


Virtual Stealth Assessment: A New Methodological Approach for Assessing Psychological Needs

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Abstract. In the past decade, the use of technology is extensively increased. Technological systems as virtual reality represent nowadays novel and efficacy tools in several areas, such as in psychology and education. Realism, sense of presence, engagement, experimental control, and ecological validity represent some of the advantages than traditional methods based on paper and pencil tests. Furthermore, psychological research gathering information about a person relative to specific attributes, such as abilities, personality, and cognitive competences is usually conducted using pre-test-post-test designs. Such traditional assessments are not able to catch and examine the dynamic and composite performances and behaviours in run. Virtual stealth assessment could provide a valid and reliable method for evaluating real behaviours in real-time during the virtual experience. In this article, we proposed stealth assessment as a new methodological approach to study the Grawe's model on the basic psychological needs by using virtual immersive environments, providing the theoretical development of the model on one psychological need with the relative virtual game.

Keywords: Virtual reality · Sense of presence · Stealth assessment · Evidence-centered design · Psychological needs · Attachment

1 Introduction

In the past decade, the use of technology for the treatment of psychological disorders has extensively increased [1–3]. Virtual Reality (VR) has emerged as an effective therapeutically tool in psychological science, including clinical psychology [4–8], neuropsychology and cognitive and motor rehabilitation [9–13]. In clinical psychology

the major use of technologies, has been developed in the field of various treatments (e.g. for anxiety disorders, phobias, etc.) and less for the assessment of psychological dimensions. Traditional assessment in psychology, based on paper and pencil tests, provided highly validity and reliability as well as highly experimental control [14, 15]. However, it shows some limitations in term of ecological validity, defined as the degree of similarity that a test has relative to the real world [16]. In this framework, VR applications are able to simulate real experiences, eliciting high levels of sense of presence and providing realistic perception of the experience and engagement, without losing experimental control [17]. Furthermore, the traditional assessment isn't able to recollect the real behaviors that the various situations relative to a psychological construct can elicit. Stealth assessment could provide a new method of assessment performance-based in real time during the virtual experience [18, 19].

In this article, we propose virtual stealth assessment (VSA) as a novel method to evaluate the basic psychological needs in adult clinical and no clinical settings. According to Grawe [20] all human beings attempt to fulfill some basic psychological needs in congruence with their motivations, memories of past experiences, and actual aims. He identified four basic psychological needs (attachment, self-esteem, orientation/control, and maximization of pleasure/distress minimization) for mental functioning [20, 21].

After reviewing the previous studies on the VR efficacy evidences in the treatment of several psychological disorders, and the traditional methods of assessing, we claim that VSA could elicit realistic experiences and behaviors and could be a valid method to indirectly and latently recollect data about various performances related to the needs. We conclude by providing the methodological development strategy related to the attachment need.

2 Efficacy of Virtual Reality in Clinical Psychology

VR is a 3D-synthetic environment generated by a computer in which real situations can be implemented and in which users are immersed and can interact each other and with the environment as if in the real one [22]. To date, in psychology, research in the VR field is moving fast, showing its effectiveness in several psychological treatments, in neuropsychology, and in cognitive and motor rehabilitation [4–13], but very few applications of VR exist in the assessment of psychological dimensions [23].

Traditionally, the psychological evaluations are caught by direct standardized measures, like self-report questionnaires or paper and pencil tests, and indirect standardized measures, such as behavioral tasks [14]. Self-report measures provide conscious attitudes towards various experiences, focusing on the views that people have about themselves, the other, and situations at a specific time, but are not able to detect the unaware responses and behaviors. Furthermore, they can't elicit the specific phenomena and situations that we want to assess. For reducing the response bias, some researchers prefer to use specific tasks, able to reveal behavioral attitudes. These tasks, traditionally, measure specific aspects of the theoretical constructs, correlating them with self-report questionnaires. However, both assessment methods show some limitations in term of ecological validity that VR attempted to solve, eliciting situations

similar to the real ones [16]. Immersion, realism, sense of presence, and engagement are some of the advantages provided by VR applications. Immersion can be defined as a technical feature of the system: higher display resolution, or more input and output devices, such as Head-Mounted Display (HMD), haptic and sound devices can create a realism perception of the experience in which all the sensorimotor modalities are perceived in run [17]. The perception of realism rendered by the immersion allows to subjects to feel present in the virtual environment. The sense of presence can be defined as the perception of “being there”, in which the media disappears from the perception, allowing to subjects interacting as if what it is happening in the virtuality is really happening [24]. Hence, the system features, the subject-system interaction, but also the subject attributes are able to generate engagement and active participation during the virtual experience. According to O’Brien and Toms (2008) [25], engagement can be seen as a “quality of user experience” characterized by a starting point of engagement, a period of sustained engagement, disengagement, and reengagement. Each phase of this process depends on the generation and stimulation of some engagement attributes that can vary during the virtual experience, as in real life experiences.

