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The effectiveness of a national security screening interview conducted by a computer-generated agent

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ABSTRACT

To determine the feasibility of automating the process of interviewing applicants for Federal security clearances, the authors examined behavioral and physiological responses of individuals (n = 120) to questions concerning their mental health, drug, alcohol, and criminal histories. The interviews were administered by a computer-generated (CG) agent. The results indicated that the number of relevant admissions during the CG interview exceeded the number of admissions made using a self-report questionnaire. In addition, significant blood volume and skin conductance amplitude differences were observed between individuals who made two or more relevant admissions and individuals who made less than two admissions. An interaction between perceived locus of interview control (either computer or human) and behavioral activation systems (BAS) on skin conductance (SC) responses was also observed.

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1. Introduction

1.1. Current status of interviewing technologies

In the United States, the process of interviewing applicants for security clearances is time consuming, labor intensive, and costly to the Federal Government. Typically, applicants fill out a security questionnaire that includes questions about the individual's background, including such things as previous illegal activities. Information on the questionnaire is then reviewed by a security officer during a face-to-face interview with the candidate. This process takes time, can lead to scheduling conflicts, and usually involves transcribing relevant information collected during the interview again by other individuals. Automating this process using a CG interview format could save time, and allow agencies to utilize their human interviewers more effectively. Automation would also facilitate standardization of the interview questions and procedures, resulting in more objective and equitable hiring decisions for the applicants. Additionally, automation makes accurate synchronization with physiological data collection systems possible, thereby enabling the use of physiological assessment similar to that of a traditional polygraph during a CG interview.

Recent studies have shown the utility of automated CG interviews, and that humans can interact with CG characters (Kopp, 2010; Müller et al., 2011; Rehm, 2008; Sadeghipour & Kopp, 2011; Van Vugt, Bailenson, Hoorn, & Konijn, 2010; von der Pütten, Krämer, Gratch, & Kang, 2010). While the application of CG agent interviews to the Federal security clearance process has shown promise in eliciting security-relevant information (Pollina, Horvath, Denver, Dollins, & Brown, 2008), several challenges remain to the operational use of these technologies within the security clearance context. Among others, such challenges include: (1) sufficiently replicating the complex interpersonal interactions that occur during security screening interviews such that interviewees report security-relevant information, (2) measuring and interpreting physiological responsivity during security interviews such that it provides utility in assessing the interviewee's credibility, and (3) identifying and addressing subject variables (e.g. personality traits, comfort with computers, etc.) that may interact with characteristics of the CG agent or the interview.

The first step in creating an effective automated interview is therefore to utilize a CG agent program that is capable of producing the types of verbal and nonverbal behaviors typically produced by the human agent. Such behaviors include humanlike voice characteristics, facial features and facial expression changes. The CG agent must also be capable of recognizing the verbal responses that human examinees make to its questions, and then responding with specific follow-on questions and statements. This capability is necessary to perform the mechanics of the interview, and also to achieve a level of verisimilitude that allows for the CG agent to subsume a level of "intentionality, sociability, and personality"

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that is only possible when virtual bodies resemble real humans (De Angeli, 2009). When they do, research shows that this increases the degree of *presence* experienced by the human in the virtual environment (Gerhard, Moore, & Hobbs, 2004, 2005; Groom et al., 2009; Guadagno, Blascovich, Bailenson, & McCall, 2007; Guadagno, Swinth, & Blascovich, 2011). Presence is the subjective sense of being in an environment, and studies have suggested that presence is positively related to *copresence*, which involves a person's perception of another mind that is capable of perceiving them (Gerhard et al., 2005). In other words, the extent to which a person feels immersed in a virtual social environment is related to the person's perception that there are other sentient beings in that environment. These perceptions serve to procure and maintain the person's attention, which is acknowledged as extremely important during suspect interviews (EASI Consult, 2007).

