

Who You Are Can Predict What You Say on a Virtual Date: Traits as Predictors of Communication Patterns of Young Men Who Have Sex With Men

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Using virtual environments (VE), we examine—for the first time—how individuals' traits predict "first date," in-the-moment conversational choices. We look at how attachment anxiety, avoidance, and Behavioral Inhibition System (BIS) predict virtual conversational choices (i.e., to dismiss, deny, or reciprocate in virtual conversations during a virtual date). We tested this possibility through socially optimized learning in virtual environments (SOLVE-IT), a web-based, interactive 3D video game intervention designed for young men who have sex with men (YMSM) to reduce risky sexual behaviors. Data analyzed were drawn from 358 HIV-negative, self-identified MSM aged from 18 to 24, who were part of the SOLVE-IT intervention. Using ordinary least squares regression, we found that both BIS and attachment styles affect in-the-moment conversational responses and that attachment moderates the effects of BIS on those responses. The implications of these findings are discussed.

Keywords: relational messages, SOLVE-IT, interpersonal communication, virtual dating, HIV

You meet this attractive guy at the bar who says to you, "that shirt looks really hot on you." Do you decide to be a little dismissive of the compliment and simply say, "thank you," deny this compliment (can't be serious, right?) and say, "no, this? I hate it," or just reciprocate, "Think so? I bet you'd look great in it too."

Even when they are responding to a similar situation (e.g., a potential hot date), individuals differ in the conversational choices they make in close relationships. Individuals' underlying traits may help us understand these patterns. For example, a study on communication styles (e.g., de Vries, Bakker-Pieper, Konings, & Schouten, 2013) suggests that those who are extraverted are likely to be

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more expressive in language use. However, that does not tell us if and how one's traits differentially predict the content of one's conversational choices (e.g., use of compliments, response to compliments) and if they do so in specific social interaction contexts, such as during a potential "hook up" in a bar. Another study on dating scripts suggested that relational messages, such as small talk and compliments on one's clothes and appearance, are typical ways to enhance positivity in the relationship (Laner & Ventrone, 2000; Rose & Frieze, 1993).

How interlocutors differ in their responses to these script components at the beginning of fleeting intimate relationships (e.g., "pickups"), and whether this is linked to traits, has historically been problematic to study. This matters to interpersonal researchers for several reasons. First, interpersonal researchers are interested in the predictors of conversational and interpersonal dynamics (e.g., predictors of the early phases of the formation of relationships). Retrospective reports are possible, but their accuracy has been challenged (Jemmott, Jemmott, & Fong, 1992; Mustanski, 2007). Second, while dating couples' conversations can be examined (e.g., in the lab), detailed conversational choices in the early stages of dating are difficult to "observe" and measure. Third, even if we could code initial conversational choices (e.g., in online chat rooms), the conversational choices of individuals depend on the underlying traits of individuals and the situational/contextual cues individuals experience—and these cues, rather than being fixed, vary freely across individuals. Ideally, we would like to examine the role of traits in conversational choices when situational cues are more fixed and the pool of conversational options from which individuals might choose more consistently across participants.

Conversational choices and traits associated with them have applied implications (e.g., for risky sexual decision-making). For HIV-negative men who have sex with men (MSM: Carballo-Diéguez, Miner, Dolezal, Rosser, & Jacoby, 2006), for example, there is a strong positive relationship between discussing safer sex and using condoms during receptive or insertive anal sex. Furthermore, individuals who possess some traits (e.g., attachment insecurity) that predict sexual behavior for young MSM (Cook, Watkins, Calebs, & Wilson, 2016; Schuetz & Volker, 2005) demonstrate less assertive and emotional communication skills (Starks, Castro, Castiblanco, & Millar, 2017).

It is unfortunate that these interpersonal conversations at the beginning of short-term relationships are difficult to directly observe and control, since they occur in face-to-face (compared with online) interactions where research has shown HIV-negative MSM to find discussing sexual risk taking especially difficult (Carballo-Diéguez et al., 2006).

Virtual Environments (VE) for Assessing Conversational Choices

Virtual environments (VE) provide a relatively new method for interpersonal researchers to explore individuals' conversational choices and interpersonal interactions and assess how these are related to traits. When immersed in VE that are naturalistically designed (i.e., representative of real-world scripts, challenges, and behavioral options), people tend to demonstrate virtual behaviors (e.g., sexual choices, alcohol choices, etc.) similar to those they encounter in their everyday lives (Christensen et al., 2013; Godoy et al., 2013). Thus, VE can be designed to represent scenarios that are otherwise hard to create in the lab (Dovis, Van

der Oord, Wiers, & Prins, 2015; Faraone et al., 2016; Miller et al., 2011, 2012; Read et al., 2006; Williams, 2010).

Miller et al. (2014) developed socially optimized learning in virtual environments (SOLVE-IT), a web-based, interactive 3D video game for young (18- to 24-year-old) MSM (YMSM) who engage in sexually risky behavior. SOLVE-IT was designed to “pickup” romantic and sexual scenarios for this population (Christensen et al., 2013; see Figure 1). For the current study, we leverage SOLVE-IT’s dating encounters wherein YMSM make a series of choices, including conversational choices, as they try to “pick up” new, potential sexual partners at a house party or club and then at the other agent’s apartment.

Relational Messages and Dating Scripts

SOLVE-IT’s design is based on formative research on dating scripts and relational messages (Read et al., 2006). Conversations between avatars and game characters are based on messages and communication styles that are the most common among YMSM. This was observed from a series of formative interviews and observational studies conducted during the production stage of SOLVE-IT (Read et al., 2006). SOLVE-IT uses dating scripts to capture the natural sequence of events that occur in the real world (e.g., Mongeau, Yeazell, & Hale, 1994; Rose & Frieze, 1993). Relational messages that indicate one’s intention to seek further proximity and emotional positivity are pervasive during first dates, which have long been considered an important juncture in the development of romantic and sexual relationships (Baxter & Bullis, 1986). Relational messages can take the form of small talk or bold expressions of desire. Such messages could be simple compliments like “You look really hot in that shirt,” or suggestive statements like “I am so attracted to you right now.” These messages are present in almost all dating scripts, whether the dating scenario involves heterosexuals (Laner & Ventrone, 2000; Rose & Frieze, 1993) or MSM populations (Klinkenberg & Rose, 1994). Such relationship-seeking messages, under the paradigm of relational message interpretation (Burgoon & Hale, 1984, 1987), usually demonstrate unambiguous intentions of positivity and further sexual attraction. As such, when playing the SOLVE-IT video game, participants encounter relationship-seeking messages from their virtual partners.

