this is instruction in self-management skills and self-instructions for recognizing risky situations, such as those involving the use of drugs and alcohol or going into the bedroom without reaching an agreement to engage in safer sex. In addition, work in cognitive therapy on imaginary and observational rehearsal (e.g., Davison & Wilson, 1973; Kazdin, 1986) suggests that the opportunity to rehearse safer sex behaviors provided by the IAV should increase the likelihood of engaging in safer sex.

The peer guides are scaffolding and responsive counselors who do two things: (a) they are ready to assist with advice that is requested and (b) they encourage participants, in emotionally supportive and positive (and often playful and humorous) ways, to stay out of harm's way. In so doing, the peer counselors can (a) make clients' emotions, cognitions, goals, problem solving, and decision-making steps more salient, especially when these are leading to risky outcomes; (b) respond with appropriately framed messages given men's choices; (c) draw on individuals' own personal and cultural narratives to challenge previous problematic links among emotions, cognitions, goals, problem solving, and behavior, and suggest reframed ways of thinking about the ongoing sexual narrative that are more likely to lead to safer sex; (d) summarize and retell the narrative to make the links between choices and risks, and what they mean, more salient; and (e) praise clients for making safer choices and issue gentle rebuffs for making risky choices. The goal of this research is to assess the effectiveness of the IAV as an intervention by comparing men who were randomly assigned to use it with those who were not.

Method

Gay men's IAV: Development and initial research

Initial research and focus groups

We first performed extensive research and focus groups to identify the steps and choice points in a typical gay male sexual encounter and the obstacles that may

prevent gay men from engaging in safer sex. This research was used as a foundation for the sexual sequence in the video, a first date. During the writing of the script, we continually consulted with staff from the Gay and Lesbian Community Services Center (GLCSC) in Hollywood, California, both to determine the video's educational content and to ensure that it would be viewed as realistic and sensitive to gay men's experience. In addition, our two main production personnel, who wrote the script, filmed the video, edited it, and programmed the IAV, were both gay, as was our primary research assistant during the construction of the video.

Description of the video

Because our budget only allowed us to create one version of the IAV, it was targeted at Caucasian MSM. The video is introduced by two guide characters who explain the objectives of the video and set up the story. The guides are attractive young gay men intended to appeal to the target audience. Men are asked to identify with the main characters who are Caucasian MSM and are given the opportunity to make choices, ask questions, and guide their character's actions. Throughout, the user is in control and governs the behaviors of his character.

The client (player of the IAV) assumes the perspective of "Dave," a Caucasian MSM who has just gone out on a first date with "Mike." The IAV begins with Dave coming over to Mike's house afterward. After some typical culturally prescribed pleasantries (e.g., commenting on the apartment), they sit on the couch and engage in small talk as it becomes increasingly clear what Mike, an attractive, sexually aggressive character, has in mind. Mike's goal is to have sex with Dave as soon as possible. The player's goal is to help Dave negotiate safer sex with Mike. As Mike engages in typical script-like dating advances (e.g., offers wine, kisses and touches Dave), the player faces decision points where he must choose (by pressing various "buttons") how the action will progress. An "advice" option, given by two friendly and attractive guides (one African American and one Caucasian), which is specific to the point in the action, is always available. For example, if the player is unsure of how to raise the topic of safer sex, the guides can offer possible strategies that Dave could use to successfully negotiate safer sex.

If, however, the player chooses a risky option, such as drinking alcohol or having unprotected anal sex, the player receives unsolicited advice from the guides (i.e., a mandatory intervention). For example, the guides might warn of the dangers of unprotected anal sex and encourage the player to find out how to bring up the topic and have protected sex that is still hot. Positive feedback is also given when the user makes good decisions, such as choosing to use condoms.

At a branching point during the "couch" scene, the narrative in the video, depending upon the user's choice, can proceed in one of two general ways: (a) eventually deciding (after a series of choices about negotiating safer sex, bringing up the topic of safer sex, etc.) to have sex with Mike that night or (b) deciding not to have sex with Mike that night but arranging to meet him for another date.

If the player decides on option 1 (i.e., having sex right away that night), and this is before sexual negotiation has taken place, the guides “pop-up” and warn the player that it is best to negotiate safer sex first on the couch before proceeding to the bedroom before things get too hot and heavy. The guides instruct the player on how to carefully listen to what the partner is and is not saying, and how to effectively insist on safer sex while not offending their partner and still having a good time. Although the player can go into the bedroom and have sex without having first negotiated an agreement to use safer sex, he can do so only by deliberately ignoring the guides’ very strong warnings. Once the player decides to proceed to the bedroom, he may select from a menu of sex acts ranging from mutual masturbation to anal sex. The various acts are explicitly and realistically portrayed but in a nonpornographic way (the actors simulate sex, but no buttocks or genitals are shown). Players decide whether the sex act will involve using or not using a condom. If the player chooses a risky action without a condom, they will receive a warning from the guides. Warnings are cast as loss-framed messages: For example, “Are you kidding? Anal sex without a condom! Don’t you know how dangerous that is? Even if you are HIV positive, you can still get other strains of the virus and get sick faster. And don’t fool yourself that being the top is safe. It’s not. So if you want to have anal sex ... and I know you do.... wear a condom every time.”

If the player decides on option 2 (i.e., deciding not to have sex with Mike that night), he can then flash forward to a future date by which time Dave and Mike have gotten to know each other better, well enough for the user to feel comfortable with a sexual encounter that night. This option is included to make it clear that sex need not occur on the first date; waiting (and even abstaining) are options. At any point during the date, the player can also choose to exit, by pressing an “EXIT” button.

When the sexual scenario concludes, the guides review the participant’s choices on his virtual date—where his choices were safer ones, and where they were potentially risky. The guides take the player back to earlier decision points in the sexual scenario where the riskier choice was made, and with video play-backs offer alternative “safer” narratives for negotiating the sequence between Dave and Mike. Thus, each participant is provided with modeling of how to effectively negotiate safer sex.

The longitudinal study described below measures the effectiveness of this IAV in promoting safer sex for MSM. We hypothesized that MSM who used our IAV would be more likely to engage in safer sex and less likely to engage in unsafe sex, compared to a control group of MSM who did not use the IAV.

Procedures

Men who were eligible for the longitudinal study were MSM, 18 years or older, who were at the GLCSC in Hollywood, California, to receive the results of an HIV test; to be eligible, they had to have received an HIV-negative test result. During the standard HIV counseling session that followed a negative HIV test, HIV counselors informed potential participants that they were eligible for a study designed to evaluate an interactive sex education video for gay men. After the counseling,

participants were introduced to the researchers, went through informed consent procedures, and then began Session 1 of the study. Participants received a total of \$95 for completing the entire study.

Participants were randomly assigned to receive IAV (one of two experimental conditions [$n = 38$; $n = 36$] or not (control condition ($n = 36$)). Participants in the two IAV conditions did not differ through the phases of the study to be described here, but subsequently the IAV participants in one experimental group were assigned to an additional “dose” of the IAV, while the other half was not. Since the two IAV conditions did not differ for the phases described here (up to and including the measures in Session 2), we collapsed the findings across conditions and report the comparisons between the combined experimental groups and the control condition.

Just before the end of Session 1, we collected participant demographic information and reports of their sexual behaviors (e.g., protected and unprotected anal sex and oral sex) over the past 3 months. Participants returned 3 months later (Session 2), and these measures were collected again. Between these sessions, there were eight weekly phone-in behavioral assessments starting the week after the first session. This is described more fully below.

Participants were also scheduled to return 5 months after the initial session to fill out a final questionnaire that was identical to that used at the 3-month follow-up. However, because of the increasing attrition rate by that point, we restricted our analyses to the phone-ins and to the immediate and 3-month questionnaire responses.

Intervention components

Counseling session

All participants were given the standard GLCSC one-on-one AIDS counseling that is administered by a trained, professional HIV counselor after a negative AIDS test. The counselor reviews methods of safer sex behavior and the importance of avoiding risky behaviors. The counseling also focused on enhancing men’s ability to form a strong behavioral intention to use safer sex behaviors when appropriate and to teach behavioral and problem-solving skills for managing cognitions and behavior when dealing with risky situations.

IAV presentation

Participants in the two experimental IAV groups were then given brief instructions about the IAV and asked to use it. The IAV identifies the steps and choice points in a first date and the obstacles that may prevent gay men from engaging in safer sex. Participants were asked to identify with the main character and given the opportunity to make choices, ask questions, and guide their character’s actions. Throughout, the user was in control of his character. For example, he could modify the sexual activity, request the use of condoms, or stop the sexual encounter.

