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Virtual Reality in Healthcare: Medical Simulation and Experiential Interface

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Virtual Reality in Health Care:

Medical Simulation and Experiential Interface

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Annual Review of CyberTherapy and Telemedicine (ARCTT – ISSN: 1554-8716) is published annually (once per year) by the Interactive Media Institute (IMI), a 501c3 non profit organization, dedicated to incorporating interdisciplinary researchers from around the world to create, test, and develop clinical protocols for the medical and psychological community. IMI realizes that the mind and body work in concert to affect quality of life in individuals and works to develop technology that can be effectively used to improve the standards and reduce the cost of healthcare delivery.

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ARCTT is a peer-reviewed all-purpose journal covering a wide variety of topics of interest to the mental health, neuroscience, and rehabilitation communities. The mission of ARCTT is to provide systematic, periodic examinations of scholarly advances in the field of CyberTherapy and Telemedicine through original investigations in the Telemedicine and CyberTherapy areas, novel experimental clinical studies, and critical authoritative reviews. It is directed to healthcare providers and researchers who are interested in the applications of advanced media for improving the delivery and efficacy of mental healthcare and rehabilitative services.

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Our publication pays careful attention to the protection of a patient's anonymity in case reports and elsewhere. Identifying information such as names, initials and hospital numbers must be avoided. Also, authors should disguise identifying information when discussing patients' characteristics and personal history.

Preface

ARCTT is a peer-reviewed all-purpose journal covering a wide variety of topics of interest to the mental health, neuroscience, and rehabilitation communities. This mission of ARCTT is to provide systematic, periodic examinations of scholarly advances in the field of Cybertherapy and Telemedicine through original investigations in the telemedicine and cybertherapy areas, novel experimental clinical studies, and critical authoritative reviews.

Healthcare delivery systems have been evolving to rely more heavily on technology. There has been a shift in care diagnosis and treatment which has decreased the importance of traditional methods of care delivery. Technology has not only helped to extend our lifespan, but it has improved the quality of life for all citizens.

We have put a great deal of effort into the definition of the structure of the volume and in the sequence of the contributions, so that those in search of a specific reading path will be rewarded. To this end, we have divided the different chapters into six main sections:

1. Editorial: This introductory text expresses the position of the Editors – Brenda K. Wiederhold, Giuseppe Riva, and Mark D. Wiederhold – about the focus of this year's issue;
2. Critical Reviews: These chapters summarize and evaluate emerging cybertherapy topics, including technology-enhanced rehabilitation, Interreality, and Intersubjectivity;
3. Evaluation Studies: These chapters are generally undertaken to solve some specific practical problems and yield decisions about the value of cybertherapy interventions;
4. Original Research: These chapters research studies addressing new cybertherapy methods or approaches;
5. Clinical Observations: These chapters include case studies or research protocols with long-term potential.
6. Work in Progress: These chapters include papers describing a future research work.

For both health professionals and patients, the selected contents will play an important role in ensuring that the necessary skills and familiarity with the tools are available, as well as a fair understanding of the context of interaction in which they operate.

In conclusion, this volume underlines how cybertherapy has started to make progress in treating a variety of disorders. However, there is more work to be done in a number of areas, including the development of easy-to-use and more affordable hardware and software, the development of objective measurement tools, the need to address potential side effects, and the implementation of more controlled studies to evaluate the strength of cybertherapy in comparison to traditional therapies.

We are grateful to Brandi Brown-Moreau, Emily LaFond, and Clemence Braissand from the Virtual Reality Medical Institute for their work in collecting and coordinating chapters for this volume.

We sincerely hope that you will find this year's volume to be a fasci- nating and intellectually stimulating read. We continue to believe that together we can change the face of healthcare.

Brenda K. Wiederhold
Giuseppe Riva
Mark D. Wiederhold

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SECTION I

EDITORIAL

This introductory text expresses the position of the Editors the Editors – Brenda K. Wiederhold, Giuseppe Riva, and Mark D. Wiederhold - the focus of this year's issue.

B. K Wiederhold, M. D. Wiederhold & G, Riva 2015

The New Dawn of Virtual Reality in Health Care: Medical Simulation and Experiential Interface

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Abstract. The 90s and 00s saw great hopes that virtual reality was poised to sweep health care and change everything. But it didn't. Though researchers could immerse themselves in more complex virtual environments, the chasm between that digital experience and the complexity of real life – using a VR system in an hospital without a dedicated technician was a real challenge - just was too great. Now the situation is changing quickly. The rise of Oculus Rift and the shift of virtual reality from PC to mobile phones thanks to both the Oculus designed Gear VR headsets for Samsung phones and the Google Cardboard project are going to transform health care tools and experiences.

Keywords. Virtual Reality, health care, cardboard, smartphones, anxiety disorders, medical simulation, experiential interface

1. The new dawn of virtual reality

The promise of virtual reality in health care has always been enormous [1; 2]. The first health care applications of VR started in the early '90s by the need of medical staff to visualize complex medical data, particularly during surgery and for surgery planning [3]. Actually, surgery-related applications of VR fall mainly into three classes: surgery training, surgery planning and augmented reality for surgery sessions in open surgery, endoscopy, and radiosurgery [4]. A couple of years later, the scope of VR applications in medicine has broadened to include neuropsychological assessment and rehabilitation with applications ranging from the treatment of anxiety disorders, post traumatic stress disorders, eating disorder and obesity [5].

The 90s and 00s saw great hopes that virtual reality was poised to sweep health care and change everything. But it didn't. Though researchers could immerse themselves in more complex virtual environments, the chasm between that digital experience and the complexity of real life – using a VR system in an hospital without a dedicated technician was a real challenge - just was too great.

Now the situation is changing quickly. The rise of Oculus Rift (https://www.oculus.com/en-us/), after a succesful Kickstarter campaign in 2012 followed by its $2 billion purchase two years after are clear signs of renewal. More, the shift of virtual reality from PC to mobile phones thanks to both the Oculus designed

Gear VR headsets for Samsung phones and the Google Cardboard project (https://www.google.com/get/cardboard/) are going to transform health care tools and experiences (see Table 1 for a list of the new low-cost devices).

Mobile seems a logical platform for the future of virtual reality. During the experience of a PC based VR system the immersion illusion is compromised by the dim awareness that you remain attached to a PC via a cradle of wires. Mobile devices, will offer a more liberating and self contained experience. They're not only self-contained but also cheaper to buy and run, both for the therapist and the patient.

Another emerging approach is the one of Augmented Reality (AR) a technological system that applies virtual and real elements in a real scene augmenting the user's perception of the world [6]. The develoment of the Hololens augmented reality helmet by Microsoft and its native support in Windows 10 will faclitate the development of a new range of training and educational applications.

Table 1. Low Cost VR and AR Headsets

Head Mounted Display	Web site	Required Hardware	Price
Oculus Rift	https://www.oculus.com/en-us/	PC	350 US$
Htc Vive	http://www.htcvr.com	PC	350 US$
Microsoft Hololens	https://www.microsoft.com/microsoft-hololens/en-us	PC	N/A
Razer OSVR	http://www.razerzone.com/osvr	PC and Mobile (not yet available)	300 US$
Samsung Gear VR	https://www.oculus.com/en-us/gear-vr/	Mobile (Samsung only)	199 US$
Google Cardboard	https://www.google.com/get/cardboard/	Mobile (both Android and iOS)	5/60 US$

2. The two faces of virtual reality in health care

For physicians and surgeons, the ultimate goal of VR is the presentation of virtual objects to all of the human senses in a way identical to their natural counterpart. As noted by Professor Richard Satava as more and more of the medical technologies become information-based, it will be possible to represent a patient with higher fidelity to a point that the image may become a surrogate for the patient – the *medical avatar* [7; 8]. In this sense, an effective VR system, should offer real-like body parts or avatars

that interact with external devices such as surgical instruments as near as possible to their real models.

However, there is another way of using VR in health care. Clinical psychologists and rehabilitation specialists use VR to provide a new human-computer interaction paradigm in which users are no longer simply external observers of images on a computer screen but are active participants within a computer-generated three-dimensional virtual world [9]. Within the virtual experience the patient has the possibility of learning to manage a problematic situation related to his/her disturbance. The key characteristics of virtual environments for these professionals are both the high level of control of the interaction with the tool without the constraints usually found in computer systems, and the enriched experience provided to the patient [10].

However, it seems likely that VR can be more than a tool to provide exposure and desensitisation As noted by Glantz and colleagues [11], "VR technology may create enough capabilities to profoundly influence the shape of therapy." (p.92). In particular, we suggested that VR, for its ability of modifying the experience of the body through the alteration of the sense of presence, may be used to facilitate therapeutic change [5].

