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Benjamin N. Johnson April 18, 2012

An Alternate Reality: Real-Life Relationship Building in the Virtual World

by

Benjamin N. Johnson

Dr. Nancy Gourash Bliwise

Adviser

Department of Psychology

Dr. Nancy Gourash Bliwise
Adviser

Dr. Kenneth Carter

Committee Member

Dr. Laura Otis

Committee Member

2012

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By

Benjamin N. Johnson

Dr. Nancy Gourash Bliwise

Adviser

An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
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Abstract

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The current study examines interpersonal interactions and tests whether or not practice of a successful romantic relationship in the virtual world improves interpersonal behavior in the real world. Seventy-seven participants (56 female, 21 male) completed the online component of the study. Fifty participants successfully finished the entire study, including both the online and the lab components. During the online phase, participants completed the Experiences in Close Relationships—Revised (ECR-R), created a personalized virtual identity, and engaged in an interactive relationship-formation story with a virtual partner. Participants were randomly assigned into either an experimental group, which underwent the secure possible self intervention, or a control group, which simply engaged in the program without intervention. Participants then visited the lab, were video recorded interacting with a researcher, and again completed the ECR-R. Change in attachment security did not differ based on study group, although an overall decrease in anxiety was found. Ratings of the positivity of participants' interactions with a researcher also did not differ based on study condition. Supplementary analyses found that relationship status predicted attachment security; a cyclical model was proposed to explain these findings. These results indicate that virtual interventions that allow individuals to create a virtual identity and practice adaptive relationship behavior may partially improve attitudes towards real-life relationships. Such findings could form the basis for widespread online relationship-building programs that are both affordable and effective.

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An Alternate Reality: Real-Life Relationship Building in the Virtual World

Benjamin N. Johnson

Emory University

Author Note

Benjamin N. Johnson, Department of Psychology, Emory University.

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For copies of scales and scoring keys developed in the course of this research, or for access to the virtual program, please contact Benjamin Johnson, 2667 Brookwest Lane, Marietta, Georgia, 30064.

Email: plasmblob@gmail.com.

Abstract

The current study examines interpersonal interactions and tests whether or not practice of a successful romantic relationship in the virtual world improves interpersonal behavior in the real world. Seventy-seven participants (56 female, 21 male) completed the online component of the study. Fifty participants successfully finished the entire study, including both the online and the lab components. During the online phase, participants completed the Experiences in Close Relationships—Revised (ECR-R), created a personalized virtual identity, and engaged in an interactive relationship-formation story with a virtual partner. Participants were randomly assigned into either an experimental group, which underwent the secure possible self intervention, or a control group, which simply engaged in the program without intervention. Participants then visited the lab, were video recorded interacting with a researcher, and again completed the ECR-R. Change in attachment security did not differ based on study group, although an overall decrease in anxiety was found. Ratings of the positivity of participants' interactions with a researcher also did not differ based on study condition. Supplementary analyses found that relationship status predicted attachment security; a cyclical model was proposed to explain these findings. These results indicate that virtual interventions that allow individuals to create a virtual identity and practice adaptive relationship behavior may partially improve attitudes towards real-life relationships. Such findings could form the basis for widespread online relationship-building programs that are both affordable and effective.

Keywords: attachment, avatar, intervention, online, possible selves, virtual reality

An Alternate Reality: Real-life Relationship Building in the Virtual World

Humans are social creatures. While many species of animals, such as ants or bonobo monkeys, utilize intricate social networks in daily functioning, humans have a qualitatively more complex and influential system of social interaction than any other creature. The human ability to communicate via language, for example, far surpasses communicative ability among the rest of the animal kingdom. The ability to interact and form relationships with others is another necessary factor in human survival and is also crucial to the functioning of societies around the world. Inevitably, however, problems arise in relationships, especially close relationships such as those between romantic partners. Improving romantic relationship attitudes and behaviors may be a way of combating problematic issues that arise in a romantic dyad. This requires a theory that describes how people interact with significant others, such as attachment theory, which focuses on development and lifespan relationship behavior. This theory forms the foundation of the current research.

Attachment Theory

More than half a century ago, British psychologist John Bowlby proposed the childhood theory of attachment to explain the interactions of young children with their mothers. He postulated that children at an early age begin to desire proximity to a mother (or mother-figure) who ends anxiety-causing or fear-inducing stimuli in the environment (Bowlby, 1982). Once the child becomes mobile, this desire for proximity produces "attachment behaviors," such as actions or calls that close the gap between infant and mother. However, if a child cannot reach its mother or is taken away from her, anxiety or emotional aloofness may result, leading to insecure attachment in the child (Bowlby, 1969).

In 1970, Mary Ainsworth and Silvia Bell examined children's behaviors in an unknown environment, the basis for the "Strange Situation" paradigm, which was later developed for observing attachment behavior. In this paradigm, a child and its mother are placed in an unfamiliar room. During the course of the study, a stranger enters the room and attempts to interact with the baby, the mother leaves and then returns, the stranger leaves, the mother leaves and the baby is left alone, the stranger returns, and then the mother returns. The child's behaviors in each of these scenarios are recorded, and such recordings have led to the solidification of three major patterns of child attachment (Ainsworth, Blehar, Waters, & Wall, 1978). On the one hand are *secure* children, who seek closeness to their mother, become moderately upset at separation, and show some interest in the stranger but less than that towards their mother. On the other hand are children who are insecurely attached, which can be divided into two types: *anxious-resistant* and *anxious-avoidant* (Bowlby, 1982). Resistant children may show increased distress at separation, are not easily comforted upon their mother's return, and are highly active in seeking and maintaining closeness to their mother. Avoidant children are not significantly distressed upon separation from their mother, often ignore their mother after separation, and treat a stranger nearly equivalent to their mother. Most children fall into the category of secure attachment to their mother, with up to 70% showing this style during studies of childhood behavior (Ainsworth et al., 1978). Nevertheless, 30% of children remain under the umbrella of insecure styles of attachment.

According to Bowlby, a child's experiences with seeking proximity from a mother-figure and the resulting caregiving behavior (or lack thereof) on the part of the mother-figure are sources of information that the child uses to generate working models of its environment and its own capabilities (Bowlby, 1982). These models of self and of others are highly detailed

foundational ways of explaining others' behaviors and defining one's own abilities and personality traits. Yet, as the term "working" suggests, they are flexible enough to be modified by stimuli that do not fit into an already existent framework (Mikulincer & Shaver, 2007). A child, therefore, creates an internal working model that guides its actions in situations involving input from the environment. Consequently, insecure attachment styles can at first be adaptive schemas, providing safety, for example, to children who become reclusive in response to a harmful caregiver or who excessively seek proximity to their mother when a dangerous stranger is near. It is only when working models become rigid, such as when a child does not incorporate new and more self-relevant information or inappropriately transfers a working model of one individual onto another, that insecure styles of attachment become maladaptive. In most situations, secure attachment behavior is most appropriate and insecurity may therefore lead a child to engage in behaviors that are not conducive to a healthy style of living or relating to others.

Although Bowlby's theory of attachment focuses on the ontogeny of attachment behavior in early childhood, he hypothesized that the same types of working models and attachment behavior that develop during infancy are also relevant in adulthood (Bowlby, 1980). Specific behaviors and internal models may fluctuate based on changes in the environment, but the general concepts of security, insecurity, and attachment to significant others remain applicable. Bowlby's theoretical claims have since been adapted and applied to adult relationships in empirical research. Several years after Ainsworth and her colleagues (1978) used the "Strange Situation" scenario to look at infants' styles of attachment with their caregivers, researchers began to direct their attention to the attachment attitudes of the mothers themselves. Main and Goldwyn (1984) document the initiation of the Berkeley Adult Attachment Interview, which

asks about memories of attachment-specific experiences in childhood as well as similar experiences during adulthood. Main and Goldwyn found that mothers' attachment-related childhood experiences predicted their own abusive behaviors towards their children. This article suggests that attachment behavior, in this case avoidance, remains present as individuals become adults. It also cautions against the maintenance of rigid internal working models. These models of attachment in adults can be considered in terms of representations of relationships with others, rather than simply interactions with a caregiver (Main, Kaplan, & Cassidy, 1985).

These working models in adulthood are also not restricted to parent-child dyads. Hazan and Shaver (1987) suggest that romantic relationships fall under the umbrella of attachment relationships and adults' behaviors and attitudes in these relationships also reflect attachment styles formed in childhood. Similar to its manifestation in children, attachment behavior in adults facilitates or avoids proximity to a romantic partner, and the partner's responses, of support or rejection, influence the security or insecurity of internal self schemas and working models (Fraley & Shaver, 2008; Mikulincer & Shaver, 2007). Securely attached adults are interdependent with their partner and see interactions with others as experiences conducive to positive change. Anxious (i.e., resistant) adults fear abandonment and therefore cling to and are preoccupied with romantic partners. They are also easily disappointed and often worried. Avoidant individuals tend to avoid intimacy with others, preferring isolation as they may lack empathy, caring, or other attributes designed to enhance interpersonal interaction (Mikulincer & Shaver, 2007).