Even though recipients of these relational messages may have reciprocal intentions to develop relationship positivity, they could still respond in ways that confuse their relational partners. According to previous formative research (Miller & Read, 2005), three types of relational responses were the most prominent. First, one might respond dismissively by not showing any signs of positivity. Such responses, referred to as *dismissive responses*, simply acknowledge the previous messages of their relationship partners without showing any sign of further relationship development (or future bonding) intentions. For example, a dismissive response toward a relational message (e.g., You look really nice in that shirt) could be responded to with a curt statement like “if you say so.” Thus, by not providing further information, their dating partner has no clue how to interpret their counterpart’s intentions. Another ambiguous response type involves denial. *Denial responses* are characterized by a lack of signals in further bonding and indications of doubts toward the other (e.g., their taste) and the future of the relationship. Given a relational message such as “you look really hot in that shirt,” a denial response could be something like, “This thing? I hate it.” Thus, while not giving distinctive indications of negativity toward the relationship, this statement indicates certain doubts about the partners’ compliments. Conversely, a less ambiguous and more commonly

observed type is *reciprocal responses*. Here, the same relational message is met with a response like, "Thank you, I bet you'd look great in it too." This type of response sends a clear relational signal and makes it easier for the partner to maintain a conversation and accelerate relationship positivity. By integrating all three types of responses into the video game, participants of SOLVE-IT can choose, based on who they are, how to respond to virtual agent "hot dates" through their avatars with the messages they would generally use on a real date.

Consistently using one or several types of these virtual conversational responses might represent a communication style. Communication styles have been defined as the verbal and nonverbal signals that express how one typically relates to others during social interactions (de Vries & de Vries, 2009; de Vries et al., 2013). For example, a person who communicates authoritatively is not only assertive, but also conveys his or her signal in terms of the relational expectations he/she has of their conversational partners (in this case, to be submissive). In our study, consistently choosing dismissive or denial responses might indicate one's reluctance or fear to create relationship positivity and intimacy.

Traits as Predictors of Virtual Communication Choices

VE has been used to study individual differences in personality traits (e.g., sensation seeking, conscientiousness, and anger/hostility) and how such individual differences predict virtual behaviors (Reader & Holmes, 2016). However, they have not been used to predict conversational choices. Below, we consider two sets of traits that interest us in predicting conversational choices, since both traits are related to seeking and to the early phases of romantic relationship development.

Attachment Styles, Romantic Relationships, and Relational Messages

Attachment theory, developed by Bowlby (1973), suggests that the attachment system that guides an adult's relationship seeking and bonding is rooted in the bonds established between the parents and the child during infancy. Bowlby's (1972, 1973) assumption was based on infancy-attachment behaviors, such as crying and searching when separated from a primary attachment figure, usually the parent or caregiver. When the infant's attachment behaviors are responded to with the attachment figure's active attentiveness, the child feels secure and confident, and he or she is more likely to actively explore the world and play with others. Conversely, when the infant does not perceive active responses from the attachment figure, the child experiences anxiety and demonstrates few attachment-seeking behaviors. As such, the attachment system developed during infancy affects and organizes one's activity through adulthood in terms of social bonding, especially in romantic relationships (DeWall et al., 2011; Hazan & Shaver, 1987; Levy, Ellison, Scott, & Bernecker, 2011; Shaver, Schachner, & Mikulincer, 2005). Growing into adulthood, people's attachment styles vary (Hazan & Shaver, 1987; Shaver et al., 2005), and different attachment styles manifest in how people handle relationships. Adult attachment styles comprise two dimensions: avoidance and anxiety (Wei, Russell, Mallinckrodt, & Vogel, 2007). Attachment avoidance is characterized by the fear of dependence and relationship intimacy, while attachment anxiety is characterized by the degree of anxiety when separated from the relational partner (Ainsworth, Bell, & Stayton, 1974).

Recently, it has been suggested that attachment styles might be important predictors of risky condom use among MSM (e.g., Cook et al., 2016; Ramirez & Brown, 2010; Shaver & Mikulincer, 2006; Starks, Millar, Tuck, & Wells, 2015; Starks et al., 2017). This may be partly because of the link found between the attachment styles and the communication skills alluded to earlier. For example, Starks and colleagues (2017) found that high attachment anxiety and avoidance were related to a lack of effectiveness in using assertive and emotional communication, both of which could affect one's perception of relationship intimacy.

Some risky MSM might be unable to accurately perceive their relational partners' intentions if such partners fail to communicate effectively, and this might affect condom use during subsequent sexual behaviors. Indeed, for individuals with high attachment anxiety and avoidance, communication with romantic partners is usually less effective in achieving relational goals. It takes more effort (e.g., time, affection, self-disclosure) to develop a close relationship with high anxiety and avoidance individuals (Hudson & Fraley, 2017). Little wonder individuals with high attachment anxiety and/or avoidance issues frequently report not being accepted (Haak, Keller, & DeWall, 2017) or being in poor-quality romantic relationships (Wang, Zhou, & Zhang, 2017). As such, attachment avoidance and anxiety might indicate problematic relationship-building conversational responses. In our study, individuals with high attachment anxiety and attachment were less likely to reciprocate effectively when communicating with their romantic partners.

Both high attachment anxiety and attachment avoidance individuals are also more likely to choose dismissive and denial responses. High attachment avoidance is usually associated with a strong need to be independent, self-reliant, and reticent. Individuals with high attachment avoidance are usually withdrawn or avoid and withhold communication during social interactions (Jang, Smith, & Levine, 2002). Dominated by the general motive to avoid relational intimacy, attachment avoidance might be predictive of dismissive and denial communication responses in a dating scenario. High attachment anxiety is usually associated with an excessive need for approval and distress toward unresponsive partners (Brennan, Clark, & Shaver, 1998; Lopez & Brennan, 2000; Wei et al., 2007). Dominated by the fear of being rejected or abandoned by relational partners, individuals with high attachment anxiety are usually more likely to experience emotional dysregulation (Nielsen et al., 2017). As hypothesized in Figures 1 and 2, highly anxious individuals, characterized by *the conflict between hoping to establish a relationship and fearing rejection, could be more likely to choose dismissive and denial conversational choices.*

BIS and Romantic Relationships

In addition to attachment styles, individual differences in the two major behavioral systems may matter for conversational response choices. The Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS) are important factors that can affect how people establish social bonds and interpersonal relationships (Elliot & Thrash, 2002; Gable, 2006; Impett et al., 2010).