Further, at appropriate points, the user could be guided through rehearsal in sexual negotiation techniques and given practice in recognizing potentially risky situations, such as those involving the use of alcohol, and how to deal with such situations.

One characteristic of many of the points at which sexual negotiation occurs in the video is that when the main character makes a proposal for safer sex, he is met with resistance from his partner. At this point, the user is given guidance in how to successfully negotiate the use of a condom and he is then guided through the actual interaction. The user is then allowed to choose from a menu of sex acts portrayed in an explicit but nonpornographic way (the actors simulate sex, but no buttocks or genitals are shown). Each can be either with or without a condom. If the user chooses one of several risky options, such as having unprotected anal sex, the user receives unsolicited advice from the guides (i.e., a mandatory intervention). Positive feedback is also given when the user makes good decisions such as choosing to use condoms. At the end of the IAV, the guides review the participant's choices and give him additional feedback.

Imagery instructions

Participants in all conditions were then given the following imagery instructions, which did not explicitly refer to the IAV. "Take approximately 15 min and imagine yourself negotiating safer sex with a partner who seems unwilling. Use whatever techniques you have heard of, read about, or can think of on your own. Imagine bringing up the topic of using safe sex and also imagine how you would continue talking about it if your partner expressed unwillingness. Think about specific instances and try to make them as realistic as possible."

Dependent measures

Phone-in behavioral assessment

For the first 8 weeks of the 3 months between Sessions 1 and 2, participants were instructed to phone-in their answers to a 21-item questionnaire each week on scheduled days. Each participant chose a unique code name that was used to identify his responses. Participants first wrote down their responses on the questionnaire and then called a voice mail service where they gave their code name and reported their responses. For each assessment, participants reported how frequently they had engaged in specific sexual behaviors during the previous week and indicated whether or not they were currently in a serious/committed relationship. The assessment measured receiving and giving anal, oral, and rimming behavior (applying an individual's tongue to the partner's anal area); each was measured separately for behaviors both with or without a barrier and with a male or female partner. They were instructed to save all phone-in assessment sheets and bring them back to Session 2. Participants were paid for the voice mails that they called in on scheduled days. Assessment sheets were used to confirm the phone-in reports.

Questionnaire measures

At the end of Session 1, participants filled out a questionnaire reporting demographic information and past sexual behavior. The same questions were also answered at Session 2.

Demographic information. Participants were asked to indicate their ethnicity: European American (EA), Latino (Hispanic), African American (Black), Asian American, Native American, or other. They were also asked to indicate their age, income, education level (e.g., high school graduate, graduate of a 2-year college, graduate of a 4-year institution), and zip code.

Sexual behavior measure. Participants were asked to indicate the frequency with which they had engaged in a variety of sexual behaviors in the period preceding Session 1. Men were asked about giving and receiving anal sex, giving and receiving oral sex, and rimming. For each, we asked about frequencies with and without barriers. Participants gave their frequencies on a 10-point scale, with each point labeled as follows: *never in my life in my life but not in the past 6 months, in my life but not in the past 3 months, less than once a month, once a month, 2 to 3 times each month, once a week, 2 to 3 times a week, 4 to 5 times a week, and every day.* We could not get pretest measures that corresponded directly to the phone-in questions. However, we thought that being able to gather the weekly phone-in measures gave us a level of accuracy for the posttest behavior that overrode concerns of strict comparability.

Results

The majority of the sample was European American (EA) (61.3%); of the rest, 22.3% were Latino (Hispanic), 8.7% were African American (Black), 3.9% were Asian American, 1% Native American, and the remainder (2.8%) “other.” Participants ranged in age from 20 to 56 years, and just less than half (45.9%) were over 30 years old. More than half (54.6%) of the participants had an annual income of \$30,000 or more, and just less than half (45.5%) were 4-year college graduates.

Retention was good. Of the MSM ($N = 136$) who completed the first session, 81% ($N = 110$) completed the set of eight phone-in weekly behavioral assessments and 76% ($N = 104$) completed the study through Session 2. Of the 110 men for whom eight-week behavioral assessments were available, 68 were EA and 42 were non-EA. Comparing the MSM who completed and who did not complete the study, no significant differences in baseline measures were found. There were no significant differences in attrition rate for EA and non-EA men or for experimental or control conditions. The overall attrition rate from Session 1 to the end of the phone-ins was 18%, with an attrition of 21% in the non-EA control group, 26% in the EA control group, 18% in the non-EA experimental group, and 14% in the EA experimental group.

As noted, we produced a single IAV with only one set of main characters, who are EA. In addition, one of the “help guides” is EA, while the other is African American. Participants who used the video were asked to identify with the main character, but conceivably, non-EA participants may have been less able to do so. Thus, ethnicity of participants was used as a factor in the analysis: We compared the EA participants to the non-EA participants. Because of the small number of men in the sample from each non-EA ethnic group, we could not break ethnicity down further. Thus, we are comparing the impact of the IAV on men who are similar to the main characters on ethnicity with those who differ.

Sexual behavior

Analyses of the phone-in behavioral assessment took the form of a 2 (conditions: IAV [$n = 68$], no IAV [$n = 35$]) \times 2 (ethnicity: EA [$n = 68$], non-EA [$n = 42$]) factorial design. We used the report of previous sexual behavior from Session 1 as a covariate. From the beginning of Session 1 until the administration of the survey in Session 2, the experimental procedures, methods, and measures were identical for the two IAV groups. Because preliminary analyses indicated that there were no significant differences between the two experimental conditions, and because the two experimental groups up to that point were not treated differently, data of the experimental conditions were collapsed to form one experimental condition.

Preliminary analyses

Participants in the experimental and control groups were compared on all preintervention demographic characteristics (i.e., age, income, or education). Although the participants were randomly assigned to conditions, ethnicity was not taken into account during assignment. There were differences in the number of EAs versus non-EAs who were assigned to each condition: non-EA control, $n = 19$; non-EA experimental, $n = 23$; EA control, $n = 17$; and EA experimental, $n = 51$. By including ethnicity (EA or not) as a factor, we systematically controlled for ethnicity as well as examined whether matching of audience and character race might have been related to the IAV's effectiveness.

Effects of IAV on behavior measured by phone-ins

For each of the sexual behaviors, giving and receiving anal sex, giving and receiving oral sex, rimming and being rimmed, both with and without a barrier, we first examined their distributions. Because essentially no one reported rimming or engaging in oral sex using a condom, we did not examine the rimming or oral sex behaviors further, but focused on the measures of anal sex.

First, a single measure of frequency of protected anal sex was devised, summing giving and receiving anal sex with a condom across the eight phone-ins. Similarly, a single measure of frequency of unprotected anal sex was formed based on summing giving and receiving anal sex without a condom across the eight phone-ins. Because measures of sexual behavior are often plagued by outliers and skewed distributions,

we then examined their frequency distributions. Because the frequencies were highly skewed, we used a square root transformation (Tabachnick & Fidell, 1996) and examined the resulting variables for outliers. From box plots and Q-Q plots, we identified two outliers on the protected anal sex measure (66 times and 55 times over the 8 weeks). These two individuals were deleted from further analyses.

To control for levels of sexual behavior before the intervention, we also calculated covariates. In Session 1, participants filled out a 10-point scale, described above, reporting the frequency with which they performed each of several sexual behaviors in the period before the session. Because points 1–3 corresponded to not having performed the act in the past 3 months, to make the measure more consistent with the phone-ins 1–3 were recoded to 0 and the rest of the scale was recoded to create an 8-point scale running from 0 to 7. We then created a measure of frequency of protected anal sex by summing the two measures of giving and receiving anal sex with a condom and created a measure of frequency of unprotected anal sex by summing the two measures of giving and receiving anal sex without a condom. Because the resulting variables were skewed, we used a square root transformation. After the transformation, no outliers were identified. Because we deleted two outliers on the phone-in measure, and because of missing data on the covariates from the questionnaire, the resulting sample consisted of 96 men.

We then analyzed the phone-in data, both with and without covariates, with the two phone-in variables of protected and unprotected anal sex as a within-subjects factor. Covariance analyses were performed with the SPSS MANOVA procedure, with the premeasure of protected sex as a covariate for the phone-in measure of protected sex and the premeasure of unprotected sex as a covariate for the phone-in measure of unprotected sex.