3 Virtual Stealth Assessment

New directions in technological application development seem to permit more accurate and composite estimations of subjects’ psychological dimensions, allowing administering assessments during the VR experiences, extracting ongoing, multifaceted information from a subject.

One of the most auspicious new research areas for evaluating psychological factors is virtual “stealth assessment” (VSA), originally developed for learning and education [18, 19]. It is a performance-based assessment in which the assessment is interlaced in activities or games, highly interactive and immersive. The user performance data are continuously collected during the VR experiences and stored in a dynamic model of user [19]. Stealth assessment proposes to remove or reduce traditional test anxiety and response bias without sacrificing validity and reliability [26]. In order to develop a valid and reliable VSA, the evidence-centered design (ECD) represents the theoretical framework of reference, and it can be divided in three models: the competency model refers to identify the attributes that we want to assess; the structural model concerns the identification of those behaviors that can elicit the attributes that we want to assess; finally, in the task model situation, problems are developed to activate that behaviors linked to the attributes [27]. Recollected information is maintained within the subject model and may include cognitive as well as non-cognitive information comprising an accurate and up-to-date profile of the subject.

4 Basic Psychological Needs

Psychology has a long tradition of thinking about basic psychological needs of humans, beginning with Mc Dougall (1908) [28] and Freud (1920) [29] and continuing on through Murray (1938) [30] and Maslow (1954) [31] to the present day [20, 21, 32,

33]. In general, the concept of needs is related to motivational psychology that affirmed that individuals attempt for satisfying certain personal aims in accordance with their motivational patterns, present and past experiences, and feedback from the external world [20]. According to Grawe, “the objectives of a person are formed during his life and ultimately serve the satisfaction of the various basic needs” [21, p.169].

Grawe identified four basic needs that define as “the needs that are present among all human beings and lasting violation or breach leads to alterations in mental health and well-being”. These are the need for attachment, orientation/control, self-esteem, and maximizing pleasure/distress minimization. The need for attachment refers to the human striving for close and intimate relationships and the desire to achieve a sense of security and balance with a reference person, mainly in distress experiences [34]. The need for orientation and control concerns to be able to orientate in the environment as well as the ability to influence and master the personal environment and context and to manage various challenges. More in detail, it can be defined as people’s desire to experience ownership of their behavior and choices. At psychological level it includes the sense of self-efficacy, self-competence, autonomy, and empowerment. The need for self-esteem is defined as the need to build and develop a positive self-image and through our interactions with others and with the environment shape our own image. Finally, humans follow the logic of increase pleasure and avoid negative, dangerous, or painful experiences. All human beings strive to meet these four basic needs every day. Therefore, the behavior and interactions with others and the environment will have to be satisfied with motivation schemes that are coherent and consistent with basic needs. These schemes are formed through positive and/or negative experiences, resulting in different internal models (cognitive and emotional) that are unconscious. Within these, there are two basic schemes: the approach scheme that is the result of the effort employed by a person to meet their basic needs; and avoidance scheme that refers to the effort of a person to protect their basic needs [20, 21].

5 The Development of Virtual Stealth Assessment for Attachment Need

5.1 Attachment Paradigm and Competency Model

Attachment is a composite psychosocial paradigm, showing how people react to stressful events seeking security, proximity and support by the relationship with others. The quality of first relationships, in terms of attention and responsiveness between children and the attachment figure, affects self-perception, others’ perception, future interpersonal relationships, emotional regulation and behavioral patterns [34, 35]. More in detail, an attentive and responsiveness attachment figure to child requests is able to generate secure and positive models of the self and the others, while inattentive or unresponsiveness attachment figure causes insecure and negatives models of the self and others. The generation of these models is unconscious and involves cognitive (such as attention, flexibility, and planning) emotional (e.g. regulation and expression in social relationships), and behavioral (quality of relationship, proximity or distance from others) responses, determining the adult expectations from the self and others in

relationship [36, 37]. Various studies have shown the significant relation among cognitive factors and attachment, as well as between the emotional responses and attachment mainly using self-report questionnaires and/or problem-solving tasks [38]. Individuals with a secure attachment show that they can easily shift attention between stressful cues in situation and environment, seeking others' support and accomplishing a goal or facing the stressful situation; insecure attachment individuals focus mainly their attention in the stressful situation or seeking support without flexibility of attention control. Moreover, insecure individuals can react to stressful events seeking extremely proximity with others or distancing extremely from others. Other studies have showed that secure individuals present positive models of the self and others and that insecure individuals show negative models of the self, in terms of self-esteem and self-concept, and positive models of others. In this literature framework, we propose a likely development of virtual stealth assessment for collecting multi-evident attachment behaviors relative to latent cognitive and emotional aspects (Fig. 1). More in detail, the main aim will be collected the various psychological attachment aspects in real-time during the virtual experiences, comparing the traditional assessment based on paper-pencil tests to the behavioral data.