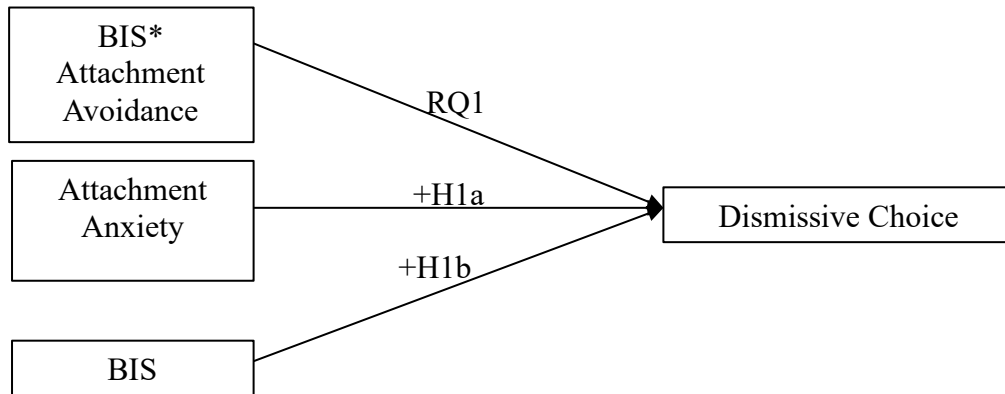


Figure 1a. Model 1: Attachment avoidance and BIS predict denial choice.

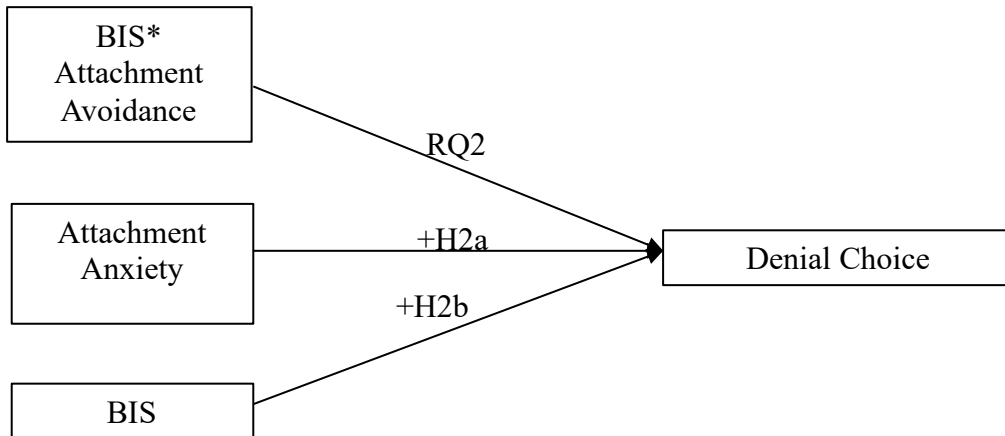


Figure 1b. Model 2: Attachment avoidance and BIS predict denial choice.

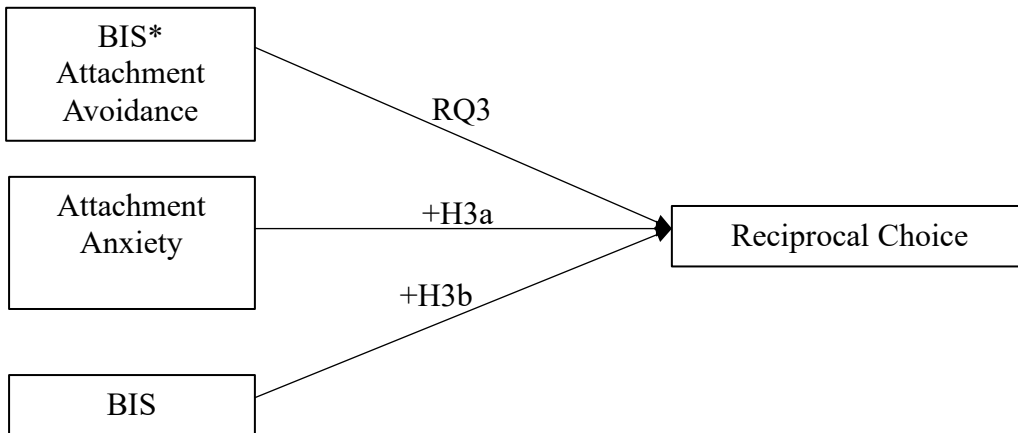


Figure 1c. Model 3: Attachment avoidance and BIS predict reciprocal choice.

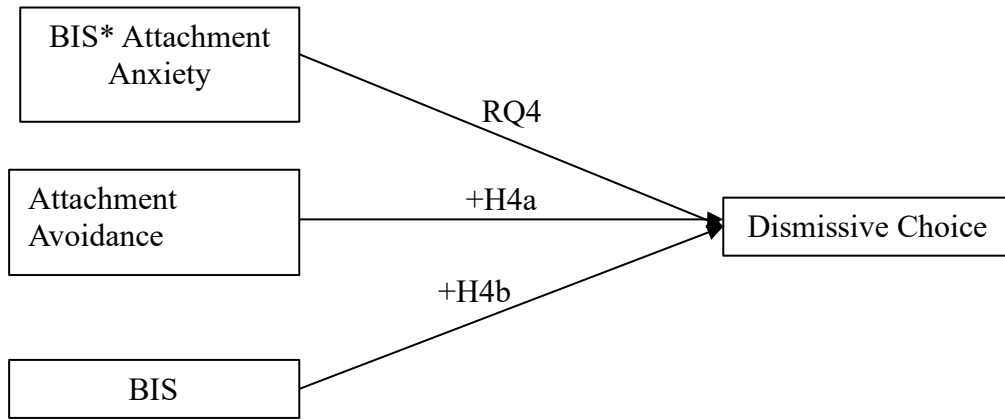


Figure 2a. Model 4: Attachment anxiety and BIS predict dismissive choice.

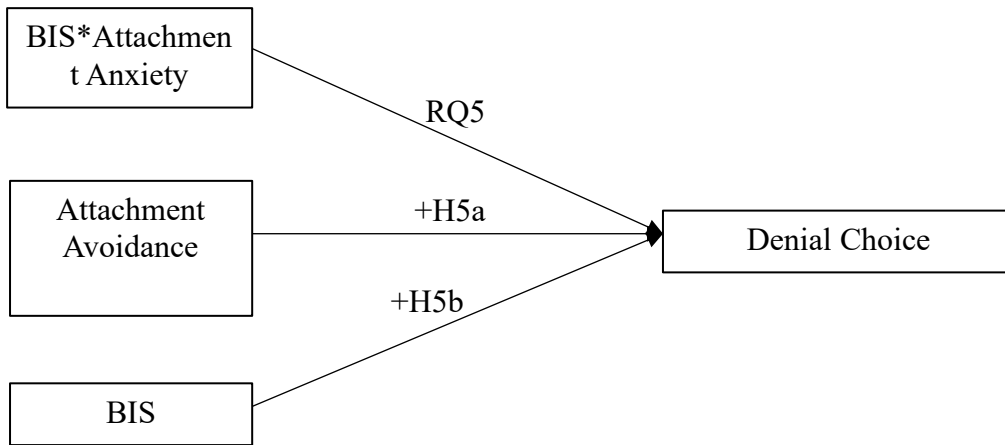


Figure 2b. Model 5: Attachment anxiety and BIS predict denial choice.