Power to observe a small³ or medium effect size of $\eta^2 = .10$ (roughly equivalent to $r = .30$) was .87, whereas the power to observe an effect size roughly equivalent to the observed effect sizes ($\eta^2 = .05$) was .58. The analysis without the covariate was done as a 2 (condition: IAV vs. no IAV, between subjects) \times 2 (ethnicity: EA vs. non-EA, between subjects) \times 2 (type of sex: protected vs. unprotected, within subjects). Because we explicitly predicted that the IAV would increase the frequency of safer sex compared to unsafe sex, this effect was tested as a directional hypothesis, with a one-tailed probability. As predicted, there was a significant interaction between the condition and the type of sex variable, $F(1, 92) = 5.53, p = .010$ (one tailed), partial $\eta^2 = .057$. Participants who received the IAV engaged in higher levels of protected anal sex and lower levels of unprotected anal sex, compared to those in the control group (see Table 1, which provides the transformed variables). There was also an unexpected interaction between ethnicity and the type of sex, $F(1, 92) = 4.15, p = .044$ (two tailed), partial $\eta^2 = .043$. Non-EA men engaged in higher levels of protected anal sex than did EA men, while there was essentially no difference between non-EA and EA men for unprotected anal sex (see Table 1). No other effects were significant.

We then did a covariance analysis to examine whether the effect of the IAV would still be observed once possible preintervention differences in sexual behavior

Table 1. Unadjusted and Adjusted Means of Pre- and Posttest for Protected and Unprotected Sexual Behaviors.

	Type of Behavior	Control			Experimental (IAV)			
		Non-EA		All Men	Non-EA		All Men	
		EA	EA	EA	EA	EA	EA	
Premeasure	Protected	M	1.22	1.28	1.25	1.31	1.29	1.30
		N	17	15	32	18	46	64
Nonadjusted posttest	Unprotected	M	1.19	1.56	1.36	1.07	1.01	1.03
		M	1.5	0.98	1.26	2.31	1.35	1.62
Adjusted posttest	Unprotected	M	1.46	2.18	1.8	1.68	1.17	1.31
		M	1.55	0.91	1.25	2.31	1.38	1.64
	Unprotected	M	1.48	1.91	1.68	1.78	1.33	1.48

Note: Premeasures involve a different scaling than postmeasures and cannot be directly compared (see text). All data are square root transformations of the original values.

were controlled. The premeasures of sexual behavior were strongly correlated with the phone-in measures, $r(95) = .39$, $p < .001$, for protected anal sex, and $r(95) = .676$, $p < .001$, for unprotected anal sex, suggesting that a covariance analysis was reasonable.

Controlling for the premeasures only slightly reduced the impact of the IAV, to $F(1, 91) = 3.74$, $p = .028$ (one tailed) (partial $\eta^2 = 0.039$), from $F(1, 92) = 5.53$, $p = .010$ (without the covariates), partial $\eta^2 = 0.057$. The adjusted phone-in measures still show a pattern in which those who watched the IAV showed higher levels of protected sex and lower levels of unprotected sex, compared to the control group (see Table 1). The Ethnicity \times Type of Behavior interaction remained significant, $F(1, 91) = 4.00$, $p = .048$ (two tailed), partial $\eta^2 = .042$. Further, there was a marginal effect of ethnicity, $F(1, 91) = 3.55$, $p = .063$ (two tailed), partial $\eta^2 = .038$, indicating that the non-EA men tended to report having more sex, which seems largely driven by a higher amount of protected sex for the non-EA men.

Explaining the ethnicity effect

We examined a number of variables to see if they could explain why non-EA men exhibited higher levels of safer sex behaviors. None of the traditional demographic factors such as age, education, and income could account for the difference. Non-EAs in the study were generally younger, had lower incomes, and were less educated than EA participants—all of which typically indicate, if anything, a higher risk sample, rather than the lower risk sample we had, although Appleby et al. (2005) found that these variables for MSM did not account for much variance in risk behavior. Further, there were essentially no differences in being in a committed relationship between the non-EA participants (31.6%) and the EA participants (28.6%).

There did tend to be a difference between the two groups in their area of residence. Using participants' zip codes for the sample in our reported analyses, we found that a larger number of EA participants (55.7%) lived within 3 miles of West Hollywood, California, compared to non-EA participants (40%), although the difference was not significant, $\chi^2(1) = 2.20$, $p = .138$.

Why might this be relevant? West Hollywood is a widely known gay community and a Mecca for gay men. Such a community might be particularly likely to attract men who are highly gay identified. Thus, it is possible that our sample of EA men is more gay identified than our non-EA men. Work by Appleby, Lauren, and Miller (1998), with men from West Hollywood, indicates that men in that community who are highly gay identified are more likely to engage in risky sex. Non-EA participants tend to come from other parts of Los Angeles and may be less gay identified.

Discussion

This study clearly indicates that the IAV is effective in promoting safer sex when compared to a control group that received only standard one-on-one counseling following an HIV-negative test result. The intervention components included in the

GLCSC standard counseling (e.g., review of methods of safer sex behavior, importance of avoiding risky behaviors, motivational and problem-solving skills, changing and managing cognitions in risky situations) are similar to those theoretically based components that past research suggests are effective in reducing HIV risk taking (for reviews, see DiClemente & Peterson, 1994; W. A. Fisher & Fisher, 1992; Kelly, 1995). Thus, our IAV's effectiveness goes beyond that provided by standard counseling components alone. Because the SOLVE components were incorporated into the IAV, SOLVE is promising not only as a supplement to standard interventions but also as a possible integrative alternative to more expensive and time-consuming one-on-one interventions, as well as providing an intervention when one-on-one interventions are not available. We are currently examining that possibility in ongoing research.

Why is virtual training effective for changing risky sexual behavior?

The goal of this research was to demonstrate that the IAV was more effective than standard post-HIV negative test counseling alone. Having demonstrated that this is the case, the next phase of our research program is to better understand why this approach is more effective.

A combination of intervention elements effective in isolation

Virtual environments make it possible to bring a wide range of intervention elements together that have been found, in isolation, to be successful in promoting risk reduction: This includes components from standard one-on-one HIV counseling interventions, messages based on the message framing literature, as well as elements of EE approaches that rely on more implicit or vicarious persuasive appeals. Perhaps, it is at least partly the combination of these elements that allows this intervention to so efficiently, as well as effectively, change behavior in a one-shot intervention. After all, EE (Singhal et al., 2004) and some of the most successful HIV prevention interventions for MSM (e.g., Kelly, 1995) involve multiweek sessions.

Factors associated with the main narrative, contextual cues, and their likely effects

Emotional connection to the story and characters. EE involves vicarious modeling by observing the behavior of similar others and role models (Bandura, 1977); our IAV not only involves passive vicarious observation of peer counselors and other characters, but also the active assumption of the role of one character in interaction with another. In IAV, as in EE, modeling and behavior change may depend, at least in part, upon an emotional connection and identification with the characters. Identification with characters and their centrality to the story in EE has been shown to predict behavioral intent (Storey, Boulay, Karki, Heckert, & Karmacharya, 1999). Still, we know relatively little about the factors that mediate these emotional connections. Does identification matter more if one is actively playing the role of a "you" character versus responding to the "other" character? When it comes to the "other"

are other factors (e.g., attraction) more important than identification in becoming engaged in the narrative? In our ongoing research, we are taking an extensive look at these potential mediating processes.

Absorption. One of the striking things about EE, and which likely occurred in the current IAV, is that audience members can become engrossed in the narrative: This type of involvement has been called absorption (Graesser, Robertson, & Anderson, 1981). Absorption involves focusing attention fully on the social interaction in a way that reflects our heritage as social information processors (Bower, Black, & Turner, 1979; Graesser et al., 1981; for a review of the factors that influence absorption, see Slater, 2002). An absorbing narrative may be effective because it may reduce audience members' ability to counterargue a persuasive message, especially if the health subtext is not too explicit (Slater).

Absorption, however, can be disrupted by the health subtext if this subtext is not naturally an important part of the narrative theme. Nevertheless, when intervening in the domain of safer sex, incorporating intimate conversations and sexual negotiations by main characters into a sexual scenario can be done smoothly, in a "fun" and sexually arousing way, that enables researchers to maintain audience absorption. Narratives may be especially persuasive when audience members are interactively engaged in a narrative, as is the case in IAV, compared to other EE approaches. In such a context, disruptions—even those that are more explicit—when they come from characters outside the "main story," but within the interactive experience—may not as readily derail absorption and therefore may also effectively bypass audience members' counterarguments while enhancing deeper encoding of health messages. Furthermore, separating the roles of the main characters and the interventionist, which is not done typically in EE (Slater, 2002), may also help facilitate attention to tailored messages and make it easy for our audience to "get back into the action" afterward.