Adults may also show a combination of anxiety and avoidance. In adults, attachment styles are often categorized by four dimensions, termed *secure*, *preoccupied*, *dismissing*, and *fearful*, created by the intersection of the two axes of anxiety and avoidance (Bartholomew,

1990) (see Figure 1). Preoccupied attachment is synonymous with anxious attachment as it describes those who have high anxiety but low avoidance. Likewise, dismissing matches avoidant attachment, being high on avoidance and low on anxiety. Those who are described as being fearfully attached tend to have both high anxiety and high avoidance. They strongly desire close relationships and dependency upon others, and yet they are afraid of or intimidated by others and hence avoid intimacy and openness (Bartholomew, 1990). However, since the four dimensions still ultimately derive from the two axes, the current study will focus on attachment insecurity in terms of the continuous variables of anxiety and avoidance, where one can be high or low on each independently. Although some analyses may include qualitative styles of attachment, this way of measuring attachment quantitatively will prove more applicable for certain statistical analyses that look for more subtle differences between variables. Therefore, similar to Bowlby (1982) and Ainsworth and her colleagues' (1978) original three classifications, this paper will refer to "secure," "anxious," and "avoidant" individuals as those who are low on both axes, high on anxiety, and high in avoidance, respectively, without denying the existence of the fourth category of attachment (i.e., fearful).

In adulthood, secure attachment is associated with countless beneficial qualities. Securely attached individuals have both social and personal advantages over the insecurely attached. Socially, they are more able to trust, be kind, sensitive, empathetic, compassionate, open, and independent (Collins & Read, 1990; Kunce & Shaver, 1994; Lopez & Brennan, 2000; Mallinckrodt, Porter, Kivlighan, 2005; Mikulincer, 1997; Mikulincer & Orbach, 1995; Rogers, 1961). They show love and forgiveness, feel connected, commit to altruistic and ethical behavior, and have a generally positive view of others (Lopez & Brennan, 2000; Mikulincer et al., 2003; Mikulincer & Shaver, 2003, 2007; Mikulincer, Shaver, Gillath, & Nitzberg, 2005).

Personally, they report stronger feelings of safeness, are resilient, optimistic, hopeful, positive, curious, have stronger values, self-image, and self-esteem (Lopez & Brennan; 2000; Mikulincer & Shaver, 2005). Securely attached adults show more self-improvement, have better defenses against psychological illness (Mikulincer & Shaver, 2007), and overall enjoy life more than either anxious or avoidant individuals (Tidwell, Reis, & Shaver, 1996).

As is clear from this review, encouraging secure attachment schemas could have positive effects throughout all areas of life. In keeping with the proportions of attachment styles in childhood, roughly 60% of adults are securely attached, with 20% being classified as anxious and 20% as avoidant (Fraley & Shaver, 2008). Based on these statistics, almost half of all adults may be lacking in many of the qualities associated with secure attachment. All of the studies above consist of data collected through surveys and self reports**.** Few studies have attempted to change attachment styles or encourage secure attachment behavior, and of these many have focused on interventions with children (Cicchetti, Rogosch, & Toth, 2006). Part of the reason for this may be the supposed stability of attachment styles across the lifespan (Waters, Merrick, Treboux, Crowell, & Albersheim, 2003). However, many researchers suggest that attachment is actually relatively labile and that interventions that focus on interpersonal behavior may be able to encourage attachment security (Mikulincer & Shaver, 2007). Some research has begun to shed light on the question of whether or not attachment styles can be modified. These studies attempt to transform maladaptive working models into more efficient and healthy schemas.

In a seminal attachment-intervention study, Pierce and Lydon (1998) subliminally (i.e., outside of conscious awareness) primed 60 female undergraduate students with terms related to both secure and insecure styles of attachment. The secure terms included items such as *supportive* and *loving*, while the negative words included *critical* and *distant*. To ensure that the

primed terms were not explicitly visible, the researchers flashed the words on a computer screen for only 33 milliseconds each (see Perfetti & Bell, 1991). They found that participants who were shown words associated with secure attachment reported that they would engage in more secure attachment behavior (such as seeking support from others) and have more secure attitudes if they were to deal with the stressful event of an unplanned pregnancy than those shown either the negative or control words.

Rowe and Carnelley (2003) expanded the scope of Pierce and Lydon's study, looking at recall of attachment-related words, expectations in close relationships, and affect after a writing task used to supraliminally (i.e., within conscious awareness) prime specific attachment styles. One-hundred and sixty undergraduate participants were instructed to write about a current relationship for 10-minutes, theoretically activating the attachment style associated with that relationship. The attachment styles of these relationships were previously ascertained by a questionnaire given to the participants during an initial visit. Participants were then given several tasks and questionnaires that measured recall, expectations, and affect. Rowe and Carnelley found that participants primed with a secure style of attachment recalled more secure words, reported more secure expectations, and had less negative affect than other groups. Similar to Pierce and Lydon's results, these findings indicate that attitudes towards close relationships are modifiable through priming a secure attachment style.

While the previous priming studies found differences in post-test secure attachment measures, research suggests that such priming experiments tend to have only short-term results (Bargh, 1989). Carnelley and Rowe (2007) used the same priming task as in their 2003 study, but had participants engage in the task on three separate occasions (on consecutive days). They found that 64 undergraduate participants who were primed with secure attachment relationships

reported more secure relationship expectations, increased positive views of self, and less attachment anxiety. More importantly, the authors found this decrease in insecurity after a two-day delay between priming and post-test measurement.

Although a two-day modification of attachment attitudes suggests that longer alterations are possible, a long-term intervention is unlikely through priming studies. Previous research that has attempted longer-term interventions is lacking. One study attempted a year-long psychotherapy with 90 individuals diagnosed with borderline personality disorder (BPD) in an effort to increase the number of those classified as securely attached (Levy et al, 2006). Although analyses showed a significant categorical increase in those with a secure attachment style, the study was not convenient to perform or replicate; psychotherapy is expensive and a year is a considerable length of time to wait to effect change. A more accessible and briefer intervention is ideal. Also, participants in the study were measured for change in attachment styles while they were still undergoing therapy. The duration of the treatment effect is therefore unknown. Furthermore, considering the psychopathology characteristic of the study's sample, the results cannot necessarily be generalized to the wider population. This study, then, in keeping with the aforementioned priming studies, also has limitations that prevent it from being useful as a general intervention for attachment insecurity.

The most significant drawback to the current experimental attachment literature is its sole focus on attachment attitudes and purely hypothetical behaviors. A prominent feature of attachment theory is its ability to describe interpersonal behaviors, which may derive from internalized attitudes. However, little, if any, research has examined behavioral change in terms of attachment constructs. The current research attempts to fill this gap by enacting a novel intervention for insecure attachment that modifies both attitudes and behaviors as well as

providing change lasting beyond the two-day effect of Carnelley and Rowe's (2007) priming experiment. This study also seeks generalizability to a broader population than individuals with BPD (Levy et al., 2006), and includes both secure and insecure individuals in the program, looking for quantitative, instead of categorical, change in attachment.

Possible Selves Motivational Theory

Hazel Markus and Paula Nurius (1986) developed a theory of motivation using the concept of the self as the focus of goal achievement. In their theory of "Possible Selves," an individual's primary mode of reaching a goal is using a mental representation of a future, "ideal" self that is somehow different from the current self (Markus & Ruvolo, 1989). This future self is goal oriented in nature. For example, a person who wants to become a concert pianist does not simply begin by engaging in behaviors that may lead to this career goal, such as practicing for several hours a day. One must first envision oneself as a concert pianist, generating a mental image of this self, and only then can steps be made that lead towards the idealized self-goal.

Markus and Nurius (1986) describe the self in terms of a "working self-concept," capturing the flexibility and allowance for growth that necessarily accompanies their motivational theory. This idea mirrors Bowlby's (1982) consideration of attachment behavior as originating from internal working models that are constantly tested and modified by environmental stimuli. Utilizing mental representations of hypothetical selves could be the source of change in attachment-specific behavior, motivating individuals to abandon or modify maladaptive working models to incorporate new and positive versions of the self (Stein & Markus, 1996). Creating a mental representation of a possible self both organizes and provides energy for actions towards an envisioned goal (Cross & Markus, 1990). In terms of attachment theory, this suggests that a person who envisions him or herself as a certain type of relationship

partner may use this possible self to influence the internal working model that describes his or her current way of acting in romantic relationships and restructure it so that the person may more easily achieve the pictured self.

Many empirical studies have found that creating possible selves can generate attitudinal change. Oyserman, Terry, and Bybee (2002) employed a 9-week possible selves intervention for 62 students in an urban middle school, including envisioning oneself as a responsible adult and imagining possible paths to reaching that possible self. Their results showed significantly greater feelings of connection to school and more concern with success for students in the intervention condition compared to students who did not utilize the program. Meevissen, Peters, and Alberts (2011) found increases in participants' reports of optimism after envisioning their best possible selves for five minutes daily over a two-week period. These results still held true even after controlling for participants' mood in analyses.

More importantly, however, and in line with the purpose of the current study, research has shown that interventions focused on the creation of a goal-oriented future self that possible selves theory are effective in producing behavioral change, not simply change in attitudes or emotions. Soon after the advent of possible selves theory, Sherman and Anderson (1987) used a possible selves intervention to study participation in psychotherapy. Of 65 participants in a mental health center, one portion both imagined themselves as continuing psychotherapy for an extended period of time and described characteristics of this possible self. The remaining participants imagined an unrelated future event (i.e., spending time with a family member) and were simply told that long-term psychotherapy is beneficial. At post-test, participants who imagined their future self in psychotherapy were far less likely to end treatment than participants who only had the benefits of therapy told to them. These results corroborate Cross and Markus's

(1990) idea that imagining a future version of oneself provides motivation to achieve that specific self through planned action.

More recently, Murru and Martin (2010) used a possible selves intervention to increase the amount of time individuals spent exercising. The researchers assigned 80 participants into three groups: one "hoped for" possible selves intervention group that was asked to imagine a more physically active self, another "feared" possible selves group that was asked to envision a less fit self, and a control group that was simply given an exercise-related quiz. Those that received either possible selves intervention showed significantly more exercise behavior (measured in minutes) at both a 4-week and an 8-week follow-up. This study indicates that an imagined possible self can inspire lasting effects on behavior, at least up to two-months post-treatment, which is much longer than priming interventions' effects on attachment behavior.