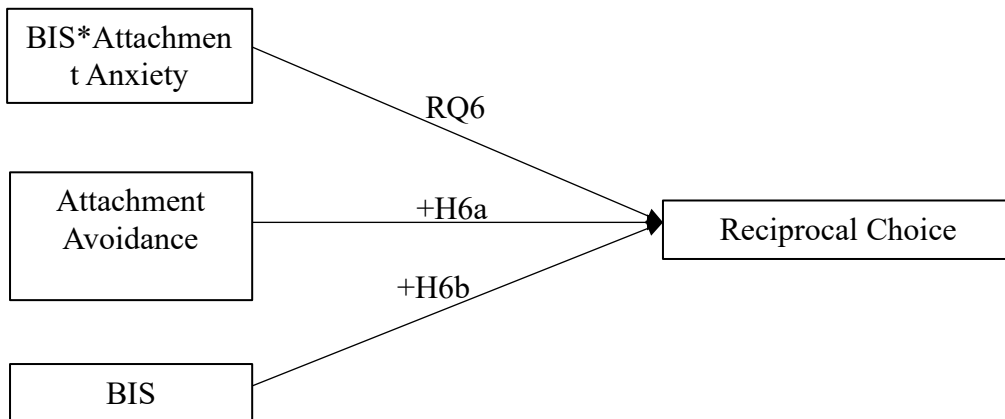


Figure 2c. Model 6: Attachment avoidance and BIS predict denial choice.

Reinforcement sensitivity theory (RST) in motivation and behavioral regulation (Gray, 1987) posits that individual motives and goals are based on BIS and BAS and behavioral responses to appetitive, rewarding signals. The Behavioral Inhibition System (BIS) inhibits behavioral responses to signals of uncertainty (e.g., novelty) or, more generally, to signals of conflict in goals (i.e., approach-avoidance, approach-approach, and avoidance-avoidance conflicts). The most recent version of the RST also posits a third system, the Fight-Flight-Freeze System (FFFS), which responds to cues that signal punishment (McNaughton & Gray, 2000). The original RST, on which the well-known Carver and White BIS/BAS scales (1994) were based, construed BIS as a general punishment system, rather than a system that responds to goal conflict. The revised reinforcement sensitivity theory splits the original conceptualization of the BIS into a two-dimensional construct that comprises the revised BIS, which produces anxiety, and the FFFS, which produces fear (Heym, Ferguson, & Lawrence, 2008; McNaughton & Gray, 2000). For brevity's sake, this article will use the term "BIS" in its original sense, rather than the label more appropriate to the revised RST, i.e., "BIS/FFFS." That said, the "BIS" and BAS are two relatively independent systems (Carver & White, 1994); they not only operate on different structures in the nervous system but also through different behavioral processes (Elliot & Thrash, 2002; Gable, 2006; Impett et al., 2010). For example, Gable, Reis, and Elliot (2000) found that while sensitive BAS individuals reported experiencing a greater number of positive events and greater levels of positive affect daily, this did not apply to individuals with sensitive BIS. Individuals with sensitive BIS never reported experiencing more negative events. Their predominant daily negative affect comes from their strong reaction to the looming possibilities of negative events that might occur (reactivity). Indeed, this may be because the BIS in the original RST was likely more than a unidimensional construct. Revisions of the RST suggested that a freeze response system (part of the FFFS in the revised RST), which regulates avoidance behavior, can mediate responses to aversive stimuli. Thus, BIS inhibits ongoing behavior by detecting, assessing, and appraising potential threats (Heym et al., 2008).

In this study, we focused on how sensitive BIS reacts to positive relationship-seeking signals. The basic processes of establishing social bonds and maintaining interpersonal relationships involve motives for moving toward a desirable end-state (appetitive/approach) and avoiding an undesirable end-state (aversive/avoidance) (Atkinson, 1958; Gable, 2006; Higgins, 1998). Those YMSM with sensitive BIS are, because of their high sensitivity toward negative consequences, more likely to be motivated by relationship motives and goals to avoid rejection (Elliot & Thrash, 2002; Gable, 2006; Gable et al., 2000). This fear of rejection can drive them to engage in risky sexual behaviors (Smith, 2015). While sensitive BAS might treat relationship-seeking messages as signals of rewards and proceed with producing reciprocal signals for a further step in the relationship, sensitive BIS could interpret those signals with the lens of possible punishments or negative consequences. Indeed, for specific social motives in establishing a relationship, sensitive BIS individuals are usually motivated by avoiding failures in performance goals (i.e., fear of making communication mistakes) or rejection from their relational partners (Elliot & Thrash, 2002; Gable et al., 2000). As such, to avoid subsequent rejection, as in Figures 1 and 2, *we hypothesize that individuals with sensitive BIS are, in general, less likely to choose a reciprocal message.* Conversely, they might choose to respond more conservatively by not indicating their actual interests or relationship-seeking goals; thus, *we also hypothesize that they are also more likely to choose denial and dismissive responses.*

Interaction Between BIS and Attachment

Though receiving less attention, the unique reinforcement between BIS, attachment avoidance, and anxiety in romantic relationships has been observed (Jones & Curtis, 2017; Meyer, Olivier, & Roth, 2005). With BIS being an avoidance-dominated process, attachment anxiety and avoidance are also driven by avoidance and anxiousness while in a relationship. Jones and Curtis (2017) found that anxious attachment was associated with both aspects of BIS, namely FFS fear and revised BIS anxiety. That is, anxiety and fear overlapped and mutually reinforced each other on both the motivational propensities of attachment and BIS. This interaction between BIS and attachment styles can mutually affect reactions to relationship threats. In high conflict-based threat situations, individuals with sensitive BIS and anxious attachment showed elevated distress toward relationship threats, while individuals with avoidant attachment and sensitive BIS exhibited avoidant behaviors in similar situations (Meyer et al., 2005).

Although the method of interaction between BIS and attachment avoidance or attachment anxiety is unclear, the theoretical underpinnings of BIS suggest that it involves more general inhibitory processes associated with possible punishments/negative consequences, while attachment styles are more specifically associated with anxiety and avoidance of relationship outcomes. This general versus specific focus provides a reason to hypothesize that attachment styles are moderating factors that add to one's general motivational propensity: BIS. We view these interactions and their forms as research questions. As such, we developed the following hypotheses and research questions in terms of attachment styles and BIS:

H1: Attachment avoidance (h_{1a}), BIS (h_{1b}), and their interaction (RQ_1) predict dismissive choices for MSM.