Sexual narratives. Virtual environments, unlike other interventions of which we are aware, afford the possibility of a detailed narrative similar to that which the individual may encounter in real life. The current work is the only work, of which we are aware, that has placed sexual risk taking in a visually rich typical sexual narrative, including the sequence just immediately preceding, including, and following the moment of simulated sexual risk. For the action to continue, players must make explicit decisions about what they want to do next—forcing not only greater engagement, but making player's choices more explicit in the very contexts where this matters.

Furthermore, in contrast to role playing that occurs in one-on-one interventions, SOLVE can be even more contextually and emotionally engaging and realistic, enhancing its potential for behavior change enacted in the appropriate context (e.g., sexually arousing and risky situations). Since with IAV (and virtual environments) the user can be in control of the decision-making process and can receive immediate feedback on behavior choices (including engaging in virtual safer or

riskier sex), we expect this approach may better transfer to real-life decision-making contexts. Better understanding these processes by taking a closer look at the idiosyncratic decisions and emotions experienced during the IAV, as well as their relationships to past behavior and future outcomes, is the goal of future research by our team.

Subsequent more automatic activation of safer sex. Because our IAV provided a rich array of realistic situational cues within realistic sexual narratives, it may be especially likely to lead to more automatic activation of learned behavioral responses (e.g., safer practices) in confronting obstacles, temptations, and similar emotional cues in subsequent real-life settings most similar to it. Encouraging individuals to initiate a safer sex strategy more automatically, given the appropriate environmental cues, would be highly desirable from a prevention perspective. Ideally, we would like to use interactive narratives to support, build on to, and scaffold processes that would encourage automatic responses that already do or could reduce risk (see Monahan, 1995). This raises many questions for future research, however. For example, to what extent do experiences at encoding involving these narratives generalize to real-life situations? If our scenarios involve bars and dance clubs, would training in these contexts generalize to quite different contexts (e.g., bathhouses, sex clubs, internet hookups)? This suggests that in future research, we may wish to systematically examine the circumstances under which real risky choice points occur and how similar and different these are from the intervention context employed in training.

Interactive counseling

Challenging risky decision making

In the current IAV, counselors can challenge parts of the decision-making process of clients when those clients are engaging in risky decisions and behaviors. Disruptions in the dating sequence that occur in watching the IAV may serve as opportunities—not typically available in other interventions—to activate more conscious processing “on the spot,” challenge existing attitudes and beliefs, and associate negative emotions and loss-framed messages with risky sexual choices. As suggested earlier, the medium may also afford possibilities for reduced counterarguments in the face of such challenges (e.g., Slater, 2002). Counselor disruption when risky choices are about to be made, followed by actively scaffolding less risky choices, may help participants become better at monitoring and regulating their own choices.

It is unclear whether (and when) positive counselor feedback for less risky choices should take place, compared to simply allowing the participant to remain engaged in a compelling “main story,” which should itself be intrinsically rewarding. In our ongoing work with interactive environments, we do not intervene with positive feedback when the participant engages in safe behavior during the parts of the sexual narrative that are the most sexually arousing, while intervening with positive feedback when this does not seem to disrupt the main story absorption. But

systematic research needs to be done to guide this type of researcher decision making. We are currently conducting and planning research that will allow us to examine some of these possible mediating processes more directly.

Message tailoring

In the current work, we tailored messages to participant behaviors such that when clients have clearly indicated (via selecting a risky behavior) that they intend to and have decided to engage in high-risk sex, they are confronted with messages most likely to motivate risk reduction (e.g., a loss-framed message). That is, we suspect this technology makes it possible to more effectively combine elements from research on explicit message persuasion with element-based research on more implicit vicarious learning in narrative scenarios. But clearly this possibility, and a better understanding of the potential mediating factors that are producing change for which type of individuals, needs to be more systematically addressed in the future.

Clarifying and regulating emotions, cognitions, motivations

IAV makes it possible to create a kind of pause in the action that enables a deeper and more conscious look at “what is happening.” In such “frozen moments,” guides can point out to users that one’s virtual partner is not really answering their questions about his risk factors and what that means for what one should do next (e.g., “Don’t let him get away with not really answering you, ask him. Here’s how you can respond in a situation like this”). Guides can also make emotions at critical points explicit. For example, at one point one of the guides, on the heels of the player’s decision to enter the bedroom with his virtual partner, rapidly approaches and rushes into his own fantasy bedroom and poses the question “Yes! In bed with this hot guy! What would I want to do?” The other guide helps to regulate and slow down a more impulsive decision-making process. “Well, while you’re making up your mind, it is important to remember that some things are safer than others. For instance, mutual masturbation is safe Oral and anal sex can be safe too if condoms are used correctly. . . . And if you decide that you don’t want to have sex, that’s okay too. I know it’s hard for some people to believe, but just because you’re in the bedroom doesn’t mean you have to have sex.” Research suggests that this type of verbalization of both acknowledged desire paired with playful regulatory considerations in the context of emotion (e.g., sexual arousal) might help regulate risk reduction in this context for the real “player” (Eich & Forgas, 2003). Clearly, however, we need more systematic work examining how to better enhance the self-regulatory possibilities with these media.

Wrap-ups, epilogues, and recaps:

Might IAV recaps better facilitate encoding and later retrieval?

Wrap-ups by counselors in some one-on-one interventions, epilogues at the end of an EE program, and guide recaps at the end of the IAV afford opportunities for participants to more deeply sum-up, encode social information, and “connect the dots” regarding the themes in the program and how they relate to their own decision

making. In EE, the characters themselves come on during the epilogues to rhetorically ask the audience questions about what they might have done in this context. As Slater (2002) notes, “apparently, without such epilogues it is too easy for viewers or listeners to focus on characters and not engage with the message’s persuasive subtext” (p. 162).

Work in EE suggests that vicarious learning alone is not enough. This fits with a body of work in developmental psychology that suggests that parents play a critical role in creating conarratives and memories with their children (P. J. Miller, 1994, 1995; Nelson, 1993; Nelson & Behler, 1989) that guide meaning and subsequent responses consistent with values and norms in a given culture.

Virtual environments as a medium: What they afford

Social interactivity and active decision making

IAV involves not just vicarious learning, but actively making choices for a character and observing the consequences of one’s own choices on outcomes. IAV requires participants to be actively engaged in making decisions and clients to have the perceived freedom to take risks and observe the consequences of their own character’s risk taking. The recursive interactivity with characters in these environments, and the feedback provided in doing so, may be an important part of the effectiveness of IAV in changing behavior. Such a possibility fits with a growing body of work indicating that IAV can have a significant impact on a variety of health-related domains, such as asthma education (Bartholemew et al., 2000; Lieberman, 1995), smoking prevention (Tingen et al., 1997), alcohol education (Reis et al., 2000), diabetes management (Brown et al., 1997), and healthful diet change (Brug, Glanz, van Assema, Kok, & Van Breukelen, 1999; Brug et al., 1998; Campbell et al., 1994; Kreuter & Strecher, 1996; Winett et al., 1991). Does assuming the role of a character (by actively making that character’s choices) enhance memory for behavior and adoption of it beyond merely identifying with that character?

Unfortunately, we know little about whether interactivity, per se, in health interventions is responsible for differential health outcomes. However, we are currently examining this possibility in ongoing research in which we are comparing an experimental condition in which participants make active choices with a yoked-control condition in which participants passively receive the choices (but do not make the choices) of another participant.

Fluid switching between an ongoing main story and guide scaffolding

A unique feature of our IAV is that participants are both part of an ongoing narrative “main story” in which they can assume the role of a character and interact with other characters on “the date.” Participants can also choose and receive interactive counseling from peer counselors, where responses of peer counselors are tailored to participant behaviors. It is unclear where vicarious learning is occurring in these media environments and where and when it combines with more

interactive and active learning. When should learning be more implicit and when should it be more explicit? Teasing this apart is another important future step in this line of research.