These results countered previous research that suggests a possible selves intervention does not change exercise behavior. Waters (2006) did not find a significant difference in exercising after employing a similar paradigm. However, she did not incorporate both positive and negative possible selves into her study, as did Murru and Martin (2010). According to Cross and Markus (1990), more elaboration and detail assigned to a mental representation of a possible self provides one with more control over the environment and increases the likelihood one will achieve that self. The participants in Murru and Martin's study may have created a more complete image of their ideal self than did those in Waters', including positive and negative aspects, and this may have been the reason for the study's significant findings. In light of this, the present intervention must incorporate participants' creation of a fully elaborated possible self to maximize the chances of this self being achieved.

Online Social Environments

In creating a possible selves intervention, researchers often simply ask participants to imagine themselves as a person with a certain currently unrealized identity (e.g., Murru & Martin, 2010). However, the more concrete and elaborated the hypothetical self, the more likely an individual's actions will bring it into being (Cross & Markus, 1990). Since the present study focuses on encouraging positive romantic relationship attachment behavior, an effective intervention should be set in a social setting in which participants can create a detailed and individualized version of themselves as a successful dating partner. The ideal scenario for this is the virtual world. The "virtual" can be considered the "hypothetical" in that one can create a version of oneself in this world that is not identical to one's current self, similar to using one's imagination. However, virtual space, such as internet-based social networking sites, goes beyond simple imagination in providing an actual visual component to idealized selves. Modern computer technology gives participants a chance to more vividly experience and internalize the complex, and perhaps previously unknown, self-concept of a secure individual. This will allow them to create a mental representation of themselves as one who can form and maintain successful romantic relationships. The internet also provides accessibility to a wide range of individuals, which is necessary to consider if one is planning to disseminate a behavioral intervention.

As technology advances, social interaction becomes increasingly less dependent on physical proximity and occurs largely in the virtual sphere. The World Wide Web has allowed the development of popular social networks like Facebook, which reports having over 800 million active users worldwide. The "web" has also opened the door to interactive gaming and role playing online though programs like the Instant Messaging Virtual Universe (IMVU), with

over 50 million users, and Second Life, totaling around 1 million. Virtual worlds allow individuals to create "avatars" (digital versions of themselves), and to interact with other users' avatars in an online domain that sports often highly realistic, visually appealing computer-generated landscapes.

Research shows that behaviors and social interactions in virtual worlds mirror those in the real world (Jarrett, 2009; Reeves et al., 2007; Yee & Bailenson, 2007). Friedman, Steed, and Slater (2007), for example, found that people playing Second Life will back away from a computer-controlled character that approaches them, trying to maintain personal space just as in real life. Barnette and Coulson (2010), in a review of online gaming, found a significant correlation between the leadership ability gamers show in Massively Multiplayer Online (MMO) games and similar ability in the real-world. The researchers suggest that behaviors in a virtual environment influence similar behaviors in the actual world, part of the reason for this correlation. One specific set of behaviors participants often engage in in these virtual worlds is forming romantic relationships with other users through the medium of their avatars. Thus, an online social environment is quite appropriate for individuals to create and practice securely attached selves. Mikulincer and Shaver (2007) suggest that forming a positive, successful relationship with a romantic partner can lead to restructuring of maladaptive working models and to increased attachment security. Therefore, the present research attempts to give participants an online social environment in which to create a secure relationship, in hopes that this will lead to more secure attachment attitudes and behaviors in the real world.

R. Chris Fraley has developed a paradigm for evaluating adults' attachment styles in romantic relationships using the "Choose Your Own Adventure" children's storybooks invented in the 70's as a framework. Fraley's paradigm presents a series of twenty scenarios with two

decisions for participants to choose between that decide the response of a virtual partner. In Vicary and Fraley's 2007 study, participants' scenario choices were recorded and then used to assess their respective styles of attachment as well as examine what trends they followed in making decisions. Attachment anxiety and avoidance were accurately measured by the scenarios when compared to measurements on the Experiences in Close Relationships-Revised (ECR-R) questionnaire. This questionnaire has been shown to be highly valid in measuring styles of adult attachment (Mikulincer & Shaver, 2007). Using this study as a guide, the current research goes a step further and employs the "Create Your Own Adventure" type story as an intervention, instead of as a purely evaluative tool, incorporating possible selves theory to motivate long-term potentiated improvement in attachment attitude and behavior.

Hypotheses

Based on the previous research, two main hypotheses were made. First, the intervention condition is predicted to report significant increases in attachment security on the ECR-R scale when compared to a control group. Second, behaviors in an interaction with a researcher in the lab should be significantly more secure when rated by independent viewers for the experimental group than for controls.

A secondary hypothesis regarding approach-avoidance behavior was also made. Approach and avoidance behavior are both shown to be associated with different styles of attachment (Ainsworth et al., 1978). For example, secure children will seek proximity to a caregiver (i.e., approach behavior) whereas avoidant children will often distance themselves from their mother or from a stranger (i.e., avoidance behavior). The distance from the researcher at which the participant chooses to sit is predicted to be correlated with attachment styles as measured by the ECR-R.

Method

Participants

A total of 100 undergraduate students from Emory University, a midsized southeastern private institution, accessed the online website designed for the purpose of this study. Eighty-two (82.0%) of these completed the online component and were contacted about coming in to the laboratory. Fifty-five (55.0%) completed the entire study. Four participants' data were deleted, being incomplete, and one participant requested her data removed from the study. Data from the remaining 77 (56 female, 21 male) participants who completed the online portion of the study were used for analyses of the online program. The 50 remaining participants (39 female, 11 male) who had completed the entire study were the source of data for all remaining hypothesis tests. Of those who completed the study, 26 were randomly assigned to the experimental group, and 24 were assigned to the control group. Ages ranged from 18-22 ($M = 19.96$, $SD = 1.19$). Freshmen made up 22% (11) of the sample, sophomores 28% (14), juniors 28% (14), and seniors 22% (11). Participants' racial make-up was relatively diverse: 52% (26) were White/Caucasian, 28% (14) Asian, 14% (7) Black/African American, 4% (2) Hispanic/Latino/Latina, and 2% (1) were of unknown racial background. Majors were roughly equally represented, with 20% (10) of participants majoring in the humanities, 34% (17) in the social sciences, 34% (17) in the natural sciences or mathematics and 12% (6) either undecided or unknown. Approximately 38% (19) of participants reported currently being in a romantic relationship, 72% (36) having previously been in a relationship, and 80% (40) having been in a relationship at some time, whether past or present.

Study Design

In order to induce attitudinal change similar to previous priming studies (e.g., Carnelley & Rowe, 2007), as well as to facilitate behavioral change, an experimental research design was deemed appropriate for the current study. The study employed a mixed-model experimental design that was divided into two parts: an online virtual program and a post-test laboratory visit. Participants were randomly assigned into an experimental or control group upon accessing the online program. Participants in the experimental condition underwent the online intervention, which guided them towards a secure attachment schema, whereas control group participants simply engaged in the online program without guidance. Since the attachment construct is a broadly defined concept, including many forms of behavior and attitudes, such as anxiety, avoidance, and proximity maintenance, the best way to isolate the effects of the possible selves intervention was to control for as many external variables as possible through an experimental research strategy. In this manner, outside influences during post-test measurement, such as participants interacting with friends or being distracted by their surroundings were (virtually) non-existent, making the direct effects of recalling a created possible self with a secure attachment style much easier to discover.

The main independent variable in the design was assignment to either the experimental or control condition. Major dependent variables included: change in pre- to post-test ECR-R scores, ratings of video recordings on success of relationship formation with researcher, and the distance the participant chose to sit from the researcher.

Measures

The Experiences in Close Relationships—Revised Questionnaire. The primary measure used in this study was the Experiences in Close Relationships—Revised questionnaire,

modified from the Experiences in Close Relationships questionnaire, by (Fraley, Waller, & Brennan, 2000) (see Appendix A). The questionnaire consists of 36 items that measure two independent constructs: attachment anxiety and attachment avoidance. Each item is measured on a Likert scale of 1 to 7, with 1 being *Strongly Disagree* with the item and 7 being *Strongly Agree*. Anxiety is measured by items such as: "I'm afraid that I will lose my partner's love." Avoidance is measured by questions including: "It's not difficult for me to get close to my partner" (reverse coded). Several items must be reverse coded to capture the intended style of insecurity. The average of the 18 anxiety-construct items and the average of the 18 avoidance-construct items give a measure for each type of attachment insecurity.

Studies have shown that this measure has very high internal consistency for both independent axes (α_{anx} = .95, α_{avd} = .93) (Sibley & Liu, 2004), and the current research supported these findings (α_{anx} = .94, α_{avd} = .95). The ECR—R is also shown to be valid for use with diverse cultures, language backgrounds, and different types of study designs (Mikulincer & Shaver, 2007).

The Attachment Style Characteristics Inventory. The Attachment Style Characteristics Inventory (ASCI) was developed for the purposes of the current research to allow assignment of personality traits to a virtual identity (see Appendices B1 and B2). The ASCI consists of 48 personality traits associated with certain styles of attachment. The measure instructs participants to think of their virtual self and to select the traits that they wish to describe themselves. They may choose as many or as few of the traits as they wish.

In line with the two study conditions of the current research, two different subsets of the ASCI were developed. The experimental subset includes 48 characteristics that describe an individual with a secure style of attachment (e.g., *adaptive*, *selfless, empathetic*). The control

subset includes a combination of 16 traits descriptive of the three main attachment styles (i.e., secure, anxious, and avoidant). These include such items as *accepting*, *worried*, and *cold*. The 16 secure attachment traits from the control subset of the ASCI are taken directly from the secure traits in the experimental subset. Attachment security is measured based on the proportion of traits selected from each style out of the total number of traits chosen. For example, choosing three secure traits out of a total of ten traits would give a control group participant a secure attachment score of .30.