For both sides, a critical advantage is that virtual environments are highly flexible and programmable. They enable the therapist to present a wide variety of controlled stimuli, and to measure and monitor a wide variety of responses made by the user. This flexibility can be also used to provide systematic experiential training that optimize the degree of transfer of training or generalization of learning to the person's real world environment.

If these experiences will be provided through our own mobile phones, the dawn of virtual reality will finally rise.

3. Open Challenges and Pitfalls

However, significant efforts are still required to move VR into commercial success and therefore routine clinical use: the more a complex and costly a technology is, the less the user is likely to accept it. Therefore, a critical challenge for the future is the development of easy-to-use and customizable virtual environments that may be adapted in real time to the patient's needs.

More, from the clinical viewpoint, the actual VR protocols consider VR a "closed" experience, produced and lived in the therapist's office only, separated from the emotions and behaviors experienced by the patient in the real world.

To overcome this issue, a critical advancement can be offered by a new technological paradigm, Interreality [12; 13] an hybrid, closed-loop empowering experience that uses smartphones and wearable devices to bridge physical and virtual worlds [14]. On one side, the patient is continuously assessed in the virtual and real worlds by tracking the behavioral and emotional status in the context of challenging tasks (*customization of the therapy according to the characteristics of the patient*). On the other side, feedback is continuously provided to improve both the appraisal and the coping skills of the patient through a conditioned association between effective performance state and task execution behaviours (improvement of self efficacy).

However, to exploit the full potential of this evolving situation the development of future presence-inducing media will require multi-disciplinary teams of engineers, computer programmers, and therapists working in concert to treat specific clinical

problems. Hopefully, by bringing this community of experts together, further interest from granting agencies and companies will be stimulated.

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SECTION II

CRITICAL REVIEWS

In general, there are two reasons why cybertherapy is used: either because there is no alternative, or because it is in some sense better than traditional medicine.

In this sense telehealth has been used very successfully for optimizing health services delivery to people who are isolated due to social and physical boundaries and limitations.

Nevertheless, the benefits of cybertherapy, due to the variety of its applications and their uneven development, are not self-evident.

However, the emergence of cybertherapy is supporting the cost-effectiveness of certain applications, such as assessment, rehabilitation and therapy in clinical psychology and neuroscience.

Wiederhold & Riva, 2004

Defining Cyberbullying: A Multiple Perspectives Approach

Alexandra ALIPAN,[a,1] Jason SKUES,[a] Stephen THEILER,[a] Lisa WISE[a]
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Abstract. To date, there has been a lack of consensus among researchers, practitioners, and laypersons about the definition of cyberbullying. Researchers have typically applied the key characteristics of intent to harm, power imbalance, and repetition from the definition of traditional bullying to cyberbullying, but how these characteristics transfer from the real world to a technology-mediated environment remains ambiguous. Moreover, very few studies have specifically investigated how cyberbullying is defined from the perspective of bullies, victims and bystanders. To this end, this article will propose a three-part definition of cyberbullying, which incorporates the perspective of bullies, victims and bystanders.

Keywords. Cyberbullying, definition, perception, bully, victim, bystander.

Introduction

With the increasing use of information and communication technologies (ICTs) such as mobile devices and networked computers that are used to text, call, or access the internet, individuals are more likely to be involved in or witness acts of cyberbullying. Due to the negative psychological and physical effects it can have on individuals, there has been a dramatic increase in cyberbullying research over the past five years, with most studies focusing on the definition, measurement, prevalence, and correlates of cyberbullying [1]. However, despite the increase in research in this area, there are significant conceptual gaps in the literature that need to be addressed. This review will examine the lack of consensus on the cyberbullying definition, not only from the perspective of researchers but also individuals who are directly involved in cyberbullying experiences. This review will also propose a multi-faceted cyberbullying definition.

Definition of Cyberbullying

To date, several definitions of cyberbullying have been proposed by researchers with no unequivocal definition established. For instance, some researchers have proposed open and broad definitions that focus on the technology, such as "bullying through email, instant messaging, in a chat room, on a website, or through a text message sent to a cell phone" [2]. On the other hand, many other researchers have attempted to adapt

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and apply the characteristics of traditional bullying to cyberbullying, namely repetition, intent to harm, and power imbalance [1;3]. A widely used definition incorporating these three key features states that cyberbullying is, "an aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend him or herself" [1]. However, it is not clear that these characteristics have the same meaning in face to face compared to a technology-mediated interaction. For example, in regards to repetition, the behaviour of taking a compromising photo may have occurred once, but uploading it onto the internet for others to see could be argued as repetition [4]. Secondly, rather than power imbalance referring to physical strength, in an online context its existence continues to be debated by researchers, with some referring to it as a discrepancy in technological skill [5] and others stating that it is not a valid feature of cyberbullying [6]. Lastly, intent to harm has been difficult to establish as email, chat, and text messaging can be easily misinterpreted due to the absence of non-verbal cues such as tone and body language. This could also interfere with one's recognition that he or she actually caused harm to another person [7]. The lack of consensus on a single definition has resulted in considerable variations in the operationalisation of cyberbullying and subsequent prevalence estimates, with reported rates ranging from 4.5% [8] to 55% [9] across different age groups.

Despite these definitional issues, it is important to note that when researchers use the term cyberbullying, they assume that participants share the same definition of what behaviours and characteristics comprise cyberbullying. Yet findings from past research have shown this to not be the case. For instance, lower prevalence rates have been reported in single-item scales that list a global definition of cyberbullying compared to multi-item scales that list certain behaviours believed to be associated with cyberbullying [10]. One possible explanation for this is that it means something different to be the target of cyberbullying behaviours versus being the victim of cyberbullying. Put simply, a person who has experienced cyberbullying behaviours but has not been negatively affected (e.g., hurt, embarrassed) by these behaviours may consider themselves to be a target of cyberbullying rather than a victim. Not surprisingly, people are less likely to identify themselves as a bully as this has both social and legal consequences.

Multiple Perspectives on Defining Cyberbullying

In spite of the absence of a widely accepted definition, very few studies have specifically investigated how laypeople define cyberbullying. This is of particular importance to this group, which may be comprised of potential victims, bullies, and bystanders. Of the few studies that asked participants to define cyberbullying, most described it as bullying online or through an ICT [7] and that this behaviour can be either direct or indirect [5]. Notably, participant provided definitions are typically from the victim's perspective and assert that it depends on the victim's interpretation of the behaviour as to whether or not an act is considered cyberbullying [11;12]. For example, Baldasare, Bauman, Goldman, and Robie [11] conducted a qualitative study on college students' perceptions of cyberbullying. The authors found that majority of the participants agreed that cyberbullying depends on how the victim interprets the situation. This suggests that regardless of the bully's intent, if the victim interprets the behaviour as hurtful and as cyberbullying, then this is the deciding factor. This

corresponds to other qualitative findings, in which there was a consensus that cyberbullying refers to a negative impact on the victim [12;13]. Participants in these studies also referred to a once-off attack as cyberbullying because the impact on the victim could be just as severe as several cyberbullying experiences. It should be highlighted that despite several qualitative studies reporting the importance of the victim's perspective in classifying cyberbullying, this perspective has not been made an explicit feature of the definition [12].

In contrast to the focus on victims, others have suggested that in order to qualify as cyberbullying from a bully's perspective, then there must be an intention to harm. Baldasare et al. [11] also reported that a smaller subset of college students believed that the motivations of the bully are critical in defining cyberbullying. In particular, regardless of how the victim interpreted the situation, if the bully did not intend to harm the victim, then the behaviour should not be deemed as cyberbullying. Similarly, in Vandebosch and Cleemput's study [7] participants identified cyberbullying as when the bully intends to harm another person. This is how participants distinguished cyberbullying from other forms of behaviour such as cyber teasing. Participants also acknowledged that in some circumstances intentionality and repetition are considered simultaneously [7]. That is, if the bully intended to harm an individual, then they would do it continuously. Alternatively, if the bully did not intend to harm the other person, then they would stop and immediately state they were just joking or apologise [11].

In comparison to victims and bullies, very little work has been conducted on how bystanders define cyberbullying, though it is likely that bystanders find it difficult to interpret whether a particular behaviour is considered cyberbullying without having the relevant cues and knowledge of the context. For example, in a focus group study conducted by Vandebosch and Cleemput [7], participants described that a message between two friends might be mutually considered a joke. However, this same behaviour may be seen as harmful and cyberbullying by a third party. Because of the subjectivity of cyber communication, bystanders are often hesitant to intervene in certain situations as they might have misinterpreted the behaviour as cyberbullying, when it is not [11;14]. It is important for bystanders to be aware of how to identify cyberbullying behaviours and how to appropriately intervene.

