

# Assessing the Emotional State of Job Applicants Through a Virtual Reality Simulation: A Psycho-Physiological Study

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**Abstract.** Job interview is one of the most frequently used methods to assess candidates for employment and it often evokes feelings of anxiety and distress. The principal aim of this study is to use a VR simulation experience to assess the emotional state, and specifically anxiety, of job applicants. Two VR job simulations are proposed to twenty-five participants, before and after a five weeks training aimed to enhance their emotional skills. Results show differences in anxiety experienced by participants exposed to VR-simulated job interviews before and after the trainings and suggest adequacy of VR as an assessment tool sensitive to the changes in internal states of candidates.

**Keywords:** Virtual reality · Assessment · Anxiety · Emotional state · Psycho-physiological measures

## 1 Introduction

Around the world, job interview is one of the most frequently used methods to assess candidates for employment [1–3]. The job interview represents a critical moment for applicants: they expect interviews as part of a selection process [4] fundamental to job search success [5] and for this reason it often evokes feelings of anxiety and distress [6]. Anxiety is an inherent part of the interview process [7], and it could be related both to the fact that the interviewer is usually a stranger and talking with strangers could provoke anxiety [8] and to the lack of control perceived by the applicants [9]. A widely accepted explanation about the emergence of anxiety is related to the “test-taking anxiety”. This view contains two principal components: performance anxiety, conceptualized as fear of failure, and behavioral anxiety that reflects the autonomic arousal due to the test-taking situation. Both these components were expected to be critical to job-interview situations, as job interviews could be considered as a type of test [10]. Anxiety can impair the individual’s ability to retain information [11, 12] and thus determine serious implications for applicants [13]. For this reason, it is important to design structured situations

helping applicants to reach a good performance and to reduce the risks of failure of their experience in a real job interview [14].

Today, thanks to the advances in technologies, Virtual Reality (VR) could represent a valid chance to overcome the limits related to the exposure in real life [15] and has been already applied in interventions aimed to reduce public speaking anxiety [16–19]. VR is a human computer interaction in which users are active participants in a computer generated three-dimensional world [20] so convincing that it allows participants to have experiences that mimic those of real world. A simulated interactive environment available through VR can offer applicants an opportunity to practice and try out new skills without the worry of embarrassment or the risk of failure. This in turn can lead to improved job interview performance and, perhaps even more importantly, a sense of personal control or self-efficacy. Self-efficacy is defined as an individual's assessment of his or her ability to perform behaviors in specific situations [21] and this evaluation influences behavior. The first and most influential source of self-efficacy is past performance accomplishments. Success experiences (e.g. being able to overcome an obstacle through effort and perseverance) generally enhance individuals' beliefs in personal competence [21]. Applied to applicants to job interview, self-efficacy theory suggests that the use of VR may provide them with a sense of mastery or self-efficacy and, in turn, result in improved perception of performance and satisfaction with performance.

Recently, Villani and colleagues [22] compared two different settings, an immersive VR job simulation and a real world simulation that was identical to its VR counterpart (same interviewer, same questions) but without technological mediation and without any social and cultural cues, and found that participants experienced higher level of presence during the virtual interview than in the real world simulation. This result supports the idea that the experience of presence is influenced by the ability of meaning attribution to the experience. In that case the design of the VR environment as a professional setting enriched of social and cultural cues traditionally associated to the job interview context played a critical role.

Thus, VR can be used as an evaluation or a self-evaluation tool that provides information to the candidate about his/her emotional competence in coping with the event. This enables the candidate to decide whether he/she feels ready to face the situation or he/she believes that additional emotional skills must be developed to deal with the event successfully.

The principal aim of this study is to use a VR simulation experience to assess the emotional state, and specifically anxiety, of applicants. In particular, we proposed a VR job simulation experience enriched of social and cultural cues before and after a training aimed to enhance emotional skills of applicants. We expected to find differences between the two VR experiences related to applicants anxiety measured both with self-report and psycho-physiological measures. Specifically, we hypothesized a reduction of anxiety in VR experience measured after a training.