H2: Attachment avoidance (h_{2a}), BIS (h_{2b}), and their interaction (RQ_2) predict denial choices for MSM.

H3: Attachment avoidance (h_{3a}), BIS (h_{3b}), and their interaction (RQ_3) predict reciprocal choices for MSM.

H4: Attachment anxiety (h_{4a}) and BIS(h_{4b}) and their interaction (RQ_4) predict dismissive choices for MSM.

H5: Attachment anxiety (h_{5a}) and BIS(h_{4b}) and their interaction (RQ_5) predict denial choices for MSM.

H6: Attachment anxiety (h_{6a}) and BIS(h_{6b}) and their interaction (RQ_6) predict reciprocal choices for MSM.

Method

Study Design

Data for this analysis were drawn from the participants of the SOLVE-IT project, a National Institute of Mental Health (NIMH)-funded, randomized, controlled trial that employed an interactive, media-based intervention to reduce sexual risk taking among YMSM throughout the United States. The intervention was a downloadable simulation video game with virtual agents. Players' virtual characters were intermittently placed under several virtual dating scenarios (i.e., a party, a first date) and were tasked with making different virtual communication and behavioral choices. Participants in this study were recruited through

banner advertisements placed on Craigslist, blogs, and gay-interest websites. Participants were recruited nationwide (in each of the 50 states) in the United States. At the beginning of the study, participants were entered into a lottery with a 1:40 chance of winning a \$100 gift card. Additional details about the design and methods of this parent study can be found elsewhere (Christensen et al., 2013).

Participants were asked to self-report on a series of surveys that measured their attachment styles and BIS scores before they were exposed to the SOLVE-IT game. While they were playing the game, the system automatically recorded their virtual choices (i.e., communication and behaviors) when they interacted with our virtual agents in the game.

Participants

The data for this study include a sample of 426 YMSM that represents a hard-to-recruit, national cohort of young men who are at high risk of contracting HIV. This sample comes from a larger sample of participants who were part of a randomized controlled trial examining the SOLVE-IT intervention game to assess changes in risky sexual behavior over time. Because this work's focus is on conversational choices and personality characteristics, we focused only on those who have been part of the experimental group (i.e., those who have been playing the SOLVE-IT video game). Results from personality and conversational choices have not previously been examined or reported in this data set. To be eligible for recruitment, MSM had to: (1) self-report being negative for HIV; (2) currently live in the United States; (3) currently be 18 to 24 years of age; and (4) have engaged in risky sexual behaviors (e.g., condomless anal sex) with a nonprimary male partner three months before enrollment in the study. "Nonprimary partner" was defined as a male partner with whom the participant had not, at the time of this study, engaged in a primary (e.g., more than 6 months) romantic relationship.

Measurements

Attachment Styles

Attachment styles were measured using the Close Relationship Scale (ECR) (Wei et al., 2007). It is a 12-item scale that assesses attachment anxiety and attachment avoidance. Participants rated each item on a 7-point scale (1 = strongly disagree to 7 = strongly agree). An example of an attachment anxiety item is, "I need a lot of reassurance that I am loved by my partner." An example of an attachment avoidance item is, "I do not often worry about being abandoned." The attachment anxiety scale had a Cronbach's alpha of .74, $M = 3.90$, $SD = 0.74$ in this sample, and the attachment avoidance scale had a Cronbach's alpha of .78 in this sample, $M = 4.35$, $SD = 0.65$.

BIS

BIS was measured using the scale created by Carver and White (1994). According to recent suggestions (Heym et al., 2008), we separated the BIS in terms of the FFFS-fear and BIS-anxiety dimensions. Because the FFFS-fear dimension had no acceptable Cronbach's alpha (.57), it was not analyzed. However, the BIS anxiety demonstrated an acceptable Cronbach's alpha of .70, $M = 3.02$, $SD =$

0.56, so we used this measure in our analyses. As such, the term “BIS” will hereafter, unless otherwise specified, denote BIS anxiety as derived from the eponymous Carver and White (1994) subscale.

Virtual Communication Choices

As players went through the gaming session, SOLVE-IT enabled a recording function that recorded virtual choices made by players for further analysis. The procedure enabled users to create virtual communication choice variables. Virtual communication choices with potential sexual partners were recorded and recoded at each communication point. SOLVE-IT automatically provided the total number of virtual choices made by each player. For example, a player could make 0 denial, 5 dismissive, and 3 reciprocal virtual choices while playing the game. The total number of choices represents the value of each relational message of interest—which is the specified frequency of that type of conversational choice across the two levels of the game for a given player.

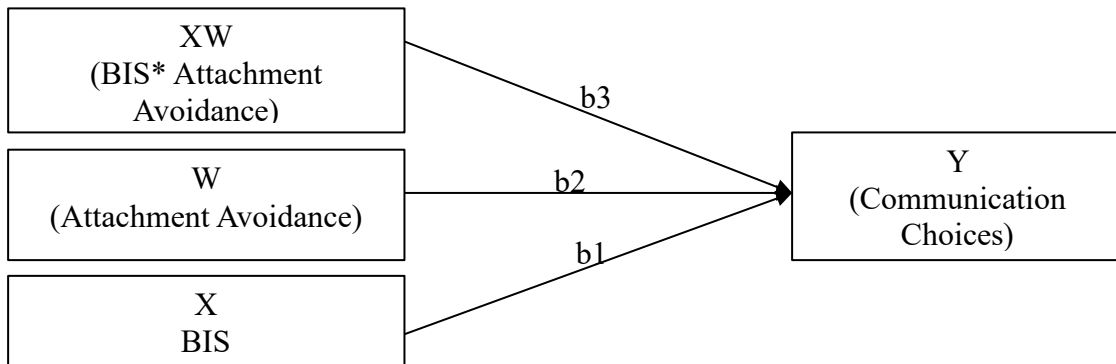


Figure 3a. Analytical model for analysis.