The way a victim responds to an attack has been reported by bystanders as an important indicator in judging whether or not to intervene. For instance, victims who ignore the behaviour have received less bystander support than victims who report the behaviour or confront the bully [15]. A lack of response might be interpreted by bystanders as the behaviour not affecting the victim. Whereas, victims who reported or responded to the behaviour may be perceived by bystanders as putting more effort into dealing with the situation, or the behaviour as more severe if they have to approach the bully about it [15]. Moreover, increasing cognitive and affective empathy in bystanders has been found to decrease negative bystander behaviours and encourage more positive responses. Thus, understanding the perspective of a victim and how that person would feel can reduce bystander support of the cyberbullying behaviour [16].

It is crucial that more qualitative research be conducted with bystanders in order to develop a deeper understanding of how they define cyberbullying, the cues that bystanders use to establish cyberbullying behaviours, and these can be used to inform the definition of cyberbullying. This will also assist researchers in educating individuals in identifying and appropriately responding as helpful bystanders when witnessing perceived cyberbullying situations.

Proposed Three-part Cyberbullying Definition

Taken together, the way individuals define cyberbullying appears to differentiate depending on the point of view that they adopt, whether it be from the perspective of bullies, victims, or bystanders. This suggests that the current definition of cyberbullying may be too simplistic and may not capture some of the conceptual subtleties that need to be considered. Past focus group studies have reported that participants regard the definition of cyberbullying as outdated, equating it with adolescent behaviour, being too general or subjective, or not an accurate description of their harmful online experiences [7;11;14]. Rather, the definition of cyberbullying appears to be multifaceted and needs to be broken down in order for individuals to understand it. While researchers have partially captured some of the different perspectives (i.e., bully's, victim's, and bystander's), they have not yet integrated these perspectives to help inform a definition of cyberbullying. To this end, a three-part definition of the term cyberbullying, which considers a combination of the perspective of bullies, victims, and bystanders is proposed.

Cyberbullying is defined here as using an information and communication technology to target one or more people directly or indirectly, whereby (1) the goal from the bully's perspective is to intentionally harm the victim. Repetition can also help establish intentionality and cyberbullying, in which the bully continuously carries out a harmful behaviour towards the same victim; (2) the behaviour is perceived as intentional and harmful as defined by a victim. A once-off attack can also be considered as cyberbullying as the negative impact on the victim may be just as severe as frequent attacks; and (3) a bystander observes that a behaviour has negatively affected another person, or that such a behaviour would likely negatively affect the bystander if directed toward him or her. A bystander may also perceive the behaviour alone as intentional and aggressive.

In order to categorise a behaviour as cyberbullying, then one needs to acknowledge which perspective he or she is taking. Depending on the perspective of interest, researchers and practitioners might employ one definition or multiple definitions. For instance, researchers or practitioners specifically focusing on the victim's perspective would define cyberbullying as, "using an information and communication technology to target one or more people directly or indirectly, whereby the behaviour is perceived as intentional and harmful by a victim." Separating the definition into each of these perspectives is beneficial to represent the perceptions and interpretations of individuals who are, or potentially may be, involved in cyberbullying behaviours. Another advantage of employing a multifaceted definition, like the one proposed, is that it will help inform the operationalisation of the term, and in turn assist with the development of valid measures of cyberbullying. In this regard, the data from these measures would provide more appropriate, useful, and meaningful results in relation to cyberbullying.

Conclusion

Although several definitions of cyberbullying have been proposed in the literature, these definitions have either tended to ignore the different perspectives of bullies, victims, and bystanders, or have focused on one perspective without incorporating other views in order to produce a comprehensive definition. Therefore, we have proposed a three-part definition of the term cyberbullying which has addressed each of

these perspectives. An important implication for the multiple perspective approach to defining cyberbullying is that it can help inform professionals where interventions need to be targeted. For instance, intervention and education programs could target bystanders by helping them to identify cyberbullying situations as well as understanding the perspectives of others. Thus, we argue that the proposed three-part definition has provided a preliminary but workable framework for researchers to advance knowledge and understanding in this area from different points of view. Future researchers should conduct more qualitative research focusing on how all individuals involved in cyberbullying situations define the concept. More in-depth responses as well as discussion surrounding the key characteristics encompassing the experience of cyberbullying from the three perspectives is essential for furthering this line of work.

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Explaining Work Exhaustion From a Coping Theory Perspective: Roles of Techno-Stressors and Technology-Specific Coping Strategies

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Abstract. The purpose of this study is to theoretically develop and empirically examine a general coping theory model which explicates the indirect effects of key job-related techno-stressors on job exhaustion. Through this study, we show that techno-stress creators are detrimental to employee well-being and should be treated accordingly. Specifically, we first argue that key techno-stress creators on the job, namely techno-invasion and techno-overload, drive unpleasant states such as work-family conflict and distress. Next, we rely on general coping theory and argue that people respond to these states differently, but with both adaptive and maladaptive technology-specific coping strategies. Adaptive coping behaviors are argued to ultimately reduce work exhaustion, and maladaptive coping strategies are argued to increase it. The proposed model was tested and validated with structural equation modeling techniques applied to self-reported data obtained from a sample of 242 employees of a large organization in the United States. Implications for theory and practice are discussed.

Keywords. techno-stress, information technologies, coping strategies, work exhaustion, work-family conflict.

Introduction

The usage of information technologies on the job often is not highly regulated or controlled by employers. There seems to be no official mandated or even recommended policy that firms and organizations observe in order to regulate the use of technologies by employees. Nevertheless, many recent studies show that (1) technologies can induce stress among employees (called techno-stress), and (2) that this stress is detrimental to employee wellbeing and performance. Consequently, many firms have been trying to find solutions to prevent negative effects mediated, triggered, or exacerbated on employees by information and communication technologies (ICTs).

This study aims at deepening our understanding on how different technology-related stressors indirectly create negative outcomes. We specifically focus on work exhaustion as outcome because it has been demonstrated that it is a key detrimental state for employee wellbeing and relationship with the organization. Focusing on this outcome, we propose a model that explains how adaptive and maladaptive coping

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strategies influence it, and how they are indirectly informed by key techno-stress creators, namely techno-invasion and techno-overload.

Theoretical Background

Techno-Stress and its Creators

Techno-stress was initially defined as "A modern disease of adaption caused by an inability to cope with the new computer technologies in a healthy manner" [1]. In this early work, techno-stress was argued to manifest in two ways: a struggle to accept technology and over-identification with technology. Given the modern progression with technologies and the ways by which they can stress individuals, this definition was updated to include "any negative impact on attitudes, thoughts, behaviors or psychology caused directly or indirectly by technology" [2]. Many situational, organizational and individual-difference features can drive techno-stress, and the literature often discusses five organizational-personal features which 'create' techno-stress (i.e., techno-stress creators), namely techno-overload, techno-invasion, techno-insecurity, techno-uncertainty, and techno-complexity.

For this study, we decided to focus on two of these techno-stress creators: techno-overload and techno-invasion. This choice was made because we considered them as the most relevant ones for our sample, which consisted of organizational employees for which it seemed that techno-stressors such as techno-complexity (describes situations where ICTs used at work force people to spend time and effort to often learn and update their ICTs competences), techno insecurity (associated with situations where people feel threatened about losing their jobs to other people who have a better understanding of new computing devices), and techno-uncertainty (problems caused by devices obsolescence) were less relevant. For example, given that the organization we examine is government-related and unionized, job insecurity is minimal, as most employees cannot be easily fired; and lengthy training on most technologies is provided so that there may be insufficient variation in techno-uncertainty.

Describing these two particular techno-stress creators, techno-overload is a sense that the use of new technologies forces people to work more and faster because of the high amount of work requests mediated by ICTs. Techno-invasion, in contrast, captures perceptions regarding being 'always exposed' so that people can be reached anywhere and anytime and feel the need to be constantly connected. In essence, with modern technologies, the regular workday is often extended: office work is done at all sorts of hours and is almost impossible to 'break away'. Both of these factors seem to be relevant in our sample. Given government pressures for increased efficiencies, employees in this organization tend to take work home and work on weekends; and are exposed to increased job demands mediated by technologies. Tarafdar's scale was utilized to measure these two techno-stress creators [3].

Work-Family Conflict

This construct refers to an "inter-role conflict in which pressures from work and family are irreconcilable" [4]. Adams' scale was selected for assessing work-family conflict [5]. Because research revealed that high and problematic levels of mobile email use

increased technology - family conflict - and ultimately work-family conflict, we hypothesize that:
H1: higher levels of techno-invasion increase the levels of work-family conflict.