Visual imagery

IAV is of course a medium that engages visual and auditory senses. What is the impact of this sensory engagement on encoding and retrieval? Does visual imagery that is depicting the characters in context matter in this process? In past research, one of the authors and colleagues found that seeing an unfamiliar character talk on video enhanced subsequent memory for what she said, compared to a situation in which participants only heard an audiotape of her speaking (Swann & Miller, 1982). Lynn, Shavitt, and Ostrom (1985) replicated this effect, and their findings suggest that it was due to greater elaboration of stimulus information at encoding. These findings raise the possibility that visual media may better enable participants to efficiently encode, organize, and retrieve social information needed at critical decision points in their future social interactions, compared to one-on-one interventions that involve imagining a scenario (as in most HIV prevention counseling, including that provided by the GLCSC in the current work).

IAV and other visual virtual environments allow participants to more visually and explicitly enact and subsequently go over their choices (as another character) while being provided with feedback about the risks involved and being provided with safer choices when risky ones had been enacted. In EE interventions, during the recaps, the actors' experiences, consequences, or alternative behaviors are not visually portrayed. Does this reduce the role of visual imagery compared to the recaps provided in our IAV? This should be examined in future research.

Situated congruent affect

Theory (e.g., Tversky & Kahneman, 1981) and research (Mann, Sherman, & Updegraff, 2004; Rothman & Salovey, 1997) suggest that health messages (e.g., gain framed vs. loss framed) are more effective if they map onto the corresponding prevailing approach motivation (and positive emotion for gain-framed messages) or avoid motivation (and negative emotion for loss-framed messages) that predominates in a given situation for a given target individual.

This work has a number of implications for the development of interventions and choice of media. For example, consider the HIV domain. In the sequence leading up to sexual risk taking, individuals are sexually aroused, which is an approach motivation. Interventions that involve gain-framed messages may be more compatible with approach motivation (e.g., sexual arousal) and therefore may be more likely to be better encoded and/or retrieved under conditions of sexual arousal.

Emotional importance

Clearly, emotions can directly affect attention and cognitive processing. Affective messages tend to grab our attention (Ray, 1977), but high-arousal negative emotions

(e.g., anger, embarrassment) impair self-regulatory processes (Leith & Baumeister, 1996). Individuals experiencing such negative emotions are unlikely to consider all the options and their affective consequences (Wegener & Petty, 1994) and therefore make poorer choices (Baumeister & Scher, 1988). Negative emotions can signal a threat and appear to have been adapted to focus more analytic and central attentional processing to quickly locate the source of the negative emotion, and to activate bodily systems to quickly respond with specific action tendencies (Frijda, Kuipers, & ter Schure, 1989; Lazarus, 1991). Our health messages historically have not always provided ways to effectively control the danger portrayed (e.g., Witte, 1992).

Positive emotions (e.g., elicited by music, art, graphics, entertainment present in IAV) enhance audiences' initial attention to health messages as well as positive feelings about the intervention itself (Monahan, 1995). In the presence of positive emotions, individuals are more averse to risk (and potential loss) and state change (Isen & Geva, 1987) and appear more likely than those in a negative mood to consider the long-term as well as the short-term consequences of their behavior (Keinan, 1987; Wegener & Petty, 1994; see also Fredrickson, 2001). Positive emotions appear adapted to signal approach behavior and opportunities (Cacioppo, Gardner, & Berntson, 1999; Carver, 2004; Carver & Scheier, 1990; Watson, Weise, Vaidya, & Tellegen, 1999). On the heels of negative events (e.g., threat, mishap) and negative emotions (e.g., humiliation, sadness, fear), the activation of positive affect (e.g., mild joy, contentment, love, empathy, hope, amusement, challenge) may help cognitively reframe an issue (e.g., empathy for characters; see Monahan, 1995; humor, Conway & Dube, 2002) and put the negative event or threat in a broader context (Fredrickson), facilitating openness to the message (Estrada, Isen, & Young, 1994), attitude and behavior change (Monahan), and resilience in finding creative ways of dealing with the threat (for reviews, see Isen, 1999; Monahan).

Understanding how these positive and negative emotions combine at encoding and retrieval and transfer to real-life contexts such that risky decisions will be more likely to demand conscious attention, while safer decisions will be more automatically implemented is the communication challenge before us. Counselors who pop-up and identify risky choices in context (while they are happening) and offer viable alternatives that still allow MSM to achieve their goals (e.g., great sex, avoid embarrassment) may disrupt a risky learned pattern (e.g., use denial or avoidance strategies to mitigate the threat without effectively reducing the danger (Hale & Dillard, 1995).

But how do we more effectively mitigate the threat in such interventions? Research by Sherman, Nelson, and Steele (2000) suggests that in the face of threatening health messages, self-affirmation-enhancing manipulations were more likely to lead to immediate message acceptance than was the absence of such self-affirming manipulations. This work suggests that HIV risk-reduction interventions for MSM that are likely to activate similar perceptions of threat should focus on enhancing

MSM's self-acceptance and positive emotions (e.g., about sexuality) so as to enable them to better regulate negative emotions: This might help reduce sexual risk taking (e.g., unprotected sex) in risky contexts. Possibly, our scaffolding and responsive counselors, and a generally more affirming, humorous, and upbeat IAV, might actually be providing for MSM an experience that affirms their sexual desires, preference, and identity, making them more "open" to changing their risky sexual behaviors. Future research needs to examine this possibility more systematically.

Tailoring the intervention to the user

IAV, like many interpersonal one-on-one interventions, can also be specifically tailored to the needs of the user. IAV can tailor responses to the user's behavior when research suggests that differentially framed messages, as mentioned earlier, should be delivered to users engaging in different behavior (e.g., taking risks or not). We are currently examining how different patterns of risky behaviors in the IAV relate to those involving past behavior and predict to future outcomes.

However, imagine the future possibilities for tailoring. If we know participants' emotional responses, our interventions in virtual environments (e.g., guides, characters) can be more responsive to and better optimize learning and behavior change in light of these emotional and motivational states. Those engaged in the field of affective computing (e.g., Picard, 1997) have made great strides in being able to effectively monitor the emotional state of the learner, and the promise of SOLVE (L. C. Miller et al., 2005) is to create virtual environments that can both monitor and effectively respond to those changing emotional states to enhance learning and behavior change.

Disrupting automatic processes that may result in risky behaviors

Interactive media also afford opportunities, as the current IAV suggests, to have guides disrupt negative emotions at critical moments (when individuals are engaging in risk—or about to), focusing attention more analytically. Then, once the individual has focused more closely, the guides can provide social support (e.g., via peer counselors) for making safer choices. Interactive media, in this regard, are potentially simultaneously capable of engaging and challenging clients' automatic beliefs and actions while scaffolding change processes.

Targeting audiences

IAV, like other media, can not only reach broader audiences, but can also be targeted to specific audiences, to enhance educational effectiveness (Slater, 1995). Our IAV was targeted to high-risk MSM; with IAV, however, this targeting can involve much more detailed and rich narratives and highly visual and contextualized situational cues to actions, including typical sexual sequences, contextual features at the man's apartment, and subcultural language used. In current work, we are targeting three different ethnic populations (African American, Latino, and Caucasian MSM) with narratives, language, contextual features, music, and humor developed specifically

to be more relevant to each population. We will examine how effective these interventions are in re-creating typical sexual narratives for our respective groups and how the extent of this realism and identification with the characters is related to behavioral outcomes.

Conclusion

The need for improved HIV intervention programs is critical. Many commentators have suggested that interactive media could have a major impact in changing a variety of risky behaviors, such as risky sex. Unfortunately, the claims for the efficacy of interactive media often far outstrip any empirical validation of their effectiveness. The current study is one of the very first attempts to empirically examine the effectiveness of interactive media in changing risky sexual behavior and to demonstrate that IAV can be effective in changing risky sexual behavior. Thus, IAV can provide an innovative tool to foster active learning of safer sex behaviors in simulated sexual interactions.

Acknowledgments

This research was supported by a grant from the Universitywide AIDS Research Program of the University of California, Grant R96-USC-160. We would especially like to thank Kirk Marcolina and Derth Adams, who did an outstanding job of filming, editing, and programming the IAV. We would also like to thank Mayada Hodeib and Leanor Johanson for their central role in data collection, Sheila T. Murphy for her comments during preliminary script development, and Carlos Godoy for his help with research during rewrites.