## 2 Method

### 2.1 Participants

Flyers were posted at Università Cattolica del Sacro Cuore and emails were sent to final years or graduated students of the same University to attract participants. We specified that we were interested in selecting people who had never had a job interview before. Twenty-five students, 9 males and 16 females, applied to participate and were included in the study. Participants' age ranged from 23 to 27 years. They were asked to imagine that they had applied for a desirable job and that they were undergoing a job interview.

### 2.2 Design

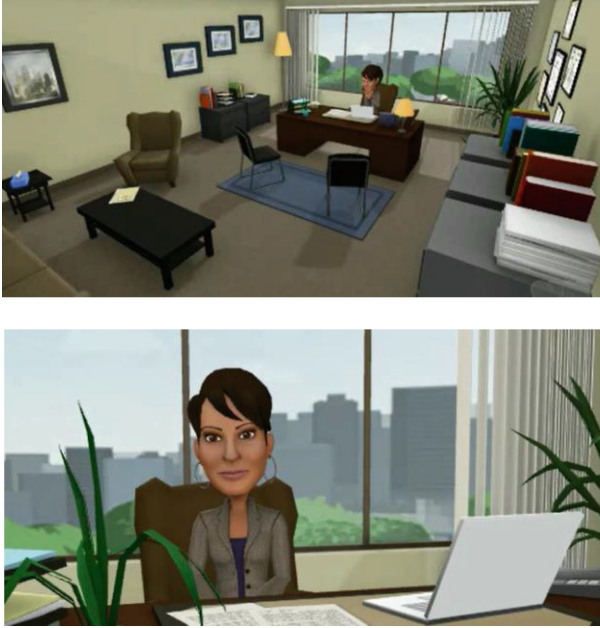
The VR job simulation was proposed two times during a face-to-face meeting with a psychologist, before and after a training aimed to enhance emotional skills of applicants. Participants were randomly assigned to two types of training: a more traditional one supported by a commercial book or a training supported by an ad hoc iBook developed using the iBooks Author tool from the Mac App store. Both trainings lasted five weeks and were focused on these issues: "prepare yourself for the job interview" (second and third weeks) included informative vs experiential materials about enhancing the awareness of candidate's profile and behavior aspects; "the job interview" (fourth and fifth weeks) included informative vs experiential materials about managing different interview types; "after the job interview" included informative vs experiential materials about dealing with the expected reply and evaluating the interview done in order to make better use of other occasions.

Within the VR job simulation the interview questions were general in nature, in order to allow participants to answer as if they were being interviewed for a job that they would like to have. The entire interview included eight questions and was split in half, yielding two sets of four questions (questions 1–4 vs. questions 5–8) each proposed in a randomized order during the first or the second virtual simulation. The items were relatively short in length, based on concrete ideas, and included only straightforward language, to ensure that each item described only one idea [23]. Each VR job simulation lasted approximately 15 min.

### 2.3 Tools

The virtual environment was developed by using Xtranormal, a cost-free tool available online which allows non-expert users to easily modify the virtual scenes, in order to best suit the needs of recreating real world contexts and that has been adapted here for the specific goal.

For this experiment the environment was modeled on a typical manager's office and was meant to represent a place that would make the student feel at a job interview. Figure 1 (a and b) shows two screenshots of the VR environment.



**Fig. 1.** The virtual office developed by using Xtranormal. Figure 1a shows the social and cultural cues (i.e. private office, furniture, books). Figure 1b shows the interviewer that is seated at a desk with laptop and applicant’s Curriculum Vitae in front of her.

## 2.4 Measures

To identify the affective dimension of the participants, we proposed an integrated multi-modal assessment—combining subjective and objective measures.

The State Trait Anxiety Inventory [24, 25] is a self-report questionnaire that assesses both state and trait anxiety levels. We used the State Anxiety subscale (STAI-S), a 20-item measures in which participants rate their level of anxiety to each item on a 4-point Likert-type scale, to evaluate the “transitory emotional states”. The State version was used as a manipulation check to measure anxiety levels at the end of each VR job simulation session.

The physiological signals were acquired using a ProComp Infiniti device from Thought Technology, including Biograph Infiniti 5.0.2 software to record and export all raw signals. According to the classic valence-arousal model [26, 27] we considered the two dimensions of physiological arousal and emotional valence for identifying affective states in participants during the experimental session. Following the guidelines of task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, typical Heart Rate Variability (HRV) temporal and spectral method indexes were used to evaluate the autonomic nervous system response [28, 29]. Specifically, we monitored the cardiovascular activity, by using two indexes such as Heart Rate (HR) and the ratio between low and high frequency components (LF/HF

ratio) known as the sympathovagal balance index [30]. A baseline measure of the psychophysiological parameters was obtained with a 3-min registration in a steady state.