Distress

Hans Selye first introduced the term distress defining it as "too much stimulation which causes negative stress, whereas eustress is usually the result of more manageable levels of stress", but what do we mean by stress? We are 'under stress' when a "situation that is perceived as presenting a demand which threatens to exceed the person's capabilities and resources for meeting it" [6] or anticipates an "inability to respond adequately to perceived demand, accompanied by anticipation of negative consequences for inadequate response" [7]. Perceived distress on job scale was adapted from the perceived stress scale by Cohen [8].

Because it has been demonstrated that techno-stressors - including work-overload, can influence role stress [9], and job satisfaction [3] we hypothesize that:
H2: higher levels of techno-overload cause higher levels of distress.

ICTs Coping Strategies

Drawing from the overarching coping theory [10] we decided to study how different groups of ICTs coping strategies influence work-exhaustion levels, and how subjects choose to cope after they experience work-family conflict or distress. Stress is defined as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well being" [10,11]. This definition introduces the concept of coping, which is a double evaluation of both stressors (primary coping) and personal resources (secondary), whose relationship brings to choose a coping strategy to deal with the stressor.

We can classify coping strategies as emotion-focused, problem-focused, cognitive, behavioural, control, avoidance, functional, and dysfunctional ones. According to Monat and Lazarus "Problem-focused coping refers to efforts to improve the troubled person-environment relationship by changing things, for example, by seeking information about what to do, by holding back from impulsive and premature actions, and by confronting the person or persons responsible for one's difficulty"; while "emotion-focused (or palliative) coping refers to thoughts or actions whose goal is to relieve the emotional impact of stress. These are apt to be mainly palliative in the sense that such strategies of coping do not actually alter the threatening or damaging conditions, but make the person feel better" [12].

Carver's coping strategies scale [13] was adapted to the ICTs context, and we identified - by exploratory factorial analysis - two clusters of coping strategies loading on two different factors which we named respectively adaptive coping strategies (or problem focused) and maladaptive (or dysfunctional) coping strategies. The first cluster is composed by the following strategies: active coping (deal directly with the problem), asking for technical support, and planning. On the other hand, the second cluster is composed by: deny, disengagement, and venting. No evidence was found for a clear emotion-focused coping strategies cluster either after an exploratory factorial analysis which included every coping strategy, or after a confirmatory factorial analysis with which we tried to confirm an emotion-focused coping strategy structure including just specific strategies in the analysis.

Although problem-focused coping tends to predominate when people feel that something constructive can be done, and emotion focused coping tends to predominate when people feel that the stressor must be endured, most stressors elicit both types of coping and there seems to be no coping style that is more adaptive across all situations [14]. Cohen also emphasizes that specific contextual factors can affect the style of coping that produces better adaptation [15].

Thus, relying on the general coping theory (which states that a coping strategy is chosen after perceiving and appraising a stressor, bringing the subject to experience a consequent outcome) we hypothesize that:

H3: higher levels of work-family conflict increase the levels of both adaptive and maladaptive coping strategies.

H4: higher levels of distress increase the levels of both adaptive and maladaptive coping strategies.

Work Exhaustion

In theory work exhaustion is considered a component of burnout construct, and is defined as the "depletion of mental resources". We assessed it by referring to Maslach Burnout Inventory - General Survey [16].

Previous studies on technology professionals found out that work overload was the strongest contributor to exhaustion in the technology workers [17]. Furthermore, role conflict, role ambiguity [18], and lack of autonomy [19] received consistent empirical support to be consider as antecedents of work exhaustion. Focusing on techno-stress context, several studies already analyzed how techno-stressors negatively affect job satisfaction [3] and burnout [20]. Therefore we decided to consider work-exhaustion as the final outcome of our SEM. Hence, we studied how work exhaustion levels change in relation to work-family conflict (which we hypothesized is caused by techno-invasion), and to distress (which we hypothesized is caused by techno-overload).

Because problem-focused coping is more probable when stressful situations are appraised as amenable to change [10, 11, 21] and because of the evident detrimental nature of dysfunctional coping, we hypothesize that:

H5: ICTs adaptive (problem-focused) coping strategies are successful in reducing work exhaustion levels.

H6: ICTs maladaptive coping strategies are not successful in reducing work exhaustion levels. They in fact increase them.

We did not consider other elements of the Schaufeli's burnout conceptualization (cynicism and decreased professional self-efficacy) because they can manifest themselves as potential consequences of work exhaustion [17]. We preferred to focus just on work exhaustion.

Methodology

Data were collected at a large government-related organization in the United States of America. Participants received an invitation via e-mail (using work e-mail distribution lists) to voluntarily participate in this study, and complete an online survey. Individuals were asked to click on a link, read the consent form, then start filling the online survey. Questionnaire items were adapted to the context of ICTs use on the job considering the following original scales: Techno-stressors (Techno-overload, Techno-invasion):

Tarafdar et al. (2008); Work-family conflict: Adams et al. (1996); Perceived stress on job: adapted from Perceived Stress Scale (Cohen et al. 1983); ICTs coping strategies: adapted from Carver et al. (1989); Work exhaustion: MBI-GS (Schaufeli, 1995).

Factorial analysis was conducted to preliminarily examine items, variables, and factor structures in the sample. Each item significantly loaded on its respective factor, and acceptable Cronbach's alpha values were registered for each variable: techno-invasion (0.894); techno-overload (0.911); work-family conflict (0.970); distress (0.842); deny coping strategy (0.843); disengagement coping strategy (0.943); venting coping strategy (0.863); active coping strategy (0.876), planning coping strategy (0.932); asking for technical support coping strategy (0.896); adaptive coping strategies (0.837); maladaptive coping strategies (0.725); work exhaustion (0.931).

Results

SEM analysis was conducted - controlling age, gender (0: male; 1: female), and work hours per day - to test hypothesis, and model fit [Chi-square: 439.3; DF: 244; Chi-square /DF: 1.8; CFI: 9.48; IFI: 9.49; RMSEA: 0.058; SRMR: 0.0765]. Every hypothesis was supported [see figure 1]:

H1: techno-invasion increases work-family conflict (0.56).
H2: techno-overload increases distress (0.39).
H3: work family conflict increases both adaptive (0.13) and maladaptive ICTs coping strategies (0.20).
H4: distress increases both adaptive (0.23) and maladaptive ICTs coping strategies (0.33).
H5: ICTs adaptive (problem-focused) coping strategies reduce work exhaustion levels (-1.17).
H6: ICTs maladaptive coping strategies meaningfully increase work exhaustion levels (3.03).

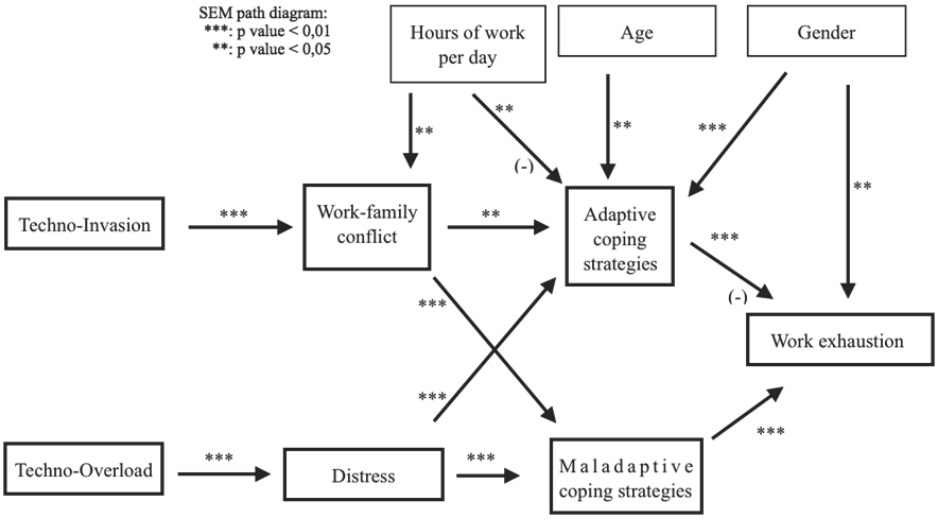

Figure 1

Furthermore, gender (females) is positively related (1.17) to work exhaustion and adaptive coping strategies (0.50). On the other hand, older people engage more in adaptive coping strategies (0.14). In the end, the amount of hours of work per day contributes positively to experience work-family conflict (0.10), and negatively to engage in adaptive coping strategies (-0.11).