The ASCI traits were drawn from several measures of personality, including the Values in Action Inventory of Strengths (VIA-IS) (Seligman, Park, & Peterson, 2004), the Inventory of Interpersonal Strengths (IIS) (Hatcher & Rogers, 2009), the Inventory of Interpersonal Problems (IIP) (Horowitz, Rosenberg, Baer, Ureño, & Villaseñor, 1988), the Interpersonal Competence Questionnaire (ICQ) (Buhrmester, 1990), the Battery of Interpersonal Capabilities (BIC) (Paulhus & Martin, 1988), the Revised NEO Personality Inventory (NEO-PI-R) (Costa & McCrae, 1992) and the Big Five Inventory (BFI) (John, Donahue, & Kentle, 1991). The ASCI most heavily relies on the NEO-PI-R and the BFI for its items, since both of these measures have been shown to be correlated with attachment styles. The Neuroticism, Extraversion, Openness, and Conscientiousness subscales of the NEO-PI-R are all associated with either anxiety or avoidance or both as measured by the Experiences in Close Relationships Questionnaire (Brennan, Clark, & Shaver, 1998) (*r* values range from -.14 to .52; Noftle & Shaver, 2006). Specific items from the Neuroticism, Agreeableness, and Extraversion subscales of the BFI are also shown to be correlated with ECR measures of attachment (*r* values range from .16 to -.37; Noftle & Shaver, 2006).

The Bond Formation Success Scale. Video recordings of participants' interactions with the researcher were each rated on the Bond Formation Success Scale (BFSS) by two researchers blind to participants' study condition (see Appendix C). This scale was developed based on the Brief Romantic Relationship Interaction Coding Scheme (BRRICS) (Humbad, Donnellan, Klump, & Burt, 2011) used to assess the quality of an interaction between romantic couples. The BFSS was also modified to incorporate positive and negative nonverbal behaviors as outlined by Dovidio, Kawakami, Johnson, Johnson, and Howard (1997). Previous direct measures of adult attachment behavior are lacking in the field, so generating a new scale based off of similar measures of relationship behavior (such as approach and avoidance; see Ainsworth, et al., 1978) proved the most efficient way to measure attachment behaviors in the present study.

The BFSS scale is comprised of two sections divided into three subscales. The first section, synonymous with the first subscale, includes eight items rating the individual's engagement in specific behaviors, such as smiling and eye contact. These are each measured on a five-point Likert scale ranging from "Never" to "Always." Three of the items require reverse-coding for scoring the success of bond formation (*Frowning*, *Harsh tone or facial expressions*, and *Negative critical statements*). The second section, split into two subscales, includes ratings of perceived personality traits. This section captures third-party ratings of characteristics related to interpersonal behavior where self-report questionnaires would have included unavoidable bias (Gottman & Notarius, 2000). Ten description-focused items are measured on five-point Likert scales from "Not at all characteristic" to "Extremely characteristic." Four of the items make up an Anxiety subscale (*Nervous*, *Indiscreet*, *Tense*, and *Self-regulated* [reverse-coded]) and four make up an Avoidance subscale (*Sarcastic*, *Trusting* [reverse-coded], *Reserved*, and *Impatient*).

Two items from the characteristics section are included as confounding variables: *Attractive* and *Intelligent*.

Reliability analysis of the BFSS showed good inter-item reliability for the behavioral subscale (α = .86). Reliability was negligible for the anxious subscale of the characteristics section of the BFSS (α = .21). However, removing two items from the subscale (*Indiscreet* and *Self-regulated*) increased inter-item reliability to an acceptable range (α = .74). Reliability was poor for the avoidance subscale (α = .57), but became acceptable with removal of the *Sarcastic* item (α = .66).

Procedure

The setting of the study was comprised of two parts. The online program could be completed wherever participants had access to a computer with an internet connection. This meant that participants may have been located anywhere on or off campus when completing this part of the program. Although this added a large amount of variability to interaction with the online program, it also encouraged participants to complete the online portion of the study in a comfortable setting without the pressure of a researcher being present. The lab component of the study was conducted in a research laboratory in the main psychology building on the university campus.

Participants were selected from the undergraduate population using recruitment fliers posted in public areas on campus, visits to classes randomly selected from the university catalogue, and an email sent out to the entire undergraduate body enrolled during the spring semester. All forms of communication gave students information about the time commitment of the study, told them of the $50 lottery incentive, provided them with the link to the online program, and gave them contact information in case they had questions. This combination of

simple random sampling and convenience sampling provided a diverse sample of students largely generalizable to the entire university population. Although the convenience sampling method of class visits could have created bias in the data, emails provided simple random sampling and may have offset this potential for bias. Participants who participated in the study were entered into a $50 lottery, awarded to three randomly selected individuals at the completion of the study.

Online Component. Upon accessing the website for the online program, students were shown an information sheet with the details of both the online and lab portions of the study, as well as confidentiality and legal issues. They were then given the opportunity to exit or continue with the study. Students who indicated that they would like to participate in the study were prompted to enter their email address, which was used to give their data an initial identifying label before being entered anonymously into an SPSS dataset. Email addresses were also used to contact participants to schedule a laboratory visit.

Participants were then taken to a screen that outlined the five parts of the online study: 1) Demographics, 2) Questionnaire, 3) Avatar Creator, 4) Personality Checklist, and 5) Interactive Story. The demographics page asked participants their gender, age, year in school, race, major, if they were currently in a romantic relationship, and if they had ever previously been in a relationship. The "questionnaire" was the Experiences in Close Relationships—Revised scale, used to capture participants' baseline romantic relationship attachment security. Items from the questionnaire were presented in random order to each participant.

Using an interactive virtual tool called My Avatar Editor (version 1.0.4.0), images were selected to give participants a range of physical features to choose from to create their personalized virtual characters, including gender, body type, skin tone, head shape, eyes, mouth,

and nose. Participants were given the freedom to create a unique avatar that represented them in the online world (see Figure 2). When viewed in light of possible selves theory, creation of an avatar was the first step for participants to generate an ideal self in the virtual world. In including a visual component, the online program allowed participants to literally see themselves as a different (perhaps future) individual, enabling a concrete representation of a possible self (Cross & Markus, 1990).

Yee and Bailenson (2009) examined identification with avatars in the virtual world and found that individuals who were themselves linked to an attractive avatar were more likely than those who simply saw an attractive avatar in a virtual "mirror" to approach a virtual confederate. Behavioral change, in this case, was generated by identification with a virtual persona, not simply the appearance of one. Also, research shows that linking a virtual avatar with character traits strengthens one's identification with the avatar in this virtual context (Trepte & Reinecke, 2010). Thus, participants in the current study assigned an individualized personality to their avatar, in order to encourage identification with the possible self associated with their avatar. This personality was selected using the 48-item ASCI.

Up until this point in the online program, participants in the control and experimental groups were given the same stimuli. However, here, the two subsets of the ASCI were given to the appropriate study condition. Experimental participants received the list of 48 secure attachment traits, in order to guide them to create a possible self that was derived from a secure attachment schema. Control participants received the combination of the three attachment styles, allowing them to create a possible self that was not solely securely attached. The order of presentation for the ASCI items was randomly generated for each participant.

Per the current research's main hypotheses, the online intervention was not only intended to promote attitudinal change in attachment security but also to create behavioral change based on modified attachment schemas. For this purpose, a behavior-based component was included in the online program, further elaborating experimental group participants' possible selves as secure. In Vicary and Fraley's (2007) interactive story-based study, participants were given critical junctures in a virtual relationship with a romantic partner at which they could influence the response of their partner and the outcome of the relationship. Vicary and Fraley allowed two possible decisions at each juncture in the story: one would enhance the quality of the relationship with the virtual partner while the other would impair it.

The current research utilized a modified version of Vicary and Fraley's (2007) paradigm to go one step further and motivate behavioral change through engaging in the interactive story. Similar to Vicary and Fraley's program, the current study's paradigm allowed participants to select the name and gender of their virtual partner, increasing how much they could customize and identify with the story. However, the virtual adventure in the present study included three possible decisions at each juncture, instead of two (see Appendix D for example scenarios). This, again, allowed for a more personalized storyline for participants to actively create, in keeping with the importance of a possible self being fully elaborated and individualized (Cross & Markus, 1990). Each juncture's decision items were presented in random order.

As the present study followed an experimental design, the adventure story paradigm was also differentiated across study groups. The experimental condition included three options at each juncture, each associated with a secure style of attachment. Selecting any of these would lead towards a successful relationship with the virtual partner. Bowlby (1982) suggests that caregiver security leads to security in a child. Likewise, a supportive and caring romantic

partner can facilitate an individual's own secure attachment schema (Mikulincer & Shaver, 2007; Vicary & Fraley, 2007). Therefore, the virtual partner in the intervention condition always responded in a secure way, regardless of which response the participant chose, in order to encourage participants' own attachment security. Although the response was not customized to each answer, participants were lead to believe that their decisions influenced their partner's responses.

The control group was presented with a possible choice from each of the three attachment styles at every juncture. These choices were tied to unique partner responses. A participant's anxious or avoidant decision lead to a negative (and similar) response from the partner, whereas the secure decision (which matched one of those in the experimental condition) lead to the same positive response that experimental participants were met with. Therefore, whereas the experimental condition guided participants through a successful positive virtual relationship with the online partner, control participants were given the range of attachment styles upon which to base their decisions. Theoretically, control participants could have acted in a completely secure way, similar to experimental participants; however, since the social conventions of the virtual world match those of the real world (Yee & Bailenson, 2007), control group participants were assumed to make choices consistent with their baseline styles of attachment. The median overall time taken to complete the online component of the study was 17 minutes.