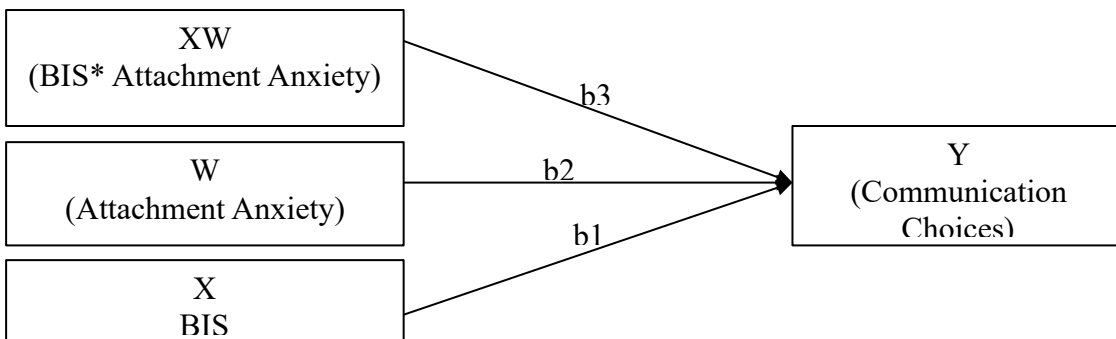


Figure 3b. Analytical model for analysis.

Data Analysis

Of the 426 participants who played the game, we analyzed 360 who had fully completed two levels of SOLVE-IT. To test our hypothesis, we conducted a series of analyses using ordinary least squares (OLS) regression provided by the SPSS -PROCESS macro (Preacher & Hayes, 2004). A series of OLS analyses

using the PROCESS macro were conducted. We tested all hypotheses and research questions using PROCESS's "model 1," wherein *W* was specified as the moderator. Figure 3 shows the statistical model we evaluated. Specifically, attachment anxiety (*W*), BIS (*X*), and the interaction between them (*XW*) were entered as IVs (Figure 3a). In three separate analyses, each of the conversational choices was entered as the dependent variable, with attachment anxiety as the moderator. This was repeated (Figure 3b), with attachment avoidance as *W*. For each interaction analysis, bias-corrected 95% confidence intervals were generated using 10,000 bootstrap samples. The original model had control variables, including age, race, and years of education. However, none of the variables were significant in the analysis. For the sake of parsimony, we reported results without those control variables.

To better understand the interaction effects, we followed the procedure recommended by Hayes (2013) and plotted five significant interactions. As shown in Figures 4a through 4e we see a general pattern of how BIS and attachment affect different communication choices. The plots were created using the pick-a-point method; we plotted interaction effects using the mean of attachment anxiety and avoidance. That is, all interactions were plotted using attachment scores at the mean, one standard deviation above the mean, and one standard deviation below the mean. To further understand the significance of the interaction, we also used the Johnson-Neyman technique to probe the significant range of the interaction (Hayes, 2013; Preacher, Curran, & Bauer, 2006). Results indicate that the interaction effects became insignificant when the attachment anxiety score was larger than 4.38, the attachment avoidance score was larger than 3.95, and the BIS-anxiety score was larger than 3.5. As such, we plotted only the significant lines.

Results

H_1 to H_3 posit that attachment avoidance is predictive of MSM's dismissive communication choices in virtual dating scenarios (when BIS and the interaction between them are included in the model). Our results indicate that H_{1a} , attachment avoidance, significantly predicts dismissive communication choices, $B = 4.08$, $t(358) = 2.84$, $p < .01$, 95% CI: [1.29, 6.89]. Thus, H_{1a} is supported. H_{1b} suggests that BIS is predictive of dismissive communication choices: Indeed, BIS predicts a greater likelihood of dismissive choices: $B = 6.63$, $t(358) = 3.34$, $p < .001$, 95% CI: [2.72, 10.55]. These results need to be interpreted in light of a significant interaction. Thus, in answer to RQ_1 , there is a significant conditional effect of BIS on the relationship between attachment avoidance and dismissive communication choices: $B = -1.39$, $t(358) = -3.05$, $p < .001$, 95% CI: [-2.28, -0.49]. The interaction explains a small, but significant portion of the choice of dismissive communication $R^2 = .03$, $p < .001$. As can be seen in Figure 4, we plotted only the significant slopes. Follow-up simple slope tests using the Johnson-Neyman approach (Hayes & Matthes, 2009; Preacher et al., 2006) reveal that when attachment avoidance scores are lower than 4.39, the simple slopes are significant.

H_{2a} , which posits that attachment avoidance is predictive of increasing self-denial communication choices (in a model with BIS and the interaction between them), was not supported: $B = 1.12$, $t(358) = 1.96$, $p = .05$, 95% CI: [-0.00, 2.25]. H_{2b} suggests that BIS is predictive of denial communication choices; indeed, a high BIS score indicates a greater likelihood of this choice: $B = 1.70$, $t(358) = 2.12$, $p = .03$, 95% CI: [0.12, 3.27]. RQ_2 examines the conditional effect of BIS on the relationship between attachment avoidance and denial communication choices. The interaction effect was significant: $B = -0.39$, $t(358) = -2.16$, $p = .03$, 95% CI: [-0.75, -0.03]. As suggested in Figure 4, the interaction also explains a small but

significant portion of the choice of dismissive communication $R^2 = .01, p = .03$. Follow-up simple slope tests using the Johnson-Neyman approach (Hayes & Matthes, 2009; Preacher et al., 2006) reveal that when attachment avoidance scores are lower than 4.39, the simple slopes are significant.

H_{3a} , which hypothesizes that attachment avoidance negatively predicts reciprocal communication choices, is supported: $B = -3.09, t(358) = 2.10, p = .02, 95\% \text{ CI} = [-6.11, -0.08]$. H_{3b} suggests that BIS is negatively related to reciprocal choice: $B = -3.09, t(358) = -2.02, p = .04, 95\% \text{ CI} = [-6.11, -0.08]$. RQ_3 assesses the conditional effect of BIS on the relationship between attachment avoidance and reciprocal communication choices, and indeed, the interaction effect is significant: $B = 1.03, t(358) = 2.10, p = .03, 95\% \text{ CI} = [0.07, 1.02]$. As shown in Figure 4, the interaction also explains a small but significant portion of the choice of dismissive communication $R^2 = .01, p = .04$. Follow-up simple slope tests using the Johnson-Neyman approach (Hayes & Matthes, 2009; Preacher et al., 2006) reveal that when attachment avoidance scores are lower than 4.38 and greater than 5.82, the simple slopes are significant.

H_4 posits that attachment anxiety is predictive of one's communication choices in virtual dating scenarios. The results indicate that H_{4a} , which posits that attachment anxiety is predictive of dismissive communication choice, is supported: $B = 2.72, t(358) = 2.32, p = .02, 95\% \text{ CI} = [0.91, 6.72]$. H_{4b} , which posits that BIS is related to dismissive choices, is supported: $B = 3.82, t(358) = 2.58, p = .01, 95\% \text{ CI} = [0.41, 0.52]$. Our results indicate that for RQ_4 , which investigates the joint effects of BIS and attachment anxiety on dismissive communication choices, the interaction effect is significant: $B = -0.82, t(359) = -2.27, p < .01, 95\% \text{ CI} = [-1.55, -0.11]$. As shown in Figure 4, the interaction also explains a small but significant portion of the choice of dismissive responses $R^2 = .01, p = .02$. Follow-up simple slope tests using the Johnson-Neyman approach (Hayes & Matthes, 2009; Preacher et al., 2006) reveal that when attachment anxiety scores are lower than 3.95, the simple slopes are significant.