Conclusions

The paper suggests helpful practices for managing and sensitizing employees considering different ICTs coping strategies, techno-stress drivers, and outcomes.

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SECTION III

EVALUATION STUDIES

To date, some cybertherapy applications have improved the quality of health care, and later they will probably lead to substantial cost savings.

However, cybertherapy is not simply a technology but a complex technological and relational process.

In this sense, clinicians and health care providers that want to successfully exploit cybertherapy need a significant attention to clinical issues, technology, ergonomics, human factors and organizational changes in the structure of the relevant health service.

Wiederhold & Riva, 2004

If You Build It, They Will Come, But What Will Wounded Warriors Experience? Presence in the CAREN

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Abstract. Military service members (SMs) are surviving complex battlefield injuries at higher rates than ever before. Cutting-edge technologies are increasingly being employed to improve assessment and treatment of these complex injuries. The Computer Assisted Rehabilitation Environment (CAREN) is a comprehensive immersive environment, featuring a treadmill, curved panoramic screen, audio array, and infrared cameras to capture movement. While the CAREN has been progressively incorporated in treatment and research, little has been reported regarding participants' subjective experiences, particularly in relation to the signature wounds of the Iraq and Afghanistan wars, traumatic brain injury (TBI) and posttraumatic stress disorder (PTSD). Here we report participant presence, in a cohort of SMs with complex, frequently dual-diagnosis injuries (N=148; 95% TBI; 58% PTSD) engaging in CAREN-driven treatment. Using a presence questionnaire, participants rated aspects of the CAREN on a 7-point Likert scale and a presence score was calculated. The average presence score was 46.83 (SD=6.04; possible score range 7-63), with 95% of participants reporting scores >36. Those with motion sickness and eye discomfort reported lower presence, whereas those with PTSD reported higher presence. Presence did not vary according to TBI severity. Overall, SMs with complex injuries experience presence in the CAREN. However, presence may be adversely affected by CAREN-associated symptoms such as motion sickness.

Keywords. CAREN, treatment, virtual reality experiences, immersion, presence, military

Introduction

In the Global War on Terror, combat service members (SMs) have sustained complex injuries as the result of unconventional insurgency tactics (e.g. improvised explosive devices) in addition to common explosive mechanisms (e.g. mortars, rocket-propelled grenades). Since blast injuries are multi-organ and multi-system, these SMs experience a complicated constellation of concurrent injuries producing multiple comorbidities [1]. In an effort to provide treatment to injured SMs, the need to utilize all-encompassing vanguard tools has remained paramount.

Going well beyond head-mounted virtual reality displays, the Computer Assisted Rehabilitation Environment (CAREN; Motek Medical BV, Amsterdam, Netherlands) brings SMs into an immersive, all-encompassing environment, which includes a 6-degree-of freedom motion based, dual-belt treadmill-equipped platform. The platform moves in sync with virtual environments (VE) projected onto a curved panoramic screen from four projectors (Projection Design, Fredrikstad, Norway) and an overhead

surround sound system (Yamaha Corporation, Buena Park, California, USA) provides a realistic auditory experience. Participants are donned with reflective markers and several overhead infrared cameras track movement in real-time (Vicon Motion Systems Ltd., Oxford, United Kingdom). The culmination of these facets makes the CAREN well poised to assess and treat complex clinical cases, such as individuals with comorbid traumatic brain injury (TBI), amputations, vestibular problems, posttraumatic stress disorder (PTSD), and other conditions. Several studies have examined the CAREN's capabilities [1], but little is known about SMs' subjective experiences related to CAREN utilization.

The current study aimed to explore factors related to "presence" – a feeling that one is immersed in the VE and not where one's body is located [2], from a sample of SMs with complex injuries. Previous research suggests a multi-sensory (visual, auditory, haptic) input VE may yield a greater sense of presence, when compared to a visual-only VE [3, 4]. The addition of locomotion, whether that be walking in-place [5] or a simulated visual movement relative to walking (e.g. optic flow) [6], is also associated with increased presence. Given that the CAREN includes a multitude of sensory experiences and locomotion with optic flow, we hypothesize that participants will experience moderate to high levels of presence within the CAREN. Objective data derived from EEG work draws a positive relationship between attentional processes and presence within a VE [7, 8]; presence is strongly related to immersion, involvement, and focus, all of which may modulate the success of efforts to rehabilitate SM within the VE [13]. We hypothesized that those reporting symptoms such as motion sickness and eye discomfort would report lower presence. Lastly, we also hypothesize that presence will be lower among those with moderate/severe TBI and PTSD, as their ability to maintain attention [9, 10] may compromise their ability to experience presence in the CAREN.

Methods

Participants and Procedures

The sample includes SMs (*N*=148, 97% men) with combat-related injuries receiving medical care at the National Intrepid Center of Excellence in Bethesda, Maryland. Participants represented all four branches of military service (36% Marine Corps, 35% Army, 18% Navy, 10% Air Force). A majority had a documented TBI (78% mild, 17% moderate/severe) and PTSD (58%). Each participant had been referred to the CAREN by their Physical Therapist (PT) after clinical evaluations were completed in that discipline. The CAREN was utilized as a modality to further explore gait, motion sensitivity, balance, and cognitive functioning. VE selection as well as task parameter and modality difficulty settings were controlled by the treating PT. Some VEs may have included the implementation of dual-tasking, completing cognitive tasks while simultaneously engaged in physical activities. For example, in the Shark Hunt application SMs must weight/step shift to navigate from one target to the next and a secondary recall task can be added to increase complexity. All clinical sessions were 30-50 minutes in duration and after completing two clinical sessions, a minimum of 60 minutes on the CAREN, participants completed self-report measures.

Measures

The CAREN presence questionnaire, abbreviated from the Witmer and Singer Presence Questionnaire [11], asked SMs to rate aspects of the CAREN (e.g. adjustment speed, responsiveness, controllability, comfort) on a 7-point Likert scale with end and mid-point descriptors (e.g. 1 = not at all, 4 moderately, 7 = very). Sample items include, "How quickly did you adjust to the virtual environment experience?" and "Did you feel as though you were immersed in the virtual environments?" Reliability of the measure was acceptable for the full scale, Cronbach's α=.65. Reliability was greatly improved when an item assessing the experience of negative feelings during CAREN use was omitted, Cronbach's α=.77. Therefore, subsequent analyses included a total presence score composed of the residual items, with a range of possible scores 7-63. Self-Reported Symptoms were measured with two yes/no questions assessing motion sickness and eye discomfort. Participant diagnoses were recorded with yes/no responses. Diagnoses included TBI (mild, moderate, severe) and PTSD.

Analytic Plan

Initial univariate analyses of demographics, self-reported symptoms, and presence were followed by *t*-test to examine whether mean presence scores were different between (1) those who did and did not report motion sickness or eye discomfort, those with mild or moderate/severe TBI, and (3) those with and without PTSD. These analyses were completed using SPSS 22.0. Follow-up tests examined whether specific presence items were associated with each variable of interest. To control for the risk of false positive findings, we utilized a False Discovery Rate calculator (http://sdmproject.com/utilities), and present the corrected *p*-values. Lastly, χ^2 tests examined whether the distribution of self-reported symptoms varied according to TBI severity or PTSD diagnosis.

Results

Participants' mean presence score was 46.83 (*SD*=6.04), with 95% of participants reporting scores >36. We examined the relationship between items on the presence questionnaire. The majority of presence items significantly correlated with each other as illustrated in Table 1.

We examined the relations between mean presence score, self-reported symptoms (e.g. motion sickness, eye discomfort), and clinical diagnoses (e.g. PTSD, TBI severity). Consistent with hypotheses, those who experienced motion sickness (t=2.65, p=.01) or eye discomfort (t=2.53, p=.01) reported lower presence than those who did not report such symptoms. In particular, those with motion sickness reported lower responsiveness (t=2.72, p=.03) and controllability (t=3.19, p=.02) than those without motion sickness. Those with eye discomfort did not differ from those without eye discomfort on presence items. Contrary to our hypothesis, those with PTSD reported higher presence than those without PTSD (t=2.06, p=.04). In follow-up tests, there were no significant differences in presence items. Presence did not differ according to TBI severity (t=.13, p=.90). The distribution of motion sickness [$\chi^2(2)$=1.52, p=.22] and eye discomfort [$\chi^2(2)$=.26, p=.61] did not vary according to PTSD diagnosis.

Similarly, motion sickness [χ^2((2)=4.63, p=.10] and eye discomfort [χ^2(2)=.10, p=.95] did not vary with TBI severity.