Laboratory Component. Upon finishing the online portion of the study, participants received an email with available times for them to visit the Adult Development laboratory space to complete the final lab-based component of the research. Participants who came into the lab signed a consent form that was identical to the online information sheet. The form reminded

them that they were to be video recorded during their visit and also gave them an opportunity to request the findings of the study once it was completed.

An undergraduate researcher working in the lab then conducted a semi-structured interview that questioned the participants on their experiences with the online program. The researcher was selected to match the preferred gender of the participant's virtual partner. Researchers were also instructed to act naturally. Both of these factors were intended to increase the likelihood, or at least potentiality, of a possible romantic bond formation between researcher and participant. Such bond formation is ideal for rating according to the BFSS.

Ainsworth et al. (1978) indicate that approach-avoidance behavior may be a reliable behavioral indicator of internal attachment schemas. In the coding scheme for the "Strange Situation," the researchers describe certain types of approach behavior as being associated with secure and anxious attachment, whereas avoidance (or distancing) behavior as indicative of avoidant attachment. For this reason, approach-avoidance behavior was also measured as the interview began in an attempt to find differences based on attachment security or study condition (see Todd, Bodenhausen, Richeson, & Galinsky, 2011). As the participant finished signing the consent form, the researcher asked him or her to slide a chair closer to be recorded during the interview. The participant's final distance from the researcher was measured according to two axes discretely marked with tape on the carpet. Lower scores suggested more approach behavior and higher scores suggested avoidant behavior.

While recording the participant's distance scores, the researcher began the interview. Although the researcher was encouraged to ask whatever questions he or she thought were appropriate based on a participant's unique experiences, four explicit questions, scored on a ten-point Likert scale, were required (see Appendix E). Because the online component of the study

was completed outside of the laboratory space, many confounding variables could have influenced possible self creation during the tasks (e.g., shared attention, influence of other people). For this reason, these four questions were asked to reactivate the schema associated with participants' possible selves. This was an attempt to control for the variation in possible self creation across participants, ensuring that each had generated a sufficiently fully realized online identity. Having a possible self active in one's mind tends to lead to increased action (Cross & Markus, 1990).

Finally, participants again completed the ECR-R, were debriefed on the purpose of the study, were reminded when they would be notified if they were to win the $50 lottery, and were thanked for their time. Although an exact average was not calculated, the lab visit lasted between 10 and 20 minutes for nearly all participants.

After each participant completed the study, the recording of his or her interaction with the undergraduate researcher was rated with the BFSS on successful relationship behaviors. Two raters who were blind to participants' assigned study group rated each video clip. The adjusted BFSS subscale scores for both raters were averaged, showing inter-rater reliability of .68 for the behavioral subscale, .50 for anxious, and .75 for avoidant.

Results

Online Program

Analyses for the online component of the study were based on data from all participants who completed the online adventure, $n = 77$. The average online anxiety score, as measured by the Experiences in Close Relationships—Revised (ECR-R) questionnaire, was roughly equivalent to the norm based on Fraley's (2010) online attachment research, gathered from a sample of 22,000 ($M_{sample} = 3.36$, $SD = 1.29$; $M_{norm} = 3.64$, $SD = 1.33$). Avoidance also

resembled the norm (M_{sample} = 3.05, SD = 1.24; M_{norm} = 2.93, SD = 1.18). The correlation between anxiety and avoidance in the current sample, r = .484, was slightly above the norm of .41 (Fraley, 2010). When classified into attachment styles based on Brennan, Clark, and Shaver's (1998) weighted coefficients, 25 participants were assigned a *Secure* attachment style, 12 *Preoccupied*, 16 *Dismissing*, and 24 *Fearful*.

No significant attachment style differences in choice of avatar features were found except for the configuration of the mouth (Table 1). Chi-square analysis showed that preoccupied individuals were more likely to choose a smile for their avatar than participants among the three other attachment styles (χ^2 = 7.68, df = 3, p = .027, φ = .316).

The control condition version of the Attachment Style Characteristics Inventory (ASCI) was found to be correlated with the ECR-R for anxiety, avoidance, and security (Table 2). To examine the profile of traits selected by participants, a repeated measures ANOVA with the Greenhouse-Geisser correction showed that the 33 control group participants chose secure characteristics significantly more than anxious or avoidant characteristics, F(1.27, 64) = 56.91, p < .001, η^2 = .64. A one-way ANOVA showed no significant attachment style differences in the proportion of secure ASCI traits selected by control participants, F(3, 29) = .37, p = .78, η^2 = .039. This finding is especially interesting considering the correlation between the ECR-R anxiety and avoidance scores and the ASCI traits. This difference most likely arises in the transformation from the continuous variables of anxiety and avoidance into categorical attachment styles.

Similar analyses showed that control participants selected secure adventure options significantly more often than either anxious or avoidant choices, F(1.18, 64) = 43.48, df = 1.18, p < .001, η^2 = .36. Analyses were again adjusted according to a Greenhouse-Geisser because of

lack of sphericity. A one-way ANOVA again showed no significant difference between control participants of different styles of attachment on the proportion of secure adventure decisions they made, $F(3, 29) = 1.308$, $df = 3$, $p = .29$, $\eta^2 = .14$.

An independent samples *t*-test with separate variance estimates revealed that participants who reported having been in a romantic relationship at some time (either past or present) were significantly less anxious and less avoidant than participants who had never dated before, $t_{anx}(75) = -4.31$, $p < .001$, $d = 1.00$; $t_{avd}(48.94) = -4.56$, $p < .001$, $d = 1.30$. More specifically, those who were currently in a relationship were less anxious and avoidant than participants who were not currently dating, even if they had been in a relationship in the past, $t_{anx}(57) = -2.91$, $p = .005$, $d = .77$; $t_{avd}(57) = -3.26$, $p = .002$, $d = .86$. A chi-square test of independence also indicated that significantly more securely attached participants were currently in a relationship than those who had insecure attachment schemas, $\chi^2(1) = 13.61$, $p < .001$, $\varphi = .42$.

Laboratory Visit

The smaller sample size, $n = 50$, was used for post-adventure analyses. The average length of time between completion of the online program and the lab visit was 5.92 days, with a maximum of 26 days and minimum of 1. The laboratory assessment began with a discussion of the online avatar. On a 1 to 10 scale, the median score for participants' feelings of resemblance to their avatar was 5, feelings of identification was 6, and similarity of online personality to real life was 8. Participants had difficulty recalling their motivations for choices in the adventure scenario. As a result, this question was eliminated from analyses. A two-tailed Spearman's bivariate correlation analysis showed that avatar resemblance was significantly associated with avatar identification, $r = .47$, $p < .001$. This echoes Trepte and Reinecke's (2010) findings that player-avatar similarity predicted identification with the avatar in video games. A two-tailed

Mann-Whitney U analysis found no significant difference between study conditions on any of the three scales above (Table 3).

A one-tailed independent samples *t*-test found no significant difference between conditions in participants' distance from the researcher during the interview, $t(48) = 0.24$, $p = .41$, $d = .069$. Furthermore, two-tailed analyses did not find an effect on interpersonal distance based on either gender of the researcher or of the participant, $t_{partgend}(48) = 0.25$, $p = .80$, $d = .072$; $t_{resgend}(48) = -0.27$, $p = .79$, $d = .077$.

Before testing the first study hypothesis, a one-tailed Chi-square test of independence as a manipulation check was run, showing that participants in the experimental condition more readily noticed the positive nature of the experimental condition than controls, $\chi^2(1) = 11.54$, $p < .001$, $\varphi = .48$, whereas controls pointed out more often the negative aspects of their stimuli, $\chi^2(1) = 9.44$, $p = .001$, $\varphi = .43$. Subsequently, a mixed factorial ANOVA found no significant difference between the two study groups on either change in anxiety scores, $F(1, 50) = 0.26$, $p = .613$, $\eta^2 = .005$, or change in avoidance scores, $F(1, 50) = 0.12$, $p = .734$, $\eta^2 = .002$, from pre-test to post-test. However, the ANOVA indicated a significant difference in anxiety from pre- to post-test for the entire sample, $F(1, 50) = 37.319$, $p < .001$, $\eta^2 = .437$. There was a large effect size according to Cohen's (1988) conventions. Incidentally, controlling for secure ASCI traits and secure choices on the adventure scenario removed this effect, $F(1, 50) = .23$, $p = .64$, $\eta^2 = .011$.

Contrary to the second research hypothesis, a one-tailed independent samples *t*-test showed no significant difference between study groups on the behavioral subscale of the Bond Formation Success Scale (BFSS), $t(48) = 0.57$, $p = .29$, $d = .16$. Also, no difference was found

between groups on the adjusted anxiety characteristics subscale, $t(48) = -0.58$, $p = .56$, $d = .17$, or the adjusted avoidance subscale, $t(48) = -0.93$, $p = .36$, $d = .27$.

Discussion

The first main hypothesis predicted that experimental group participants would show a greater increase in attachment security on the Experiences in Close Relationships—Revised (ECR-R) scale after completing the online program than the control group. This was not supported by analyses of the data. Instead, there was no significant difference between study groups on change in ECR-R scores from pre- to post-test. There are several possible explanations for these findings. First, it is possible that the experimental condition was not motivating behavior through creation of a positive possible self as predicted. However, the manipulation check showed that participants in the experimental condition were aware that they were indeed creating a more positive self than controls. Therefore, this explanation is unlikely.