However, H_{5a} , which hypothesizes that attachment anxiety predicts denial communication choices, was not supported. $B = -0.33, t(358) = -0.50, p = .62, 95\% \text{ CI} = [-1.15, 0.68]$. H_{5b} posits a positive relationship between BIS and denial choices, greater than 5.82; the simple slopes were significant. $B = -0.33, t(358) = 0.56, p = .57, 95\% \text{ CI} = [-1.49, 0.83]$, thus H_{5b} is not supported. RQ_5 explores the interaction between BIS and attachment avoidance in predicting denial choices, $B = 0.08, t(359) = 0.57, p = .57, 95\% \text{ CI} = [-0.20, 0.37]$, failing to provide answers for RQ_5 .

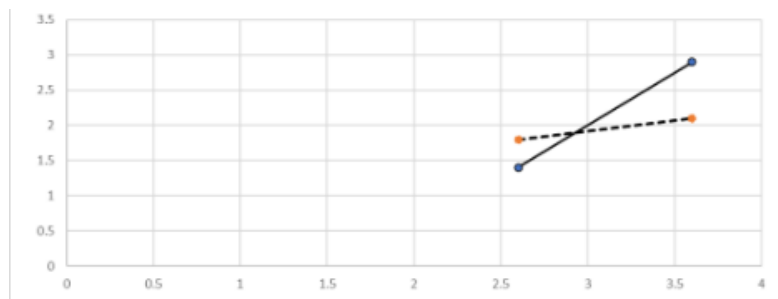


Figure 4a. RQ_1 : Attachment Avoidance and BIS Predict Dismissive Choice.

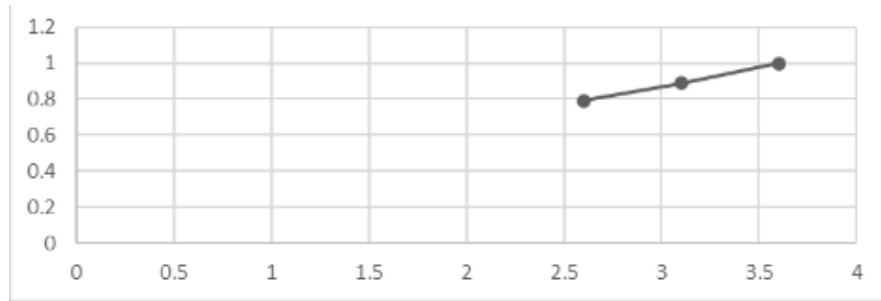


Figure 4b. RQ₂: Attachment Avoidance and BIS Predict Denial Choices.

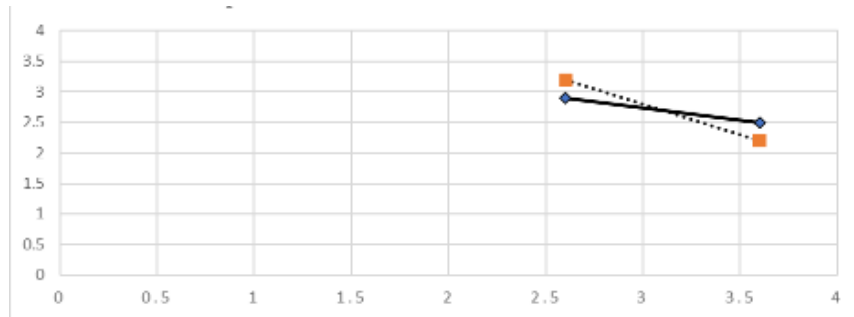


Figure 4c. RQ₃: Attachment Avoidance and BIS Predict Reciprocal Choices.

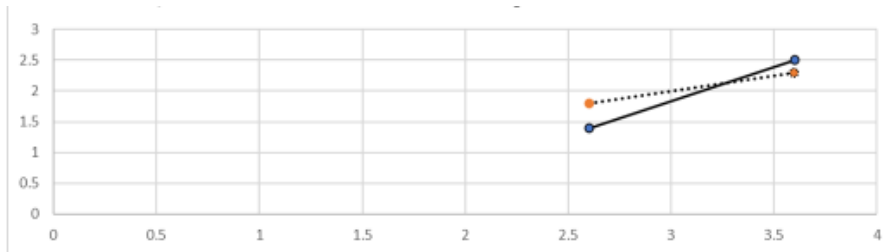


Figure 4d. RQ₄: Attachment Avoidance and BIS Predict Dismissive Choice.



Figure 4e. RQ₆: Attachment Avoidance and BIS Predict Reciprocal Choice.

H_{6a}, which hypothesizes that attachment anxiety is predictive of a decrease in reciprocal communication choices, is supported: $B = -4.14$, $t(359) = -3.36$, $p < .01$, 95% CI: [-6.57, -1.72]. H_{6b} posits that BIS is predictive of reciprocal choices; indeed, $B = -4.37$, $t(359) = -3.45$, $p < .01$, 95% CI: [-6.57, -1.72]. RQ_6 examines the interaction of BIS and attachment on reciprocal choices; indeed, the interaction is significant, $B = 1.52$, $t(359) = 3.26$, $p < .01$, 95% CI: [0.49, 2.01]. In Figure 4, the interaction also explains a small but significant portion of the choice of dismissive communication, $R^2 = .03$. Follow-up simple slope tests using the Johnson-Neyman approach (Hayes & Matthes, 2009; Preacher et al., 2006) reveal that when attachment anxiety scores are lower than 3.83 and greater than 3.92, the simple slopes are significant.

Discussion

Summary of Findings

In the current work, using the communication choices made by YMSM in the SOLVE-IT intervention, we examined how general motivational propensities, such as BIS and more specific relationship motivational propensities associated with attachment styles, could be predictive of in-the-moment dynamic communication virtual choices. Despite not being able to find significant relationships between BIS and attachment anxiety on denial responses (see the limitation section), all other models were supported.

By analyzing six hypothesized models, we found that both BIS anxiety and attachment styles (i.e., attachment anxiety and avoidance) were related to different response choices. Specifically, sensitive BIS correlated with an increasing tendency to make more ambiguous communication choices (i.e., dismissive and denial choices with no clear indication of desired relationship intimacy) and a decreasing tendency to respond with choices that indicate desired mutual intimacy (i.e., reciprocal choices). We also found the same pattern applied to individuals with high attachment anxiety and avoidance scores, whose responses indicated more dismissive and denial choices and fewer reciprocal choices. Furthermore, when looking at the interaction effects of attachment and BIS on the three types of responses, we found significant interaction effects that could help us further understand the reinforcing effects of BIS and attachment styles.