Table 1. CAREN Presence means and correlations

Presence Item	Mean (SD)	1	2	3	4	5	6	7	8
1. Adjustment to CAREN	5.19 (1.24)								
2. Responsiveness of CAREN	5.99 (1.11)	.38**							
3. Control within CAREN	5.80 (1.04)	.38**	.53**						
4. Awareness of external environment	3.35 (1.91)	-.27**	-.16	-.19*					
5. Concentration on CAREN tasks	5.60 (1.24)	.31**	.35**	.51**	-.21**				
6. Consistency with real world	5.00 (1.37)	.17**	.43**	.42**	-.23**	.32**			
7. Acquisition of new techniques	4.58 (1.58)	.07	.26**	.34**	-.31**	.24**	.49**		
8. Immersion within CAREN	5.59 (1.25)	.17*	.27**	.28**	-.17*	.16	.39**	.43**	
9. Comfort level	5.72 (1.32)	.38**	.43**	.44**	-.20*	.42**	.17*	.18*	.09

**p<.01, *p<.05

Discussion

In our population of SMs, with a mix of TBI and psychological health concerns, the reported degree of presence within the CAREN was high while symptoms were infrequent, regardless of TBI severity (mild vs. moderate/severe). The majority of participants (60%) did not report motion sickness or eye discomfort after CAREN use. Those reporting such symptoms tended to report lower levels of presence. In particular, those with motion sickness reported less responsiveness and lower controllability. However our measure of self-reported symptoms was limited to yes/no responses assessing motion sickness and eye discomfort, and therefore we cannot specifically state the degree to which these symptoms were experienced by participants after CAREN sessions.

Some evidence suggests that the CAREN may produce less symptoms after use (e.g. motion sickness) than other virtual reality modalities [12]. Since the CAREN screen wraps past the periphery and the platform motion and treadmill speed are synched to the graphics for each VE, there is congruence between what the SM sees and feels. For example, as the visual field shows an incline, the treadmill inclines; as waves move on the screen, the platform rocks with them synchronously. Hence, there is no visual mismatch or disconnect, which is a common cause of motion sickness [13].

Interestingly, those with PTSD reported higher overall presence than those without PTSD. Previous studies examining virtual reality exposure therapy for anxiety disorders indicates presence as being an essential conduit between pre-treatment anxiety and in-session anxiety [14]. The current results demonstrating presence, especially among those with PTSD, gives credence for future clinical applications of the CAREN. Given documented success of virtual-reality systems in treating anxiety disorders [15], programs could someday be adapted to include multi-sensory input and locomotion within the CAREN. To date, some preliminary work has sought to utilize the CAREN as an all-encompassing virtual environment for therapy among combat SMs with PTSD [16].

Conclusion

We provide evidence of presence within the CAREN for SM with complicated concurrent injuries including TBI and PTSD. Future research is needed to determine the role of presence within an exposure-based CAREN application for PTSD among SMs with TBI, with comparisons to currently utilized head-mounted displays and other virtual reality modalities. Furthermore, research is needed to examine the role of presence in functional outcomes. The views expressed in this article are those of the authors and do not reflect the official policy of the Department of Army/Navy/Air Force, Department of Defense, or U.S. Government.

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Evaluating User Experience of Augmented Reality Eyeglasses

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Abstract. Augmented reality based applications have been experimented with in various contexts. Typically, the interaction is supported by handled devices, which, in specific scenarios, may hinder the interaction and spoil the experience of use, as the user is forced to hold the device and to keep her eyes on it at all times. The recent launch on the market of light-weight, unobtrusive head-mounted displays may change this circumstance. Nevertheless, investigations are needed to understand if such head-worn devices effectively outperform handheld devices in terms of comfort and pleasant experience of use. Here we present two experiments aimed at assessing the comfort of wearing a head-worn, see-through AR viewer in both a controlled and a natural setting. Besides the comfort of wearing the device, aspects related to the user experience were also investigated in the field evaluation. Our findings suggest that the head-mounted display examined is comfortable to wear regardless of the context of use. Interestingly in the field trails, participants did not express concern for the impression they would have made on other people and the experience of use was overall pleasant. Possible issues related to visual fatigue emerged.

Keywords. Augmented Reality, Wearable Computers, Eyeglasses, User Experience

Introduction

Augmented reality (AR) refers to the combination of real and digital information on top of the user's view [1], in a way so that the physical world visualized by the user is enhanced with contextualized information. The majority of the applications exploiting AR technology have been developed for handheld devices, as the solutions attached on the user's body were typically bulky and heavy [2] (see for example [3]). However recent advances of technology have brought to the market light-weight, head-mounted displays that have the potential to change this perspective. One of the main advantages of this type of head-mounted display over the handheld ones is that it allows the user to interact hands-free and to raise his or her sight from the screen, which is desirable in an urban context [4]. AR technology has been experimented with a lot in the touristic

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scenario, as it conveys a valuable means for accessing enhanced contextualized information to the tourist [5] without spoiling urban heritage with multiple signs. Previous research has proved that the perceived comfort of wearing a wearable computer, or the device's wearabilty, can impact the user's willingness to adopt and use a device [6], e.g., a head-mounted display. Furthermore, the way the user perceives how the wearable computer makes her appear in other people's eyes has been identified as a factor impacting on the willingness of use [7]. The present study aims to explore the comfort of wearing a head-worn AR device in the laboratory and in the field. Moreover, the experience of use of such a device was also investigated in the field.

The research

The present study is composed of two experiments both assessing the same head-worn, see-through AR device: the first experiment consists of the preliminary laboratory evaluation of the eyeglasses' wearability; the second experiment investigates wearability as well as other dimensions of the user experience in an ecological setting.

2.1 Materials and Methods

In both experiments, users wore Epson Moverio BT-200 (developer version). Epson Moverio is a lightweight (240 g) see-through AR viewer, in which each lens is endowed with a display allowing 3D vision of the objects overlaid onto the surroundings. The user can input commands by touching a hand-held pad. The device works on Android™ 4.0 System. Experiment 1 was run deploying a simulation app of the Solar System[2]. In Experiment 2, users interacted with Junaio[3], a commercial AR app displaying points of interest (POI) in the surroundings. To assess wearability, a brief questionnaire was built, consisting of 14 statements to which the respondent expressed her level of agreement on a 5-point Likert scale (1=completely disagree; 5=completely agree). The items explored the physical sensations and possible hassles caused by the components of the eyeglasses in direct contact with the user's head, namely the sidepieces (six items) and bridge (four items). Additionally, four general statements regarding the overall feelings of wearing the device (weight and balance) were included. All statements were enriched with images highlighting the device component to which each item referred. A second questionnaire (used in Experiment 2 only) was composed by 15 items assessing the user experience. Besides collecting background information, the questionnaire asked to assess the perceived usefulness of the head-worn display (3 items), its ease of use (3 items), general comfort (2 items), visual comfort (2 items), pleasantness (3 items), and embarrassment (2 items).

[2] 3D Solar System, https://moverio.epson.biz/jsp/pc/pc_application_list.jsp

[3] Junaio, https://play.google.com/store/apps/details?id=com.metaio.junaio&hl=it

2.2 Tasks and Experimental Procedure

Experiment 1 took place in the laboratory and participants were asked to explore a simulation app of the solar system until they found the planet Neptune; the task lasted approximately 3 minutes. Afterward, they filled in the wearability questionnaire. Experiment 2 took place in the center of a mid-sized city. Users were required to reach a target POI that was out of the participant's view (approximate distance 150 m) following the augmented indication provided by the eyeglasses. The task duration was approximately 5 minutes. After reaching the target POI, they filled in the wearability and user experience questionnaires.

Figure 1. A participant during the experimental trial in the field.

2.3 Participants

In Experiment 1, six people volunteered to take part in the experiment. Three of them were women and three were men. The mean age of the sample was 26.1 (*SD*= 1.52). In Experiment 2, 12 people took part in the study (7 of them were women). The mean age of the sample was 26.91 (*SD*= 9.51). In both experiments, participants had a very low or no self-reported level of expertise with AR applications.

3. Results

A sample t-test was run to assess if users' opinions differed from the central point of the response scale. The results of Experiment 1 suggest that users did not find annoying the contact of the device components neither on the nose, $t(5)= 4.89$, $p= 002$, $M= 2.0$ $SD= .53$, nor on the temples and rear part of the head, $t(5)= 5.75$, $p=.004$, $M= 1.66$ $SD= .50$. Respondents expressed a neutral attitude on the device being heavy and not well-balanced on the head, $t(5)= 2.101$, $p=.09$, $M= 2.54$ $SD= .5$. Similar results emerged from Experiment 2: users found the eyeglasses comfortable while using them in the field, both with respect to the sidepieces, $t(11)= 5.05$ $p<.001$ $M= 1.7$ $SD= .83$, and to the bridge, $t(11)= 4.4$ $p= .001$ $M= 2$ $SD= .82$. In the mobile context, participants also

reckoned the head-worn device was well-balanced and light ($t(11)= 3.06$ $p= .008$ $M= 2.45$ $SD= .69$).