### 3 Results

**Anxiety State Outcome.** First of all, the level of anxiety experienced in both VR job simulations was investigated as measured by STAI State Pre-Post index compared by using a paired comparison T-test (first vs. second session). Results showed significant statistical differences ( $t = 2.112$ ,  $df = 24$ ,  $p = .045$ ) between the two sessions. In the first session participants experienced a significant increase of anxiety state level, while in the second session they experienced a significant decrease of anxiety state level.

**Physiological Outcome.** The levels of physiological arousal and emotional valence calibrated on the baseline between the two VR sessions have been compared in order to verify differences in participants' affective states. After the noise reduction process we excluded some participants from the analyses. Results showed significant statistical differences both in HR ( $t = 2.078$ ,  $df = 19$ ,  $p = .051$ ), and LF/HF ( $t = 11.398$ ,  $df = 14$ ,  $p = .001$ ) between the two sessions. We found a significant reduction for both indexes.

Descriptive statistics of all measures are shown in Table 1.

**Table 1.** Descriptive statistics of the level of anxiety state change (STAI) and physiological indexes measured during VR job simulation sessions

	Session 1 M (SD)	Session 2 M (SD)
STAI Pre VR	35.92 (8.77)	36.96 (8.39)
STAI Post VR	36.72 (10.03)	34.20 (9.06)
HR	11.26 (8.30)	9.47 (6.70)
LF/HF	.94 (.21)	.24 (.29)

We also analyzed the differences between the trainings (paper book vs digital book) and we did not find differences between them.

### 4 Discussion and Conclusion

Results show differences in anxiety experienced by participants exposed to VR-simulated job interviews before and after the trainings, both measured with self-report and physiological signals. In addition to coming out in favor of the trainings' efficacy, this result implies an adequacy of VR for providing salient experiences to the participants. In other words, the results show that such experiences appear sensitive to the changes in internal states induced by trainings. Indeed, session 1 induced an increase in state anxiety such as the simulation had been experienced by the participants similarly to a real job interview. Consistently, after different trainings designed to empower participants' emotion regulation skills, the anxiety experienced during the virtual job interview was significantly reduced. This result does not seem attributable to the lack of novelty of the second virtual

simulation, given that the group that had followed the Ibook training had more opportunities to try virtual job interview simulations.

Although the job interviews were simulated by means of VR, featuring cartoon-like characters and dialogues voiced by actors, the participants experienced them as immersive resources for meaningful role-playing. Indeed, the use of virtual environments and virtual characters has been found able to promote motivation for learning in role-playing [31]. Consistently, previous experiences have shown that such tools are useful to improve communicational and emotional skills, both in pathological and non-pathological contexts [32, 33]. In the present study, the coherence between self-report and physiological assessment leads us to consider that the VR simulation may be used both as an assessment experiential tool under laboratory setting, where traditionally the psychophysiological signals are used, and as a self-evaluation experiential tool by the candidates. Indeed, they reported to be aware of the change in the level of anxiety as measured by the questionnaire. This opens to the possibility of designing virtual environments for self-evaluation and self-empowerment, given that both immersive and non-immersive VR are more and more widespread resources, thanks to the emergence of commercial VR devices for home gaming and in the mobile technology industry [34].

Generally speaking, the main consequence the present study is that VR-based simulation of complex real-life experiences can be used to test the effectiveness of trainings for emotion regulation. In other words, effectiveness can be evaluated not only testing participants' emotional reactions to generalized, abstract stimuli, but also to controlled experiences that resemble (at least in virtual/simulative terms) the actual experiences they encounter in their own everyday life. Along with previous research [22] the present study suggests that VR-based simulations can be used as effective surrogates of complex real-life anxiety triggers, such as the job interview experience. Further research is needed to understand whether and how such a technology may be improved in its effectiveness resembling real life, and whether it can be applied to the empowerment of emotion regulation in multiple real-life problematic context [35].

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