Removing study group as a factor in analyses showed that there was a significant overall decrease in attachment anxiety, as measured by the ECR-R. This finding is extremely important as it indicates the online program truly did influence real-life attitudes about relationships. Although the manipulation check showed that experimental group participants realized the positivity of their stimuli more so than controls, control participants tended to choose significantly more secure options than either anxious or avoidant on both the ASCI and the adventure scenarios. This suggests that, although control participants consciously realized there were negative options to choose from during the online program, they still tended to choose more positive traits and relationship options regardless. Consequently, both study groups may have created possible selves that were comparably secure during the online program and it may have

been these possible selves as motivators across both groups that led to an overall decrease in attachment anxiety.

As Mikulincer and Shaver (2007) reports, simply an imaginary encounter with a supportive dating partner led to decreases in attachment anxiety. This study brings possible selves theory to bear on this issue. Individuals who create a mental representation of themselves as securely attached, by populating their self-image with related personality traits and behaviors, may then use this possible self to motivate change towards an envisioned goal (Cross & Markus, 1990; Stein & Markus, 1996). This becomes clear when controlling for the proportion of secure adventure decisions and secure ASCI traits chosen eliminates the decrease in attachment anxiety. It is safe to conclude that it was, in fact, control participants acting securely in the online program that caused them to be synonymous with the experimental group and so an undifferentiated decrease in anxiety was found.

This finding is especially fascinating in light of the one-way ANOVA tests that show no significant difference between proportions of either secure ASCI traits or secure adventure choices across control group attachment style categories. This suggests that, although individuals may have internalized and relatively stable working models of attachment in the real world (as shown by the strong correlations between pre-test and post-test ECR-R anxiety and avoidance scores), even those who are insecure may act securely in a hypothetical "practice" relationship with a virtual partner.

In this vein, though, theoretically, attachment avoidance should also have decreased from pre-test to post-test. If creating a possible self that is securely attached motivates an individual to achieve that self and move along the anxiety axis, then why should there not be change along the avoidance axis? Schindler, Fagundes, and Murdock (2010) suggest that those who are

avoidantly attached tend to be more hesitant to form a committed relationship with a partner than secure or anxiously attached individuals. In our sample, perhaps maladaptive avoidant attachment schemas were not activated as strongly by the virtual relationship building program as were anxious schemas and therefore could not as easily be modified or adapted to fit the supportive and encouraging responses of the virtual partner. Therefore, only attachment anxiety would have changed because internal working models related to anxiety could have been more readily altered by the external stimuli of a new relationship partner than avoidant working models.

The current study found changes in anxiety over an average delay of five days between pre-test and post-test measures, with a maximum of almost a month time-span between intervention and post-test measure. This finding suggests that fully elaborated possible self schemas can generate longer-term change in attachment attitudes than both subliminal and supraliminal priming tasks (Carnelley & Rowe, 2007; Pierce & Lydon, 1998; Rowe & Carnelley, 2003).

The second main hypothesis predicted a greater average score on the behavioral subscale of the Bond Formation Success Scale (BFSS) for the experimental condition than the control condition. Lower scores on the anxiety and avoidance characteristics subscales were also predicted. None of these predictions was supported by the data. Participants may have monitored their behaviors in the experimental setting, thus not acting naturally or according to their internalized attachment schema. The literature suggests that subtle linguistic cues from a researcher may suggest the intended goals of an experiment (for example, questions of attitudes towards relationships), thus enabling evaluation apprehension and an alteration of participants' normal behaviors (Finkelstein, 1976). This "evaluation apprehension," which consists of an

awareness of being observed and an attempt to act to meet experimenter expectations, may have lead to the similarity between study groups' behavior as all participants may have tried to behave securely to appear more appealing or satisfactory to the researcher. If observations had been done of more natural interactions, perhaps of a participant's engaging with a confederate presumably unaffiliated with the current research, this may have eliminated the participant's purposeful modification of his or her behavior for the sake of the experiment.

Since the scales were not based specifically on attachment concepts but were drawn from a coding scheme measuring the concepts of positive and negative affect and approach-avoidance in close relationships (Humbad et al., 2011), as well as incorporating measures of intimacy and tension (Dovidio et al., 1997), their validity in measuring attachment may be lacking. The absence of significant correlations between the BFSS subscales and the ECR-R confirms this. However, the BFSS was shown to have acceptable to good internal consistency and at least acceptable inter-rater reliability on the behavior and anxiety subscales. Furthermore, all three of the subscales were interrelated. This suggests that the scale is indeed measuring a specific construct or set of constructs, although they are not attachment-specific. The BFSS may in fact be measuring approach-avoidance behavior, although none of its subscales correlates with participants' distance from the researcher (see Table 4).

Ainsworth et al. (1978) describes childhood approach-avoidance behavior in a situation of reunion with the mother as a form of conflict between desire for proximity and feelings of rejection due to abandonment. Bowlby (1973) explains that both approach and avoidance behaviors are designed to provide safety and consequently may come into diametrical opposition to one another as they are contrary behaviors driven by the same internal goal. Main and Goldwyn (1984) go one step further and suggest that approach-avoidance behavior is itself

qualitatively different from either approach behavior or avoidance behavior. It can be described as a state of approach that includes conflicting behaviors such as averted gaze or sudden withdrawal movements. Therefore, if either the BFSS or the measure of distance from the researcher are in fact measuring interpersonal approach-avoidance behavior, such approach-avoidance conflict might explain why there were no correlations of these measures with attachment constructs and no difference based on study conditions.

A supplementary analysis indicated that those who had been in a relationship at some point were more likely to be securely attached than those who had never dated. Interestingly, this effect persisted when comparing those in a current relationship with those who have dated previously. Conversely, being securely attached predicted a current romantic relationship. These results can be explained in two different ways. First, those who are more securely attached may tend to find themselves more readily in relationships. Eastwick and Finkel (2008) report that an adaptive desire for closeness and intimacy, as evidenced by those with secure styles of attachment, increases the likelihood of formation and maintenance of romantic relationships. Mikulincer and Shaver (2007) likewise suggest that individuals who are securely attached will find themselves more often in successful relationships. Whether insecure individuals also find themselves in equally as many relationships, just unsuccessful ones, is not addressed by the authors. As mentioned above, Schindler and her colleagues (2010) found that avoidant individuals are less likely to want to form romantic bonds, although anxiety was not a factor in likelihood to begin a dating relationship. Nevertheless, the body of literature as a whole suggests that secure attachment schemas do play a role in one's probability of being in a romantic relationship.

On the other hand, a second explanation for the findings that current relationship status predicts security and vice versa is that a romantic relationship may act as a buffer against insecurity. Kirkpatrick and Hazan (1994) found in a four-year-long study of relationship and attachment stability that securely attached individuals who experienced a break-up with their romantic partner during the four-year period had roughly a 50% chance of no longer being secure at the end of four years. In conjunction with the results of the current study, this suggests that relationship break-ups may adversely affect working models of romantic relationships, causing people to either create a distance between themselves and others (i.e., avoidant behavior) or become worried and dependent upon others (i.e., anxious behavior). Similarly, Vicary and Fraley (2007), using their "Choose Your Own Adventure" paradigm, found that participants of every style of attachment, including both anxious and avoidant styles, chose increasingly secure choices as they engaged in a relationship with a virtual partner. This may indicate that simply the presence of a romantic relationship increases participants attachment security. In fact, the current study's finding that anxiety decreased after participants used the online program could be explained simply in terms of the existence of a relationship, instead of the creation of a secure possible self, inhibiting the presentation of anxiety.

Verifying either of the above claims lies beyond the scope of this paper. However, a cyclical model that incorporates both ideas is proposed and should be tested by future research in the field (see Figure 3). Attachment security and a current (perhaps successful) relationship may be cofactors in this relationship, influencing and encouraging each other.

The current study extends the existing body of attachment literature in several major ways. First, it introduces, tests, and supports a novel paradigm for encouraging attachment security over an extended period of time. Although the current study did not measure change in

attachment after the post-test visit, interventional studies should include follow-up measures of attachment in order to precisely record the duration of an experimental effect. More specific data on the length of an intervention's effect can reveal when changes in self-schema occur that may indicate a relapse into insecure attachment.

In the current research, using a possible selves intervention for attachment appears to be partially effective. Attitudes can be changed through this theory, but behavioral change was not found. Future studies must find more valid ways of measuring adult attachment behavior and then incorporate such measures into attachment interventions. Drawing from a reliable and long-tested measure of attachment attitudes like the ECR-R could provide an accurate scale for operationalizing adult attachment behavior.

The present research also puts forth the Attachment Style Characteristics Inventory (ASCI) as a foundational reliable attachment measure focused solely on personality traits. This scale might be utilized in studies that look at other major measures of personality such as the Big Five Inventory, or in research that seeks to incorporate possible selves theory or other self-concept-focused theories in terms of application. However, the ASCI needs to be tested further in correlational survey studies to ensure its validity in measuring attachment constructs.

From the perspective of possible selves theory, using online avatar-based technology to help create fully elaborated possible selves appears to facilitate the motivational aspect of this theory, at least with regard to attitudinal change. Including visual stimuli like personalized avatar features, along with the individualization of selecting one's own personality, may prove invaluable in interventions focused on deeply set, implicit, and internalized constructs like attachment. Studies should expand the scope of using the virtual world in research, possibly

creating entire locales or even worlds that guide participants to otherwise hard-to-access possible selves.

Finally, research may be able to test the hypothesized cyclical model of attachment security and relationship status through longitudinal studies that isolate factors in attachment style change, specifically looking at relationship formation and dissolution. If further research supports the previous studies that seem to suggest this interactive cycle, a more complex, integrated, and practical model could be developed that includes related factors such as closeness of a best friend or the presence of other significant attachment figures.