A further comparison was run to assess if the testing condition (laboratory vs. field) affected the users' evaluations. A t-test for two independent samples showed no difference in the evaluations of the sidepieces' comfort, $t(17)= .32$ $p=.74$ (average score for Experiment 1 was 1.6, $SD= .56$, and average score for Experiment 2 was 1.7 $SD= .83$), the bridge, $t(17)= .18$ p= .85 (average score for Experiment 1 was 2 $SD= .5$ and average score for Experiment 2 was 2, $SD= .82$), and overall, $t(17)= .289$ $p= .77$. The average score for Experiment 1 was 2.54 $SD= .53$ and the average score for Experiment 2 was 2.45 $SD= .69$.

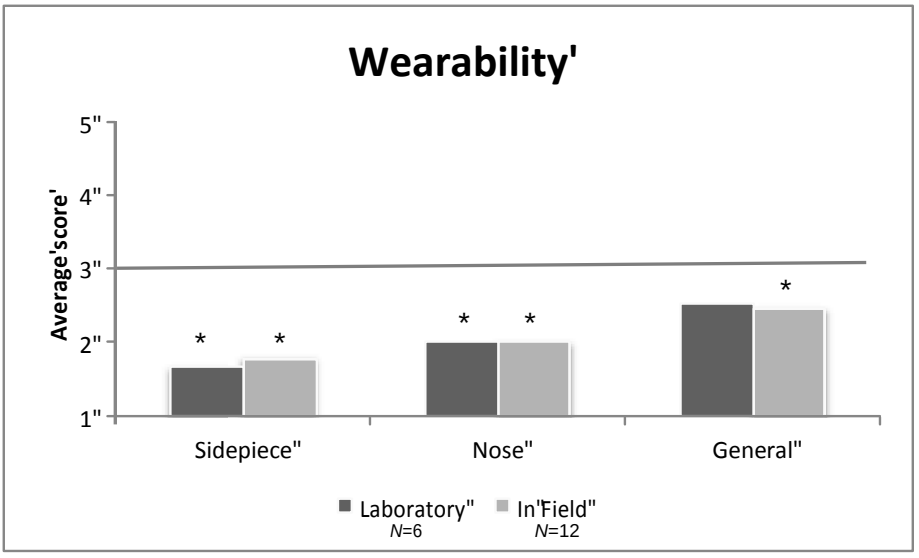

Figure 2. The average wearability score attributed to the components of the eyeglasses and overall to the eyeglasses. The asterisk indicates a significant difference between mean score and the central value of the scale, i.e., 3, at =.05.

Regarding the user experience questionnaire, the analysis highlighted that users found the eyeglasses easy to use, $t(11)=2.28$, p=.043 ($M=3.47$, $SD=.71$). A positive evaluation also emerged from the items assessing the pleasantness of use, $t(11)= 3.91$ $p=.008$ ($M=3.91$, $SD= .98$). Participants seemed positive regarding the usefulness of the device but not statistically significantly ($M=3.36$, $SD=.83$), $t(11)=1.5$, p=.16. Interestingly, participants did not show strong concerns about being observed by other people when using the Moverio viewer $t(11)=1.2$, $p=.25$, $M=2.7$, $SD=.83$. Regarding the general comfort of use, they showed a neutral attitude $t(11)=.24$, p=.81, M=2.9, SD= 1.18, possibly connected with the neutral score given to ease of reading and recognizing the visual elements, i.e., visual fatigue, $t(11)=.66$, $p=.52$, $M=3.25$, $SD=1.3$. This finding is consistent with our informal observations, in which we noticed that often participants used a hand to shadow from light and thus be able to distinguish the augmented icons.

Conclusion

Our findings show that, overall, users found the device and its components unobtrusive and comfortable in both a controlled and a natural setting. Additionally, respondents considered the eyeglasses easy to operate and pleasant to use. Interestingly, they were not concerned about the possibility of being stared at by other people while wearing the eyeglasses. A possible issue emerged in Experiment 2, where the task required participants to read information: here, the comfort as well as the ease of reading were evaluated with scores that did not differ from the neutral value of the scale, showing that the comfort was not critical but that visual fatigue could be an issue. This suggests it is necessary to reduce the amount of augmentation to a minimum conveyed via text. Further evaluations are needed to understand if the users' experience is positive also after longer interactions, e.g., 20-30 minutes, and to comparatively evaluate the experience with other augmentation devices, i.e., tablet or smartphones, in the same task and in others with a different level of mobility involved.

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Bridging Minds: A Mixed Methodology to Assess Networked Flow

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Abstract. The main goal of this contribution is to present a methodological framework to study Networked Flow, a bio-psycho-social theory of collective creativity applying it on creative processes occurring via a computer network. First, we draw on the definition of Networked Flow to identify the key methodological requirements of this model. Next, we present the rationale of a mixed methodology, which aims at combining qualitative, quantitative and structural analysis of group dynamics to obtain a rich longitudinal dataset. We argue that this integrated strategy holds potential for describing the complex dynamics of creative collaboration, by linking the experiential features of collaborative experience (flow, social presence), with the structural features of collaboration dynamics (network indexes) and the collaboration outcome (the creative product). Finally, we report on our experience with using this methodology in blended collaboration settings (including both face-to-face and virtual meetings), to identify open issues and provide future research directions.

Keywords. Networked Flow, Group Creativity, Flow, Social Presence, Interlocutory Logic, Conversational Analysis, Social Network Analysis

Introduction

In recent years, the increasing acknowledgment of the key role played by collaboration in creativity has resulted in several conceptual of group creativity. In a review of this field, Gl veanu [1] identified two main perspectives: the sociocognitive approach and the sociocultural approach. The first paradigm has mainly focused on the cognitive dimensions of group creativity and on the possible strategies to enhance its effectiveness. The sociocultural approach, in contrast, has put more emphasis on the process of creative collaboration, focusing in particular on its intersubjective and cultural dimensions. In an attempt to bridge these two views, Gaggioli et al. [2, 3, 4] introduced the Networked Flow (NF) model. Central to this model is the development of a shared intersubjective space, which the authors identify with high levels of social presence («we-intentionality»). When high social presence is achieved, participants can enjoy an optimal state that maximizes the creative potential of the group (Networked Flow, NF). The adjective «networked» is used to stress the conceptualization of NF as a systemic emergence, resulting from the micro-interactions between the components of the group [3]. In simple words, a central assumption of the model is that the a group

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enjoying NF shows specific features in terms of network structure with respect to a group that is not experiencing this optimal collective experience.

Methodology

A key challenge of the NF framework is to identify an appropriate methodology for capturing the multiple facets of optimal networked creativity, given the inherent complexity of the theoretical construct. NF is conceptualized as an evolving, interactive process, which leads to the emergence of stable group structures (eventually embodied in novel artifacts). Thus, a first methodological requirement is to take into account both processual and structural features of creative collaboration, as well as its outcomes (e.g. the creative product). Furthermore, the NF model assumes that in order to elucidate the evolution of the creative collaboration, one has to take into account both the micro, meso- and macro-genetic levels. The methodological translation of this assumption is that the focus of the analysis should be both on the interaction patterns occurring between group participants over time (micro); on the structural changes occurring in group internal dynamics (meso); and on the outcomes of micro- and meso- interactions, in terms of transfer of the creative product (the artifact) over a larger socio-cultural context (i.e. a community). A final methodological requirement is that, in order to identify the possible links between the experiential features of NF (social presence, flow) and the structure of group dynamics, both qualitative and quantitative data are needed.

To address the above issues, we propose a longitudinal, mixed methodology which combines qualitative and quantitative and topographical analysis of creative collaboration. Here, we use the term mixed method to refer to the specific procedure of collecting and analyzing both quantitative and qualitative data in the context of a single study.