5.2 Structural Model of Attachment

As mentioned before, the structural model concerns the identification of those behaviors that can elicit the attributes that we want to assess. Starting from the research findings over the years [39–42], Shaver and Mikulincer (2002) [43] develop a comprehensive model on the activation and dynamics of the attachment system based on three components (Fig. 2). The first includes the cognitive attentional monitoring and evaluation of distress events: if an event is evaluated as threatening, the attachment system activates the support and proximity seeking. The second component includes the evaluation of the availability, attentiveness and responsiveness of the attachment figure: if the figure is available and responsiveness, individuals feel a sense of security, allowing regulating emotions and engaging in activities to cope the threatening situation; if the figure is not available or responsiveness, individuals can develop two different reaction strategies in accordance with the internal models: individuals that act distancing from the attachment figures focusing on coping the situation and individual that react with more distress behaviors towards the attachment figures in order to receive attention and response [43]. To sum, the attachment paradigm can be related to cognitive and emotional components that virtual stealth assessment could measure during the stressful situations. In the following section, we present the virtual environment with the relative situations and task for eliciting attachment behaviors.

5.3 Task Modeling for Attachment

In order to create engagement of the user, we propose an immersive 3D game that will take place in a spaceship with six virtual characters and whose aim is to discover and settle a new land because the earth is no longer habitable. A narrative storytelling will be created for leading subject into the play and in which situation of loneliness, threatening and lost will be simulated for eliciting attachment responses (Figs. 3 and 4).

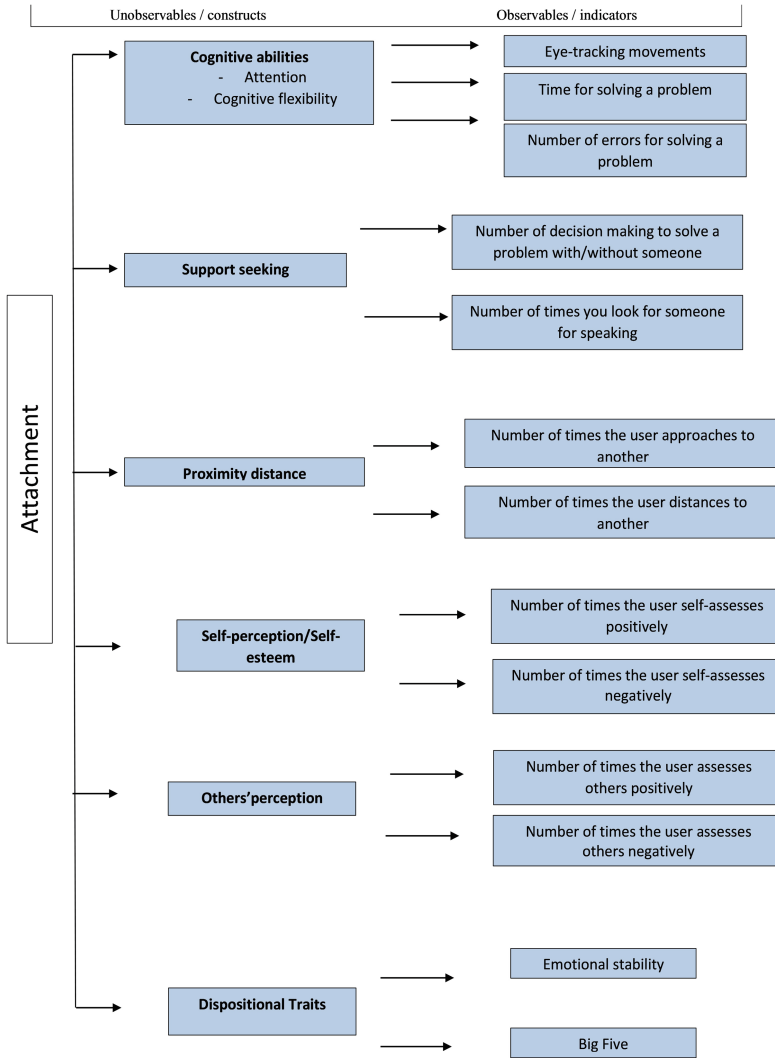


Fig. 1. Competency and structural model of attachment

More in detail, each distress situation will include two problem tasks relative to the cognitive functioning, such as attention and cognitive flexibility, by creating ad hoc and contextual cognitive sets alternation and dual-tasks, that they will previously be validated with traditional cognitive tasks. Traditionally, cognitive functions, as attention cues and cognitive flexibility are based on behavioral tasks such as the Wisconsin Card Sorting Test (WCST), in which are collected the number of errors to change strategy during the game, and the Implicit Association Test (IAT) in which time of execution represent the outcome in relation with cognitive flexibility. In the virtual stealth