Some practical implications of the current study include incorporating virtual attachment-intervention programs into social networking sites like Facebook where they would be widely accessible. The findings of this study suggest that even if utilized in the comfort of one's own home a brief online intervention may produce positive change in internal working models self and others. In tandem with structured relationship therapy, such online programs may prove most beneficial; however, even in isolation, an online intervention appears to have lasting and significant effects. Another use of the current research could be in the entertainment sector. Developers of Massively Multiplayer Online games could incorporate positive traits associated with beneficial qualities (like in secure attachment) to avatar creators. In this way, gamers might improve their own working models, modifying and repairing maladaptive schema, while playing interactive games online.

The present study is limited in several key ways. The BFSS and ASCI were both newly developed for the purpose of this research and although the ASCI proved valid in measuring attachment concepts, the BFSS did not correlate with attachment constructs. This hindered post-test measurements of behavior and largely eliminated the possibility of identifying behavioral

change due to the intervention. The scale needs either to be modified for attachment research, or used in studies of approach-avoidance behavior to test for validity in what may be an area more relevant to its items.

Allowing control group participants to act identically to the experimental condition is a weakness in the design of the study. Because of this, there was no valid comparison group from which to draw conclusions of change in attachment styles. Including a third group of participants that were restricted only to negative personality traits and behaviors on the adventure program may have better highlighted difference between conditions that were otherwise impossible to detect. However, it may have been primarily because of this flexibility in the control group boundaries that allowed the study to cause decreases in attachment anxiety.

The sample size of the study was moderate but not large enough for highly powerful tests of attachment change. Many analyses that were not significant may have become so with an increased number of participants. Furthermore, increasing the size of the sample would have allowed more within-group analyses, such as the effect of participants' race or year in school on the dependent variables. Offering a small incentive to every student who participates, instead of combining incentives into rewards for only three individuals, may increase the response rate for similar studies in the future.

Finally, more accurate ratings of behavior might have been possible if participants had been deceived into interacting with a researcher unknowingly. If participants had engaged in conversation with a confederate, thinking that he or she was simply another student on campus unaffiliated with the research, more genuine behaviors specific to bond formation might have arisen, avoiding evaluation apprehension. However, ethical needs would need to be considered

in this case, as deception would necessitate stricter precautions for confidentiality purposes and safeguarding of participants' rights.

Attachment theory describes highly integrated attitudes and behaviors that have often seemed resistant to change through experimental research. However, the current study suggests that attachment constructs such as anxiety may not be inaccessible to motivated change and may actually be readily manipulated through mental representations of possible future selves. This study calls for the field to redouble its efforts to encourage secure attachment, which is associated with countless social, emotional, and psychological benefits. Future researchers may be able to use the study's findings to develop more intricate self-concept-focused interventions for the purpose of improving relationship formation, or perhaps taking steps towards influencing other vital human behaviors like communication skills and leadership ability. Virtual worlds may soon become training grounds for perfecting social skills and improving human well-being.

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Table 1

Chi-square tests of independence between attachment styles on avatar feature selections

	Avatar Features					
	Body Type	Skin Tone	Head Shape	Eyes	Mouth	Nose
Attachment styles (χ^2)	10.90	15.82	21.10	9.36	23.77*	6.21

Note: $^{*}p < .01$, one-tailed

Table 2

Correlations between proportions of attachment style choices on the ASCI and ECR-R anxiety and avoidance

	1	2	3	4	5
Proportion ASCI Traits					
1. Secure					
2. Anxious	-.90***				
3. Avoidant	-.63***	.23			
ECR-R Attachment					
4. Anxiety	-.57***	.55***	.30*		
5. Avoidance	-.36*	.24	.39*	.48***†	

Note. $n = 33$.
† $n = 77$
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Mann-Whitney U analysis of difference between study conditions across three interview questions of strength of possible self creation

	Statistics	
Interview Questions	Mann-Whitney U	*p*
Avatar Resemblance	288.50	.65
Avatar Identification	293.50	.72
Similarity of ASCI	270.50	.40

Note. Tests are two-tailed. No results significant at $p < .05$.

Table 4

Correlations between BFSS subscales, ECR-R anxiety and avoidance, and participant's distance from the researcher

	1	2	3	4	5	6
BFSS Subscales						
1. Behavior						
2. Anxiety (Revised)	-.25*					
3. Avoidance (Revised)	-.74***	.61***				
ECR-R Attachment						
4. Anxiety	.21	.087	-.11			
5. Avoidance	.11	.20	-.056	.48***†		
6. Participant Distance	-.017	.14	.12	.094	.188	

Note. $n = 50$.
† $n = 77$
*$p < .05$. ** $p < .01$. *** $p < .001$.

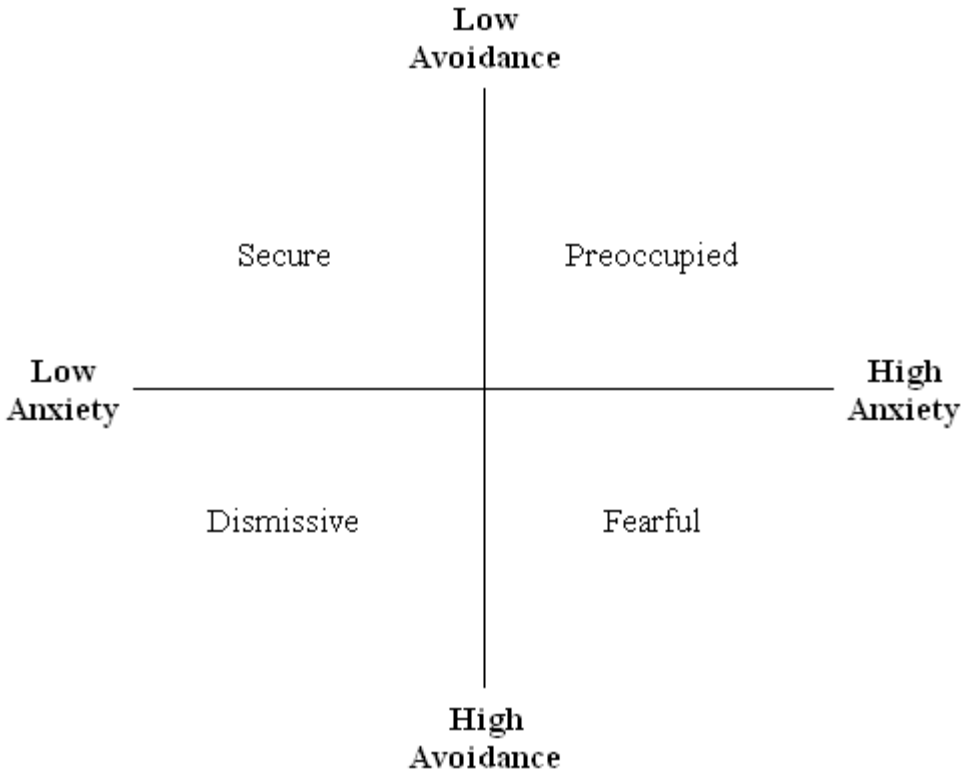

Figure 1. A dimensional view of attachment styles. Proposed by Bartholomew (1990), each of the four dimensions consists of a high or a low score on each of the two axes (anxiety and avoidance). For example, a *fearful* individual would report high attachment anxiety and high attachment avoidance, whereas a *dismissive* individual would report low attachment anxiety and high attachment avoidance.

Figure 2. A "modal" avatar. Created by combining the modal avatar features selected by all participants in the study *(n* = 77).

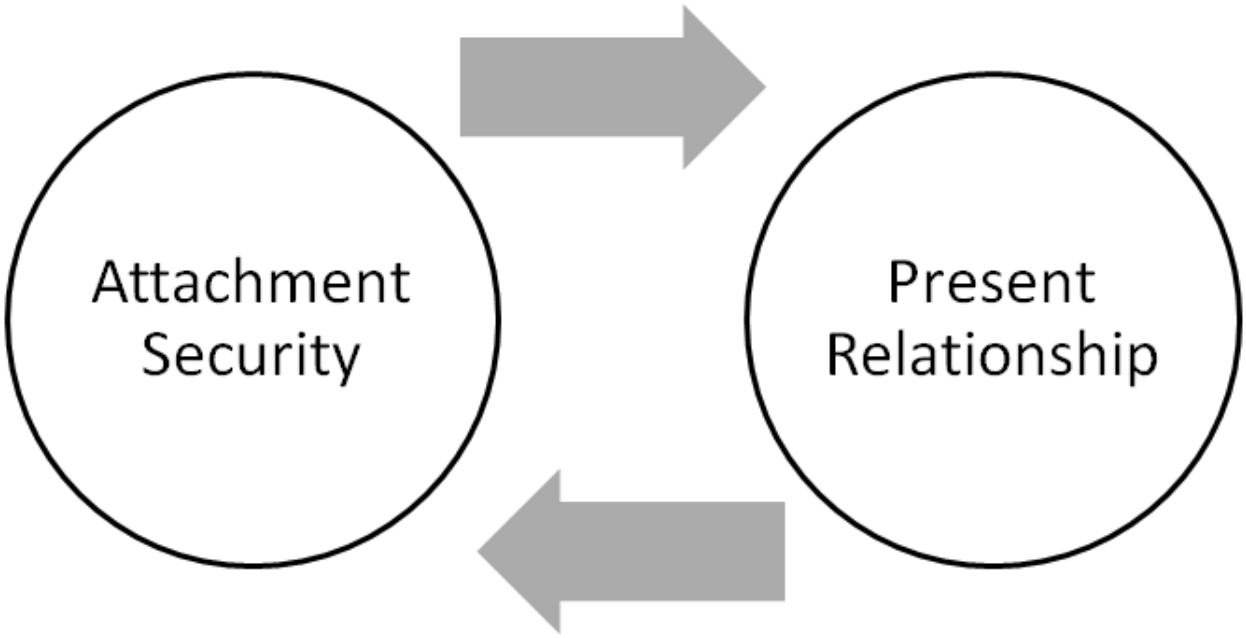

Figure 3. A cyclical model of attachment security and romantic relationship formation. Postulates an interactive association between the two constructs, where attachment security enhances likelihood of forming and maintaining a romantic relationship and a current relationship increases attachment security through support, encouragement, comfort, or other social interaction variables.