Notes

- 1 An intriguing combination of the components of a theory of reasoned action (Ajzen & Fishbein, 1980), social cognitive theory (Bandura, 1994), and the role of EE that play out over time as stages of change (Prochaska & DiClemente, 2002). Nevertheless, this combination does not deal directly with emotions and decision making in situated risky contexts.
- 2 We should note that saying that one intends to engage in protected sex when one is sexually aroused may not be particularly diagnostic of what one will do when one is actually sexually aroused since the initial emotional response may guide decision making outside of conscious awareness (Damasio, 2003).
- 3 To perform a covariance analysis that matched the premeasures with the dependent variables in this way, we had to use the MANOVA procedure in SPSS 11, which is only available through the syntax commands. The GLM (General Linear Model) procedure available through the menu system of SPSS does not allow the pairing of specific covariates (e.g., premeasure of unprotected anal sex) with specific dependent variables (e.g., posttest measure of unprotected anal sex) but instead treats any entered covariate as a covariate for all dependent variables. We felt it was much more appropriate to pair each covariate with its matching dependent variable on the phone-ins.

References

- Appleby, P. R., Lauren, A., & Miller, L. C. (1998). *Gay identification: Does it reduce or increase sexual risk-taking?* 12th World AIDS Conference, Geneva, Switzerland.
- Appleby, P. R., Marks, G., Ayala, A., Miller, L. C., Murphy, S., & Mansergh, G. (2005). Consideration of future consequences and unprotected anal intercourse among men who have sex with men. *Journal of Homosexuality*, *50*(1), 119–133.
- Ajzen, I. (1991). The theory of planned behavior [Special issue: Theories of cognitive self-regulation]. *Organizational Behavior and Human Decision Processes*, *50*, 179–211.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. (2005). The primacy of self-regulation in health promotion. *Applied Psychology: An International Review. Special Self-Regulation Across Domains of Applied Psychology: Is There an Emerging Consensus?*, *54*, 245–254.
- Bartholomew, L. K., Gold, R. S., Parcel, G. S., Czyzewski, D. I., Sockrider, M. M., Fernandez, M., et al. (2000). Watch, discover, think, act: Evaluation of computer-assisted instruction to improve asthma self-management in inner-city children. *Patient Education and Counseling*, *39*, 269–280.
- Baumeister, R. F., & Scher, S. J. (1998). Self-defeating behavior patterns among normal individuals: Review and analysis of common self-destructive tendencies. *Psychological Bulletin*, *104*(1), 3–22.
- Beck, A. T. (1970). Cognitive therapy: Nature and relation to behavior therapy. *Behavior Therapy*, *1*(2), 184–200.
- Biocca, F. (2002). The evolution of interactive media: Toward “being there” in nonlinear narrative worlds. In M. C. Green, J. J. Strange, & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 97–130). Mahwah, NJ: Lawrence Erlbaum Associates.
- Blatt, S. J., & Zuroff, D. C. (2005). Empirical evaluation of the assumptions in identifying evidence-based treatments in mental health. *Clinical Psychology Review*, *25*, 459–486.
- Bower, G. H., Black, J. B., & Turner, T. J. (1979). Scripts in memory for text. *Cognitive Psychology*, *11*(2), 177–220.
- Bower, G. H., & Forgas, J. P. (2000). *Affect, memory, and social cognition*. New York: Oxford University Press.
- Bowlby, J. (1969). Disruption of affectional bonds and its effects on behavior. *Canada's Mental Health Supplement*, *59*, pp. 12.
- Bowlby, J. (1970). Disruption of affectional bonds and its effects on behavior. *Journal of Contemporary Psychotherapy*, *2*(2), 75–86.
- Bowlby, J. (1980). *Attachment and loss*. New York: Basic Books.
- Bowlby, J. (1982). Attachment and loss: Retrospect and prospect. *American Journal of Orthopsychiatry*, *52*, 664–678.
- Brewer, W. F., & Pani, J. R. (1996). Reports of mental imagery in retrieval from long-term memory. *Consciousness & Cognition: An International Journal*, *5*, 265–287.

- Brown, S. J., Lieberman, D. A., Gemeny, B. A., Fan, Y. C., Wilson, D. M., & Pasta, D. J. (1997). Educational video game for juvenile diabetes: Results of a controlled trial. *Medical Information*, 22(1), 77–89.
- Brug, J., Campbell, M., & van Assema, P. (1999). The application and impact of computer-generated personalized nutrition education: A review of the literature. *Patient Education and Counseling*, 36(2), 145–156.
- Brug, J., Glanz, K., van Assema, P., Kok, G., & Van Breukelen, G. J. P. (1998). The impact of computer-tailored feedback and iterative feedback on fat, fruit, and vegetable intake. *Health Education & Behavior*, 25, 517–531.
- Bryant, J., & Zillman, D. (Eds.). (2002). *Media effects: Advances in theory and research* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
- Byng-Hall, J. (1999). Family couple therapy: Toward greater security. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 625–645). New York: Guilford Press.
- Cacioppo, J. T., Gardner, W. L., & Berntson, G. G. (1999). The affect system has parallel and integrative processing components: Form follows function. *Journal of Personality & Social Psychology*, 76, 839–855.
- Calkins, S. D., & Howse, R. B. (2004). Individual differences in self-regulation: Implications for childhood adjustment. In P. Philippot & R. S. Feldman (Eds.), *The regulation of emotion* (pp. 307–332). Mahwah, NJ: Lawrence Erlbaum Associates.
- Campbell, M., DeVillis, B. M., Strecher, V. J., Ammerman, A. S., DeVillis, R. M., Sandler, R. S. (1994). Improving dietary behavior: The effectiveness of tailored messages in primary care settings. *American Journal of Public Health*, 84, 783–787.
- Carver, C. S. (2004). Self-regulation of action and affect. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 13–39). New York: Guilford Press.
- Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review*, 97(1), 19–35.
- Cassidy, J., & Shaver, P. R. (1999). *Handbook of attachment: Theory, research, and clinical applications*. New York: Guilford Press.
- Conway, M., & Dube, L. (2002). Humor in persuasion on threatening topics: Persuasion is a function of audience sex role orientation. *Personality and Social Psychology Bulletin*, 28, 863–873.
- Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin*, 115(1), 74–101.
- Crowell, J. A., Fraley, R. C., & Shaver, P. R. (1999). Measurement of individual differences in adolescent and adult attachment. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 434–465). New York: Guilford Press.
- Damasio, A. (2003). *Looking for Spinoza: Joy, sorrow, and the feeling brain*. Orlando, FL: Harcourt.
- Davison, G. C., & Wilson, G. T. (1973). Processes of fear-reduction in systematic desensitization: Cognitive and social reinforcement factors in humans. *Behavior Therapy*, 4(1), 1–21.
- DiClemente, R. J., & Peterson, J. L. (1994). *Preventing AIDS: Theories and methods of behavioral interventions*. New York: Plenum Press.

- Eich, E., & Forgas, J. P. (2003). Mood, cognition, and memory. In A. F. Healy & R. W. Proctor (Eds.), *Handbook of psychology: Experimental psychology* (Vol. 4, pp. 61–83). New York: John Wiley & Sons.
- Estrada, C. A., Isen, A. M., & Young, M. J. (1994). Positive affect improves creative problem solving and influences reported source of practice satisfaction in physicians. *Motivation & Emotion*, *18*, 285–299.
- Fisher, W. A., & Fisher, J. D. (1992). Understanding and promoting AIDS preventive behaviour: A conceptual model and educational tools. *Canadian Journal of Human Sexuality*, *1*(3), 99–106.
- Fisher, W. R. (1987). *Human communication as narration: Toward a philosophy of reason, value, and action*. Columbia: University of South Carolina Press.
- Fox, K. K., del Rio, C., Holmes, K. K., Hook, E. W., Judson, F. N., Knapp, J. S., et al. (2001). Gonorrhoea in the HIV era: A reversal in trends among men who have sex with men. *American Journal of Public Health*, *91*, 959–964.
- Fox, N. A., & Card, J. A. (1999). Psychophysiological measures in the study of attachment. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 226–245). New York: Guilford Press.
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, *56*, 218–226.
- Frijda, N. H., Kuipers, P., & ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. *Journal of Personality & Social Psychology*, *57*, 212–228.
- Gaskill, J., & Hoy, A. W. (2002). Self-efficacy and self-regulated learning: The dynamic duo in school performance. In J. Aronson (Ed.), *Improving academic achievement: Impact of psychological factors on education* (pp. 185–208). San Diego, CA: Academic Press.
- Gerbner, G., Gross, L., Morgan, M., & Signorielli, N. (1994). Growing up with television: The cultivation perspective. In J. Bryant & D. Zillmann (Eds.), *Media effects: Advances in theory and research. LEA's communication series* (pp. 17–41). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Goffman, E. (1961). *Encounters: Two studies in the sociology of interaction*. Oxford, England: Bobbs-Merrill.
- Gollwitzer, P. M. (1990). Action phases and mind-sets. In E. T. Higgins & R. M. Sorrentino (Eds.), *Handbook of motivation and cognition* (Vol. 2, pp. 53–92). New York: Guilford Press.
- Gollwitzer, P. M., & Moskowitz, G. B. (1996). Goal effects on action and cognition. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 361–399). New York: Guilford Press.
- Graesser, A. C., Olde, B., & Klettke, B. (2002). How does the mind construct and represent stories? In M. C. Green, J. J. Strange, & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 229–262). Mahwah, NJ: Lawrence Erlbaum Associates.
- Graesser, A. C., & Ottati, V. (1996). Why stories? Some evidence, questions and challenges. In R. S. Wyer (Ed.), *Knowledge and memory: The real story* (pp. 121–132). Mahwah, NJ: Lawrence Erlbaum Associates.