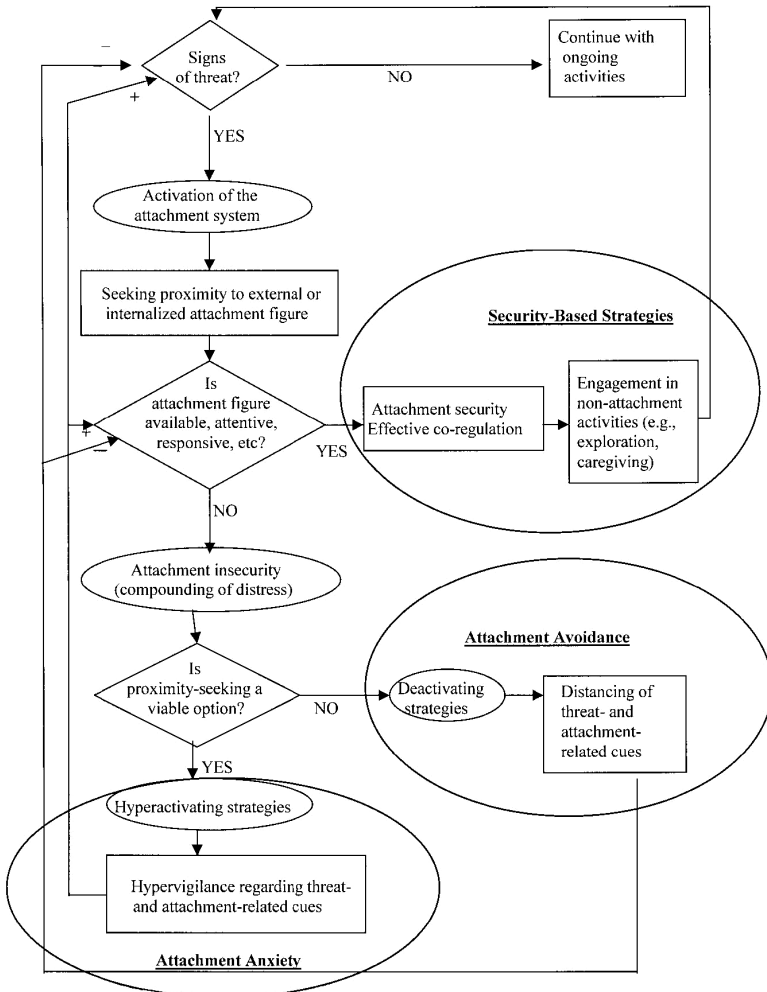


Fig. 2. Shaver and Mikulincer model on the activation and dynamics of the attachment system.

assessment, cognitive flexibility will be based on seeing how long users spend on situational tasks and how many errors commit in solving problems.

Furthermore, after the presentation of each distress situation will be asked to subject if he or she seeks support for solving the problem, as well as at the end of the situation if he or she wants to speak with someone else. At the end of each situation, subject will be asked to self- and others-evaluate for collecting the number of times that the subject evaluate positively or negatively himself and others.

To sum, each distress situation will mainly involve the data collection of the real behaviors relative to latent variables on cognitive (attention and cognitive flexibility) and emotional (support seeking, proximity distance, and quality of relationships) attributes. As well, the emotional attributes, as seeking support and physical proximity



Fig. 3. Task control room



Fig. 4. Virtual characters

will be assessed on the number of decision making to solve problems with or without someone, or number of times that user seeks support for speaking. Finally, these behavioral measures will be correlated to the traditional paper and pencil tests on attachment, self-perception, others' perception, and personality.

6 Conclusion

In conclusion, as we mentioned above, psychological traditional assessment is often too simplified, abstract, and decontextualized to provide a multi-dimensional psychological evaluation. Virtual stealth assessment can provide meaningful assessment environments by providing situations and problems able to elicit specific behavioral patterns. The performance data are then statistically linked to the specific psychological concepts. The first aim of this research project will be the yielding of the validity and reliability of stealth assessment for psychological attributes. If stealth assessment would provide accurate information about multi-dimensional psychological attributes, we could generate composite and valid subjects' profiles that then they could be taken into consideration for specific psychological treatments.

Funding Statement. This work was supported by the Spanish Ministry of Economy, Industry and Competitiveness funded project “Advanced Therapeutically Tools for Mental Health” (DPI2016-77396-R).

Acknowledgment. The work has been promoted by the call for support for mobility 2016 within the Program for Training Researchers of the Universitat Politècnica de València.

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