Appendix A

The Experiences in Close Relationships-Revised (ECR-R) Questionnaire

The statements below concern how you feel in emotionally intimate romantic relationships. We are interested in how you *generally* experience relationships, not just in what is happening in a current relationship. Respond to each statement by circling a number to indicate how much you agree or disagree with the statement.

(Each item is measured on a Likert scale of 1 to 7, with 1 being Strongly Disagree *with the item and 7 being* Strongly Agree. *Items 1 to 18 measure attachment anxiety. Items 19 to 36 measure attachment avoidance. "(R)" indicates reverse coding is necessary.)*

1. I'm afraid that I will lose my partner's love.
2. I often worry that my partner will not want to stay with me.
3. I often worry that my partner doesn't really love me.
4. I worry that romantic partners won't care about me as much as I care about them.
5. I often wish that my partner's feelings for me were as strong as my feelings for him or her.
6. I worry a lot about my relationships.
7. When my partner is out of sight, I worry that he or she might become interested in someone else.
8. When I show my feelings for romantic partners, I'm afraid they will not feel the same about me.
9. I rarely worry about my partner leaving me. (R)
10. My romantic partner makes me doubt myself.
11. I do not often worry about being abandoned. (R)
12. I find that my partner(s) don't want to get as close as I would like.
13. Sometimes romantic partners change their feelings about me for no apparent reason.
14. My desire to be very close sometimes scares people away.
15. I'm afraid that once a romantic partner gets to know me, he or she won't like who I really am.
16. It makes me mad that I don't get the affection and support I need from my partner.
17. I worry that I won't measure up to other people.
18. My partner only seems to notice me when I'm angry.
19. I prefer not to show a partner how I feel deep down.
20. I feel comfortable sharing my private thoughts and feelings with my partner. (R)
21. I find it difficult to allow myself to depend on romantic partners.
22. I am very comfortable being close to romantic partners. (R)
23. I don't feel comfortable opening up to romantic partners.
24. I prefer not to be too close to romantic partners.
25. I get uncomfortable when a romantic partner wants to be very close.
26. I find it relatively easy to get close to my partner. (R)
27. It's not difficult for me to get close to my partner. (R)
28. I usually discuss my problems and concerns with my partner. (R)
29. It helps to turn to my romantic partner in times of need. (R)
30. I tell my partner just about everything. (R)
31. I talk things over with my partner. (R)

32. I am nervous when partners get too close to me.
33. I feel comfortable depending on romantic partners. (R)
34. I find it easy to depend on romantic partners. (R)
35. It's easy for me to be affectionate with my partner. (R)
36. My partner really understands me and my needs. (R)

Appendix B1

The Attachment Style Characteristics Inventory (ASCI): Control Subset

Now that you have created a virtual version of yourself, let's define your personality. Below is a list of 48 characteristics. Select the descriptive terms that you feel describe you. You may select as many or as few words as you want.

1. Accepting
2. Aloof
3. Altruistic
4. Angry
5. Annoyed
6. Anxious
7. Apprehensive
8. Bitter
9. Cheerful
10. Cold
11. Courteous
12. Dependable
13. Dependent
14. Disgusted
15. Doubtful
16. Emotional
17. Fearful
18. Forgiving
19. Frustrated
20. Genuine
21. Helpless
22. High-spirited
23. Hostile
24. Hot-blooded
25. Indecisive
26. Initiative-taking
27. Jittery
28. Leader
29. Lonely
30. Loner
31. Loving
32. Mad
33. Moody
34. Nervous
35. Outgoing
36. Quick-tempered
37. Resentful
38. Risk-taking
39. Scared
40. Social
41. Stressed
42. Temperamental
43. Tense
44. Thoughtful
45. Touchy
46. Vocal
47. Vulnerable
48. Worried

Appendix B2

The Attachment Style Characteristics Inventory (ASCI): Experimental Subset

Now that you have created a virtual version of yourself, let's define your personality. Below is a list of 48 characteristics. Select the descriptive terms that you feel describe you. You may select as many or as few words as you want.

1. Accepting
2. Adaptive
3. Adventurous
4. Altruistic
5. Caring
6. Charitable
7. Cheerful
8. Committed
9. Considerate
10. Courteous
11. Decisive
12. Dedicated
13. Dependable
14. Empathetic
15. Fair-minded
16. Forgiving
17. Friendly
18. Fun-loving
19. Genuine
20. Happy
21. Helpful
22. High-spirited
23. Honest
24. Humble
25. Initiative-taking
26. Interested
27. Joyful
28. Leader
29. Light-hearted
30. Likeable
31. Loving
32. Open-minded
33. Optimistic
34. Outgoing
35. Reliable
36. Respectful
37. Risk-taking
38. Selfless
39. Sincere
40. Social
41. Sympathetic
42. Talkative
43. Thoughtful
44. Tolerant
45. Trusting
46. Unsuspicious
47. Vocal
48. Warm

Appendix C

The Bond Formation Success Scale (BFSS)

Please rate the participant in the video you just watched. (Review the video as needed.)

Behavior Subscale

How often did the participant engage in each of the following behaviors?

(Each item is measured on a Likert scale of 1 to 5, with 1 being Never *and 7 being* Always*.)*

1. Smiling (genuine, not nervous)
2. Frowning
3. Eye contact
4. Laughing
5. Joking or making humorous statements
6. Positive feedback to researcher's questions or comments
7. Harsh tone or facial expressions
8. Negative critical statements

Characteristics Subscales

How characteristic of the participant were the following descriptors?

(Each item is measured on a Likert scale of 1 to 5, with 1 being Not at all characteristic *and 7 being* Extremely characteristic*.)*

1. Sarcastic
2. Nervous
3. Trusting
4. Indiscreet (i.e., overly revealing)
5. Tense
6. Reserved
7. Self-regulated (i.e., steady, emotions controlled)
8. Intelligent
9. Impatient
10. Attractive

Appendix D

Interactive Adventure Story (Excerpts)

Control Condition Scenario 3

Morning comes around and the sun is shining through the blinds into your room. Time to get up for breakfast! You wonder what John is doing and remember he said the two of you would meet downstairs at 8AM. You glance at the clock and realize you only have 20 minutes! Soon you're downstairs and you see him by a table. You walk over to him and he asks you where you want to sit.

1. **You tell John you'd rather have breakfast on the go. "Maybe we can pick up something to eat on the way to our first outing?"**

2. **Another couple invites you to sit at their table and you agree.**

3. **You choose to sit at a two-person table in the corner.**

(Participant selects option 1—Avoidant)

"You just don't want to sit down so you don't have to talk to me, is that it?" John asks. "It's fine, let's just go get some bagels or something."

Control Condition Scenario 13

Mentioning family leads to John talking about his own. He looks down at his food as he starts talking about his mother. "I've been worried about my family," he says. "My mom thinks she may lose her job in this economy."

1. **"Oh, that's terrible, does that mean you're going to have to drop out of school? Does Emory have a way to support you?"**

2. **"That's a bummer. I should cheer you up, do you want dessert?"**

3. **You frown. "How's the rest of your family taking it?"**

(Participant selects option 1—Anxious)

"Oh, wow, I don't know, I didn't even think of that! This is stressing me out so much…"

Experimental Condition Scenario 2

You and Jane carry your luggage to the front desk of the hotel to check in to your rooms. She gives you the information about checking in and you begin talking to the staff member on duty. Soon, you've got your room, although you realize Jane is not done checking in yet. You wait patiently and then talk to her.

1. **"Did they have everything in order?"**

2. **"Would you like to get some dinner together later, or would you rather rest a bit?"**

3. **"Did they give you directions to your room? Do you want me to get the bellman for your luggage?"**

(Participant selects option 1)

"Everything's in order!" Jane replies. "Let's just bring our luggage up to the room and we then we should definitely get something to eat, I'm starving!"

Experimental Condition Scenario 12

The conversation is going well as the two of you enjoy your dinner. It seems to be getting quite serious, actually, and Jane asks you a question: "Tell me about your family," she says.

1. **"We get along pretty well. Sometimes we disagree about politics, but it's okay. I always tell myself, 'If that's the worst thing we've got going on, we're great.'"**

2. **"Sometimes I worry about my younger brother in the army… But I know he'll be okay."**

3. **"I just saw them over break actually. My mother tried to get my little sister to eat Brussels sprouts, but she made this disgusted face. It's a crazy but fun house most of the time."**

(Participant selects option 3)

Jane smiles and says, "Sounds like you get along pretty well. I didn't get to see my family over the break, but I'm looking forward to when I do."

Appendix E

Explicit Interview Questions

1. On a scale from 1 – 10 ("not at all" to "completely"), how much do you feel your avatar resembles you?

2. On a scale from 1 – 10 ("not at all" to "completely"), how much do you identify with your avatar?

3. On a scale from 1 – 10 ("not at all" to "completely"), how much do you feel your virtual personality is similar to yours in real life?

4. On a scale from 1 – 10, as you were playing the adventure game, how much did you feel you acted based on your own (real life) personality, and how much did you act according to your virtual personality? A score of 1 would mean you acted completely based on your own personality, and a score of 10 would mean you acted completely based on your virtual personality.