Notably, our sample has a predominantly higher than midpoint (3.5) attachment score, indicating that our sample includes relatively few securely attached participants (lower attachment scores indicate less anxious, less avoiding, and more secure individuals). Thus, the interaction plots may represent the communication choices of less securely attached YMSM. For example, our participants had a mean attachment avoidance score of 4.35. One standard deviation lower than this score is still 3.74, way above the absolute midpoint of the scale and above the typical mean of avoidant attachment scores (3.05, 2.56, 3.45) in other samples (Eastwick & Finkel, 2008). As such, our results may indicate the communication choices of a highly insecure subpopulation. Nevertheless, there is still variability in attachment scores that predicts variability in communication choices. With this in mind, we see mutually reinforcing patterns of BIS and attachment when attachment anxiousness and anxiety scores are relatively high, suggesting that for less secure individuals, sensitive BIS increases the likelihood of choosing less effective communication choices, including dismissive and denial responses.

Limitations

Lack of Significant Results on Denial Choices

Despite the overwhelming support we received for the effects of BIS and attachment styles in influencing dismissive and reciprocal choices, our models did not predict denial choices. This could be because we had relatively few participants with secure attachments in our sample, and this attenuated our correlations. This could also be because, instead of having the choice of switching to another virtual dating partner, participants had to stay and finish a series of interactions. As such, even though our participants had the motivational propensities of avoidance, they might, to a certain extent, choose responses that indicate their preferences to continue with their current relationship partners rather than chat up alternative partners.

Inclusion of Other Relational Responses

In this study, we tested three types of responses to relationship messages; admittedly, there could be other types. Indeed, romantic interactions are dynamic social situations that encompass a wide range of communication possibilities. Thus, in future studies, we see the necessity of conducting more formative studies to further explore other types of communication choices. In addition, if we include self-report measures (or naturalistic everyday measures of conversational responding to partners), we could relate individuals' past-partner communication patterns to virtual communication patterns, which we did not do here (and relate both to trait measures). Furthermore, in future studies, we hope to create more choice points and game levels that can allow us to better evaluate, with more measurement precision, how communication responses toward partners affect subsequent choices of sexual responses.

Conclusion and Implications

Using Traits to Predict States

The current study is the first to predict virtual communication interaction responses using general motivational propensities, such as BIS. In the past, even though associations between communication patterns and personality factors had been found, no study had observed how trait measures could affect in-the-moment, dynamic "first virtual date" social interactions. Previous studies have focused on the associations between general communication styles and traits. Consistent with previous results on the associations between attachment styles (i.e., avoidant and anxious) and communication skills, such as emotional expressiveness (de Vries et al., 2013) and self-disclosure (Starks et al., 2015), we found that individuals with high anxiety and avoidant attachment scores were more likely to choose communication responses in romantic encounters that undermined relationship positivity. Similarly, consistent with previous studies that examined associations between BIS and specific social goals in avoiding communication failure, we found that BIS-sensitive individuals tended to make communication choices that were "safer." After all, responses that do not signal the intention to continue with relationships mean that one cannot subsequently be rejected. As our results have suggested, about highly sensitive BIS, we predict that they would respond with more dismissive and denials and fewer reciprocal responses.

This study bridged the gap in linking “trait” and “state” in the realm of communication behaviors, paving the way for many potential future studies. If we can predict problematic communication based on personality traits like general motivational propensities, what other trait factors could be at play here? Past studies have shown associations between “Big Five” personality traits and communication styles (de Vries et al., 2013). Our results suggest that personality traits can also predict communication responses at critical moments of social interactions.

Potential for Using VE to Study Communication Behaviors and Improve Communication Skills

In our study, we also found that in creating critical moments that could elicit communication responses, VE could be a powerful tool for examining communication behaviors. In particular, our findings raise the possibility of introducing a relatively new, yet potentially powerful method (i.e., using virtual humans) of creating a more ecologically valid, easily manipulated lab environment in the field of interpersonal communications (Bombari, Schmid Mast, Canadas, & Bachmann, 2015).

Indeed, compared with the elicited dyadic interactions in laboratories, VE can compensate for the trade-offs between the struggles of achieving ecological validity and standardization (Bombari et al., 2015). Specifically, the biggest obstacle to understanding how people behave in social interactions is controlling for or standardizing the reactions of their interaction partners. This is because, in social interactions, one person’s action almost depends on the reactions of another. A smile from a partner could elicit a different response. Thus, studying the interpersonal behaviors of participants from dyads usually require strict control for the reactions of their partners such that they behave in the same, standardized way with each participant. Even though the long tradition of using trained confederates can partly standardize the interaction and create an ecologically valid conversational environment, one cannot guarantee complete control. One small difference, especially a small nonverbal behavior caused by facial mimicry, could affect the results (Reader & Holmes, 2016). Problematically, although using vignettes as videos can reduce the standardization problem, they are hardly valid in representing real-life interactions, thus rendering the results less generalizable than we would like.

Using virtual humans, by comparison, we have both the benefits of having a more controllable and ecologically valid social environment (Reader & Holmes, 2016). Nonverbal behaviors (e.g., facial expressions and mimicry) could easily be manipulated and prerecorded, thus reducing the problems of using confederates. One can even manipulate facial mimicry to evaluate differences in social interactions (Bailenson, Blascovich, Beall, & Loomis, 2003; Bailenson & Yee, 2005). The interactive features of VE, such as creating personalized avatars or choosing different narrative storylines, could provide a high-level presence, thus creating an ecologically valid scenario (Bailenson et al., 2003; Blascovich et al., 2002). Indeed, “virtual characters may represent a compromise between full two-person interactions and fully controllable, pre-recorded stimuli” (Reader & Holmes, 2016, p. 140).

The current work also suggests the intriguing possibility that interpersonal researchers could use virtual environments to change communication skills and communication choices in interpersonal contexts where different choices may affect relationship development. We could design interventions that target challenging moments within common scenarios for target audiences of interest that make a difference, as we did here. If so, could we improve the communication competencies of more individuals in a range of

interpersonal situations and contexts? We can make use of existing dispositional information to anticipate possible problematic communication patterns that may occur and to provide interventions that can help one better negotiate difficult topics (e.g., condom use, serostatus here; but in additional populations working on interpersonal conflicts with one's romantic partner, parents, and coworkers/boss) and achieve one's interpersonal (develop more enduring relationships, enhance relationship quality) and personal (health promotion; professional) goals.

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