1.2. Prior deception studies

While polygraph screening methods tend to be standardized, at least within the U.S. Government, they cannot achieve the reliability offered by an automated approach. Because the questions asked during a security screening interview are largely the same for every applicant, it was possible to develop an automated test format for all applicants, in order to look for patterns among applicants' behavioral and physiological responses to individual topic areas or questions on the test. Ultimately, the goal of this line of research is to develop a new kind of credibility assessment test that will be capable of augmenting the traditional polygraph tests that are in widespread use as part of the security screening process. It is hoped that the automated nature of the interview will facilitate the fusion of data streams that include signals, such as thermal images and nonverbal behaviors, not currently used in polygraphy. However, in the current study, we focused on participants' cardiovascular and electrodermal responses to each question, recorded using "traditional" polygraph sensors (Cutrow, Parks, Lucas, & Thomas, 1972; Elaad & Ben-Shakhar, 2006; Gödert, Rill, & Vossel, 2001; Hirota et al., 2003; Horneman & O'Gorman, 1987; Verschuere, Crombez, De Clercq, & Koster, 2004). We also used a variant of the standard comparison question test (CQT) format, in which responses to questions within each of the relevant categories is compared to personally-relevant and (presumably) emotion-arousing "comparison" questions, because this test is in widespread field use (Bell & Grubin, 2010; Honts, 1996; Honts, Amato, & Gordon, 2004). Response time, recorded as the latency value between the end of the CG agent's question and the beginning of the participant's verbal response, has been extensively studied in the field of credibility assessment at least since the 1920s, was also included as a dependent measure in this study (Crosland, 1929; Goldstein, 1923; Marston, 1920; Sheridan & Flowers, 2010; Vendemia, Buzan, & Green, 2005).

In 2003, a report authored by the National Academy of Sciences suggested that personality differences could elevate autonomic activity for reasons unrelated to deception and threaten the validity of polygraph tests (National Research Council, 2003). The automated interview afforded us the opportunity to examine this issue by exploring the relationship between the motivational systems thought to control appetitive and aversive behaviors in humans and the physiological and behavioral responses to specific types of interview questions. We used the theoretical framework outlined by Gray, which postulates the existence of two systems, the behavioral inhibition system (BIS) that mediates responses to signals of aversive stimuli, resulting in passive avoidance, and the behavioral activation system (BAS), which mediates responses to signals of appetitive stimuli, resulting in approach behavior, to make predictions about the nature of the relationship between an individual's personality type and their responses to questions asked by the CG agent during the interview (Corr, Pickering, & Gray, 1997; Gray, 1987). Our predictions were also informed by more recent revisions of the model, in which the role of the BIS is now seen as a mediator of conflict resolution. In this revised model, the BIS is activated by stimuli that simultaneously engage both the BAS and a third Fight/Flight/Freeze System (FFFS), which is itself triggered in response to threat (Brenner, Beauchaine, & Sylvers, 2005; Smillie, Pickering, & Jackson, 2006). According to this recent formulation, the FFFS is responsible for mediating fear reactions to all aversive stimuli, and the BIS mediates passive avoidance in situations where approach–approach, approach–avoidance, or avoidance–avoidance conflicts arise (DeYoung, 2010). Other researchers investigating physiological correlates of these systems found that self-report and physiological measures of BAS and BIS reactivity are independent, which suggests that the self-report scales may be more sensitive to individual differences in trait affect rather than state responding (Brenner et al., 2005).

1.3. Objectives of the current study

Our first objective in conducting this study was to investigate the possibility of using a CG agent to conduct a security screening interview – aspects of a successful automated interview include: the interviewees' feel comfortable with the process; information is obtained by the CG interviewer, including information related to whether an individual is suitable for obtaining a security clearance; when an interviewee does volunteer information concerning a relevant topic, follow-on questions capture additional information, and clarification is possible using open-ended questions. This first objective was designed to deal with some of the challenges currently faced by security professionals. However, if it could not be shown that interviewees were willing to make statements against self interest to a computer or admit any wrongdoing during the course of the interviews then, even if the mechanics of the process produced acceptable results, the use of CG agents to conduct these types of interviews would be of little practical use (Pollina et al., 2008). We predicted that participants would feel comfortable enough with the CG agent to divulge information about themselves, some of which would be specific to their criminal, drug and alcohol, and mental health histories. However, as stated above, it is also possible that some individuals might make admissions because the CG agent is perceived as NOT human.

Our second objective was to investigate the relationship between physiological and behavioral measures that are often used in credibility assessment tests and the number and types of verbal admissions made to the CG agent's questions. This objective was designed to determine the feasibility of using a CG interviewer to assess the credibility of the interviewee's statements, similar to the way a polygraph is used today. We reasoned that it is unlikely that participants would be motivated to make false admissions to "relevant" questions. Therefore, it was also hypothesized that admissions would be related to the amount of physiological arousal in response to these questions and topic areas, relative to a set of broad-in-scope and somewhat threatening comparison questions – a technique that is often used by the designers of traditional polygraph tests (Pollina, Dollins, Senter, Krapohl, & Ryan, 2004). Results suggesting a relationship between these measures would support further exploration into the development of an automated credibility assessment test using a CG agent. These findings would be of theoretical interest as well, given the dearth of research on the use of polygraph in security screening contexts.

Our third and final objective was to explore the relationships among BIS/BAS sensitivity, as measured by self-report, and physiological arousal, response time (*i.e.*, latency of response production; RT), and the perceived locus of interview control. This