- Graesser, A. C., Robertson, S. P., & Anderson, P. A. (1981). Incorporating inferences in narrative representations: A study of how and why. *Cognitive Psychology*, 13(1), 1–26.
- Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, 101, 371–395.
- Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature* 423, 534–537.
- Green, M. C., & Brock, T. C. (2005). Persuasiveness of narratives. In T. C. Brock & M. C. Green (Eds.), *Persuasion: Psychological insights and perspectives* (2nd ed., pp. 117–142). Thousand Oaks, CA: Sage.
- Green, M. C., Strange, J. J., & Brock, T. C. (Eds.). (2002). *Narrative impact: Social and cognitive foundations*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Hale, J. L., & Dillard, J. P. (1995). Fear appeals in health promotion campaigns: Too much, too little, or just right? In E. Maibach & R. L. Parrott (Eds.), *Designing health messages: Approaches from communication theory and public health practice* (pp. 65–80). Thousand Oaks, CA: Sage.
- Isen, A. M. (1999). Positive affect. In T. Dalgleish & M. J. Power (Eds.), *Handbook of cognition and emotion* (pp. 521–539). New York: John Wiley & Sons.
- Isen, A. M., & Geva, N. (1987). The influence of positive affect on acceptable level of risk: The person with a large canoe has a large worry. *Organizational Behavior & Human Decision Processes*, 39(2), 145–154.
- Joseph, G. E., & Strain, P. S. (2003). Comprehensive evidence-based social-emotional curricula for young children: An analysis of efficacious adoption potential. *Topics in Early Childhood Special Education*, 23(2), 65–76.
- Kazdin, A. E. (1986). Covert modeling: Imagery-based rehearsal for therapeutic change. In L. Krueger, J. E. Shorr, & M. Wolpin (Eds.), *Imagery: Recent practice and theory* (Vol. 4, pp. 131–153). New York: Plenum Press.
- Keinan, G. (1987). Decision making under stress: Scanning of alternatives under controllable and uncontrollable threats. *Journal of Personality & Social Psychology*, 52, 639–644.
- Kelly, J. A. (1995). *Changing HIV risk behavior: Practical strategies*. New York: Guilford Press.
- Kelly, J. A., Hoffman, R. G., Rompa, D., & Gray, M. (1998). Protease inhibitor combination therapies and perceptions of gay men regarding AIDS severity and the need to maintain safer sex. *AIDS*, 12(1), F91–F93.
- Kelly, J. A., St. Lawrence, J. S., Betts, R., Brasfield, T. L., & Hood, H. V. (1990). A skills training group intervention to assist persons in reducing risk behaviors for HIV infection. *AIDS Education & Prevention*, 2(1), 24–35.
- Kreuter, M. W., & Strecher, V. J. (1996). Do tailored behavior change messages enhance the effectiveness of health risk appraisal? Results from a randomized trial. *Health Education Research*, 11(1), 97–105.
- Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *American Psychologist*, 46, 819–834.
- Leith, K. P., & Baumeister, R. F. (1996). Why do bad moods increase self-defeating behavior? Emotion, risk taking, and self-regulation. *Journal of Personality & Social Psychology*, 71, 1250–1267.

- Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Development*, 71(1), 107–118.
- Lieberman, D. A. (1995). *Three studies of an asthma education video game: Executive summary* (Report to the NIH: National Institute of Allergy and Infectious Diseases, Grant #R43 AI34821, pp., 1–17)n.p.
- Lynn, M., Shavitt, S., & Ostrom, T. (1985). Effects of pictures on the organization and recall of social information. *Journal of Personality & Social Psychology*, 49, 1160–1168.
- Main, M., Kaplan, N., & Cassidy, J. (1985). Security in infancy, childhood, and adulthood: A move to the level of representation. *Monographs of the Society for Research in Child Development*, 50(1–2), 66–104.
- Mann, T., Sherman, D., & Updegraff, J. (2004). Dispositional motivations and message framing: A test of the congruency hypothesis in college students. *Health Psychology*, 23, 330–334.
- McAdams, D. P. (1988). Personal needs and personal relationships. In S. Duck, D. F. Hay, S. E. Hobfoll, W. Ickes, & B. M. Montgomery (Eds.), *Handbook of personal relationships: Theory, research, and interventions* (pp. 7–22). Oxford, England: John Wiley & Sons.
- McGuire, W. I. (1989). Theoretical foundations of campaigns. In R. E. Rice & C. K. Atkin (Eds.), *Public communication campaigns* (2nd ed., pp. 43–66). Newbury Park, CA: Sage.
- Miller, L. C., Bettencourt, A., DeBro, S., & Hoffman, V. (1993). Negotiating safer sex: Interpersonal dynamics. In J. Pryor & G. Reeder (Eds.), *The social psychology of HIV infection*. Hillsdale, NJ: Erlbaum.
- Miller, L. C., Graesser, A. C., Read, S. J., Picard, R., & Johnson, W. L. (2005). *Institute for socially optimized learning in virtual environments*. Grant submitted to the National Science Foundation for the Science of Learning Center competition.
- Miller, L. C., & Read, S. J. (1987). Why am I telling you this?: Self-disclosure in a goal-based model of personality. In V. J. Derlega & J. H. Berg (Eds.), *Self-disclosure: Theory, research, and therapy. Perspectives in social psychology* (pp. 35–58). New York: Plenum Press.
- Miller, L. C., & Read, S. J. (1991a). Inter-personalism: Understanding persons in relationships. In W. H. Jones & D. Perlman (Eds.), *Advances in personal relationships: A research annual* (Vol. 2, pp. 233–267). Oxford, England: Jessica Kingsley.
- Miller, L. C., & Read, S. J. (1991b). On the coherence of mental models of persons and relationships: A knowledge structure approach. In G. J. O. Fletcher & F. D. Fincham (Eds.), *Cognition in close relationships* (pp. 69–99). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Miller, P. J. (1994). Narrative practices: Their role in socialization and self-construction. In U. Neisser & R. Fivush (Eds.), *The remembering self: Construction and accuracy in the self-narrative. Emory symposia in cognition* (Vol. 6, pp. 158–179). New York: Cambridge University Press.
- Miller, P. J. (1995). Personal storytelling in everyday life: Social and cultural perspectives. In R. S. Wyer, Jr. (Ed.), *Knowledge and memory: The real story: Advances in social cognition* (Vol. 8, pp. 177–184). Hillsdale, NJ: Lawrence Erlbaum Associates.

- Miller, P. J., Fung, H., & Mintz, J. (1996). Self-construction through narrative practices: A Chinese and American comparison of early socialization. *Ethos*, *24*, 237–280.
- Monahan, J. L. (1995). Thinking positively: Using positive affect when designing health messages. In E. Maibach & R. L. Parrott (Eds.), *Designing health messages: Approaches from communication theory and public health practice* (pp. 81–98). Thousand Oaks, CA: Sage.
- Moreno, R., Mayer, R. E., Spires, H. A., & Lester, J. C. (2001). The case for social agency in computer-based teaching: Do students learn more deeply when they interact with animated pedagogical agents? *Cognition & Instruction*, *19*, 177–213.
- Nelson, K. (1993). The psychological and social origins of autobiographical memory. *Psychological Science*, *4*, 7–14.
- Nelson, W. M., & Behler, J. J. (1989). Cognitive impulsivity training: The effects of peer teaching. *Journal of Behavior Therapy & Experimental Psychiatry*, *20*, 303–309.
- Oatley, K. (2002). Emotions and the story worlds of fiction. In M. C. Green, J. J. Strange, & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 39–69). Mahwah, NJ: Lawrence Erlbaum Associates.
- O'Quin, K., & Aronoff, J. (1981). Humor as a technique of social influence. *Social Psychology Quarterly*, *44*, 349–357.
- Pennington, N., & Hastie, R. (1992). Explaining the evidence: Tests of the story model of juror decision making. *Journal of Personality and Social Psychology*, *62*(2), 189–206.
- Picard, R. W. (1997). *Affective computing*. Cambridge, MA: MIT Press.
- Piotrow, P. T., Kincaid, D. L., Rimon, J. G., & Rinehart, W. (1997). *Health communication: Lessons from family planning and reproductive health*. Westport, CT: Praeger.
- Prochaska, J. O., & DiClemente, C. (2002). Transtheoretical therapy. In F. W. Kaslow (Ed.), *Comprehensive handbook of psychotherapy: Integrative/eclectic* (Vol. 4, pp. 165–183). New York: John Wiley & Sons.
- Ray, M. L. (1977). When does consumer information processing research actually have anything to do with consumer information processing. In W. D. Perreault, Jr. (Ed.), *Advances in Consumer Research*, *4*, 372–375.
- Read, S. J. (1987). Constructing causal scenarios: A knowledge structure approach to causal reasoning. *Journal of Personality and Social Psychology*, *52*, 288–302.
- Read, S. J., & Miller, L. C. (1989). Interpersonalism: Toward a goal-based model of persons in relationships. In L. Pervin (Ed.), *Goal concepts in personality and social psychology* (pp. 413–473). Hillsdale, NJ: Erlbaum.
- Read, S. J., & Miller, L. C. (1995). Stories are fundamental to meaning and memory: For social creatures could it be otherwise? In R. S. Wyer, Jr. (Ed.), *Knowledge and memory: The real story. Advances in social cognition* (Vol. 8, pp. 139–152). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Reis, J., Riley, W., Lokman, L., & Baer, J. (2000). Interactive multimedia preventive alcohol education: A technology application in higher education. *Journal of Drug Education*, *30*, 399–421.
- Roseman, I. J. (2001). A model of appraisal in the emotion system: Integrating theory, research, and applications. In K. R. Scherer & A. Schorr (Eds.), *Appraisal processes in emotion: Theory, methods, research. Series in affective science* (pp. 68–91). London: Oxford University Press.

- Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin*, *121*, 3–19.
- Rubin, J. (1995). The contribution of video to the development of competence in listening. In D. Mendelsohn & J. Rubin (Eds.), *A guide for the teaching of second language listening* (pp.151–165). San Diego, CA: Dominic Press.
- Sabido, M. (2004). The Origins of Entertainment-Education. In A. Singhal, M. J. Cody, E. M. Rogers, & M. Sabido (Eds.), *Entertainment-education and social change: History, research, and practice. LEA's communication series* (pp. 61–74). Mahwah, NJ: Lawrence Erlbaum Associates.
- Schank, R. C., & Abelson, R. P. (1995). Knowledge and memory: The real story. In R. S. Wyer, Jr. (Ed.), *Knowledge and memory: The real story. Advances in social cognition* (Vol. 8, pp. 1–85). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Schank, R. C., & Berman, T. R. (2002). The pervasive role of stories in knowledge and action. In M. C. Green, & J. J. Strange, & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 287–313). Mahwah, NJ: Lawrence Erlbaum Associates.
- Scherer, K. R. (2001). Appraisal considered as a process of multilevel sequential checking. In K. R. Scherer & A. Schorr (Eds.), *Appraisal processes in emotion: Theory, methods, research. series in affective science* (pp. 92–120). London: Oxford University Press.
- Sherman, D. A. K., Nelson, L. D., & Steele, C. M. (2000). Do messages about health risks threaten the self? Increasing the acceptance of threatening health messages via self-affirmation. *Personality & Social Psychology Bulletin*, *26*, 1046–1058.
- Silvia, P. J., & Eichstaedt, J. (2004). A self-novelty manipulation of self-focused attention for Internet and laboratory experiments. *Behavior Research Methods, Instruments & Computers*, *36*, 325–330.
- Simon, H. A. (1967). Motivational and emotional controls of cognition. *Psychological Review*, *74*(1), 29–39.
- Singhal, A., Cody, M., Rogers, E. M., & Sabido, M. (Eds.) (2004). *Entertainment-education and social change: History, research, and practice*. Mahwah, NJ: Erlbaum.
- Singhal, A., & Rogers, E. M. (1999). *Entertainment education: A communication strategy for social change*. Mahwah, NJ: Erlbaum.
- Slade, A. (1999). Representation, symbolization, and affect regulation in the concomitant treatment of a mother and child: Attachment theory and child psychotherapy. *Psychoanalytic Inquiry. Special Attachment Research and Psychoanalysis: Clinical Implications*, *19*, 797–830.
- Stater, M. D. (1995). Choosing audience segmentation strategies and methods for health communication. In E. Maibach & R. Parrott (Eds.), *Designing health messages: Approaches from communication theory and public health practice*. (pp. 186–198). Thousand Oaks, CA: Sage.
- Slater, M. D. (2002). Entertainment education and the persuasive impact of narratives. In M. C. Green, J. J. Strange, & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations* (pp. 157–181). Mahwah, NJ: Erlbaum.
- Stein, N. L., & Levine, L. J., & Craik, F. (1991). Making sense out of emotion: The representation and use of goal-structured knowledge. In W. Kessen, A. Ortony, & F. Craik (Eds.), *Memories, thoughts, and emotions: Essays in honor of George Mandler* (pp. 295–322). Hillsdale, NJ: Lawrence Erlbaum Associates.

- Storey, D., Boulay, M., Karki, Y., Heckert, K., & Karmacharya, D. M. (1999). Impact of the integrated radio communication project in Nepal, 1994–1997. *Journal of Health Communication, 4*, 271–294.
- Stuss, D. T., Gow, C. A., & Hetherington, C. R. (1992). “No longer Gage”: Frontal lobe dysfunction and emotional changes. *Journal of Consulting & Clinical Psychology, 60*, 349–359.
- Swann, W. B., & Miller, L. C. (1982). Why never forgetting a face matters: Visual imagery and social memory. *Journal of Personality & Social Psychology, 43*, 475–480.
- Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). New York: HarperCollins.
- Tingen, M. S., Grimling, L. F., Bennett, G., Gibson, E. M., & Renew, M. M. (1997). A pilot study of preadolescents to evaluate a video game-based smoking prevention strategy. *Journal of Addictions Nursing, 9*(3), 118–124.
- Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science, 211*, 453–458.
- Vaughn, B. E., & Bost, K. K. (1999). Attachment and temperament: Redundant, independent or interacting influences on interpersonal adaptation and personality development? In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 198–225). New York: Guilford Press.
- Vorderer, P., & Knobloch, S. (2000). Conflict and suspense in drama. In D. Zillman & P. Vorderer (Eds.), *Media entertainment: The psychology of its appeal* (pp. 59–72). Mahwah, NJ: Erlbaum.
- Vorderer, P., Wulff, H. J., & Friedrichsen, M. (1996). *Suspense: Conceptualizations, theoretical analyses, and empirical explorations*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Watson, D., Weise, D., Vaidya, J., & Tellegen, A. (1999). The two general activation systems of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology, 76*, 820–838.
- Wegener, D. T., & Petty, R. E. (1994). Mood management across affective states: The hedonic contingency hypothesis. *Journal of Personality and Social Psychology, 66*, 1034–1048.
- Winett, R. A., Wagner, J. L., & Moore, J. F. (1991). An experimental evaluation of a prototype public access nutrition information system for supermarkets. *Health Psychology, 10*(1), 75–78.
- Witte, K. (1992). The role of threat and efficacy in AIDS prevention. *International Quarterly of Community Health Education, 12*, 225–249.
- Wolitski, R. J., Valdiserri, R. O., Denning, P. H., & Levine, W. C. (2001). Are we headed for a resurgence of the HIV epidemic among men who have sex with men? *American Journal of Public Health, 91*, 883–888.
- Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35*(2), 151–175.
- Zillman, D., & Vorderer, P. (2000). *Media entertainment: The psychology of its appeal*. Mahwah, NJ: Erlbaum.

Copyright of Human Communication Research is the property of Blackwell Publishing Limited and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.