Qualitative data

The proposed mixed methodology focuses on two types of qualitative data longitudinally collected troughout the collaboration process: the data collected to examine the *quality of experience* of group participants (intra-personal level); and the analysis of *communicative interactions* occuring between participants (inter-personal level). The quality of experience is investigated with specific reference to the constructs of flow and social presence. To assess Flow Experience, it is proposed to use the *Flow State Scale* [5], a widely-used tool to measure optimal experience. To assess social presence, the Networked Minds Measure of Social Presence is proposed [6, 7]. Although this tool has been specifically devised to study social presence in mediated contexts, its use can be extended to non-mediated settings (face-to-face interactions). Communicative interactions are investigated with specific reference to the constructs of collective zone of proximal development and dialogical style. To assess these two constructs, we propose to pay particular attention to dialogical processes taking place in conversations analysing them by means of Interlocutory logic [8] to individuate some dialogical patterns occuring between participants during their group's activity [9].

Quantitative and topographic data

An essential methodological requirement of NF is to take into account both processual and structural features of collaboration, as well as its outcomes (e.g. the creative product). To address the first issue, we propose to use the Social Network Analysis (SNA). By considering individuals as interdependent units as opposed to autonomous elements, SNA offers a suitable methodology to study group dynamics as well as to investigate the role of the individuals within these dynamics [10, 11]. On the other hand, SNA has proven useful for gaining insight into social network characteristics associated with creativity [12, 13]. SNA focuses on various aspects of the relational structures and the flow of information, which characterize a network of people, through two types of interpretation, graphs and structural indices [14, 11]. Graphs (or sociograms) plot the dots (individuals) and their social relationships (edges). Structural indices depict quantitatively the network of social relations analyzed based on several characteristics (e.g., neighborhood, density, centrality, centralization, cohesion, and others). For each structural characteristic of a relational network, SNA provides two types of indices: individual indices (i.e., based on relations and exchanges characterizing each actor of the networks) and group indices (i.e., based on relations and exchanges characterizing the network as a whole). To study the Networked Flow, different structural SNA indices have been proposed, such as Density, Group Centralization and Cliques Participation index (for a throughout description of these indexes, see Gaggioli et al. (2015). Further, it is possible to carry out SNA in two different modalities: focusing on the group structure in a precise moment in time, or adopting a longitudinal approach, which allows taking multiple "snapshots" of the network structure over time. Finally, for the quantitative evaluation of the creative outcome of the collaboration (the creative product), a suitable instrument is the *Creative Product Semantic Scale* [15] (CPSS). The CPSS uses 55 items organized into subscales to measure three main dimensions of creative products, each made up of underlying facets: novelty (the product is surprising, original), resolution (the product is logical, useful, valuable, and understandable), and elaboration and synthesis (the product is organic, well-crafted, and elegant).

Conclusion

In this contribution, we have described the key features of a mixed methodology to investigate Networked Flow, a theory of collective creativity that aims at integrating the cognitive, interpersonal and socio-cultural dimensions involved in the creative process. The proposed methodology is based on the longitudinal collection of qualitative and quantitative data to analyze the processual and structural features of creative collaboration dynamics. The final objective of this approach is to characterize and describe the emerging properties of NF and of creative collaboration process. Preliminary application of this mixed methodology suggest its potential for investigating NF, although several issues concerning i.e. the transformation of qualitative into quantitative data and the definition of appropriate statistical analysis techniques to deal with longitudinal nested data needs to be appropriately addressed.

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Teaching-learning: stereoscopic 3D versus Traditional methods in Mexico City

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Abstract. In the UNAM Faculty of Odontology, we use a stereoscopic 3D teaching method that has grown more common in the last year, which makes it important to know whether students can learn better with this strategy.
The objective of the study is to know, if the 4th year students of the bachelor's degree in dentistry learn more effectively with the use of stereoscopic 3D than the traditional method in Orthodontics.
Methods: first, we selected the course topics, to be used for both methods; the traditional method using projection of slides and for the stereoscopic third dimension, with the use of videos in digital stereo projection (seen through "passive" polarized 3D glasses). The main topic was supernumerary teeth, including and diverted from their guide eruption. Afterwards we performed an exam on students, containing 24 items, validated by expert judgment in Orthodontics teaching. The results of the data were compared between the two educational methods for determined effectiveness using the model before and after measurement with the statistical package SPSS 20 version.
The results presented for the 9 groups of undergraduates in dentistry, were collected with a total of 218 students for 3D and traditional methods, we found in a traditional method a mean 4.91, SD 1.4752 in the pretest and X=6.96, SD 1.26622, St Error 0.12318 for the posttest. The 3D method had a mean 5.21, SD 1.996779 St Error 0.193036 for the pretest X= 7.82, SD =0.963963, St Error 0.09319 posttest; the analysis of Variance between groups F= 5.60 Prob> 0.0000 and Bartlett's test for equal variances 21.0640 Prob>chi^2 = 0.007. These results show that the student´s learning in 3D means a significant improvement as compared to the traditional teaching method and having a strong association between the two methods.
Conclusion: The findings suggest that the stereoscopic 3D method lead to improved student learning compared to traditional teaching.
Keyword: Teaching-learning, stereoscopic 3D, traditional.

Introduction

In recent years, many professors have integrated auxiliary education through virtual reality, in order to meet the challenge of helping the students on the subject of Orthodontics 1 that is taught in a theoretical form during the fourth year of dental surgeon school. We detected that when the students go through the course of the fifth year that is taught in a practical way by attending directly the patient in the clinic, the students were slow to apply the theoretical knowledge, hindering its application, and their decision-making and analysis in the diagnosis and treatment plan, since they present little experience in dealing with infant patients who are in their mixed dentition (between 6 and 14 years) presenting different pathologies.[1]

As to the procedural part, the 4th year students practice only in plaster prefabricated models without any alteration, this does not happen in the next course, because the patients have different anomalies, that the student of 5th year will need to know; but they don't know how to start, they still have little ability to know what to do, which one is the first step to follow, and can even omit steps because they believe that they can do it better and faster even when they can recite the clinical procedures.

In recent years a big concern has emerged as to ensuring that students are better prepared and can apply what they have been learning whenever they want to. For this reason the professors have focused their skills in creating materials in third dimension, with the objective of achieving the integration of bone and dental characteristics of the patients through stereoscopic videos of real patients in 3D. This is where the professor can teach the differences in the characteristics that may be present in patients undergoing growth and what the possible treatments that may be performed are.[2]

This way when the student starts 5th year and is confronted with the problem of a clinical patient, it would be easier to identify anomalies in the moments that the clinical examination of the patient is under process. The student will acquire the ability to identify, diagnose, and treat these patients; on this issue, it is important to emphasize the need the student has to solve the difficulties that are presented, the solution and decision making about different ailments of the patients, as well as how it will be solved and in what time. [3]

Using the stereoscopic 3D, a 4th year student may integrate the knowledge that has been acquired with the new ways of teaching and thus succeed in improving their cognitive skills and practices for diagnosis and different treatment plans that he will use from the beginning of the 5th year, in this way they may provide quality service to low income patients seeking preventive and interceptive treatments and thus avoiding a greater measure of adverse events that may occur.[4]

In recent years, in order to take advantage of technological advances of "Virtual reality" as auxiliary in education, the professors of the Faculty of Odontology, National Autonomous University of Mexico, have developed stereoscopic teaching material, being supported with videos, photographs and models in 3D with the topic of different diseases including diverted and supernumerary teeth. The aim in preparing this material is that students who are studying the subject of Orthodontics 1 develop skill in diagnosis and treatment plan and obtain the different skills needed for professional life.[5]

Virtual reality is used in fourth year students to reinforce the knowledge for future clinical training classes. In the 5th year the clinical procedures are limited depending on the requirements of each patient's treatment and thus restrict clinical experience depending on the treatments of the needs patients, who are treated by one student each. In this case the knowledge in the class group will not be very homogeneous. Virtual reality could be a useful tool for the students because they can see different types of malocclusion with possible treatment options.[6]

On the other hand, all of the procedures that are used for the manufacture of the equipment for the treatment plan are either fixed or removable so they will also be taught with stereoscopic 3D video, this way all students can observe what the teacher is doing at the same time.

It is important to mention that technological advances such as the use of computers, the creation of virtual worlds, the platforms on internet being used in the Faculty of Odontology to support different kinds of classes with many subjects that are taught during the Bachelor's degree, has led to the interest of professors in the use of this

technology, and create educational materials that can serve as a new teaching tool for students of the Bachelor of Dentistry of the National Autonomous University of Mexico.[7]

In the specific case of teaching orthodontics, the use of stereoscopic 3D video, allows the student to observe different clinical characteristics of the Mexican population as they are growing. The students can view options of preventive and interceptive treatment of real patients. It is worth mentioning that some orthodontic treatments require a long time and depend on the pace and growth potential of the patient. [8, 9]

That is why videos help us to exemplify the complete treatments that normally would take longer than the school year, allowing student to follow the treatment.

In this context the researcher Bartolemé Pina, mentions in his article "*Prepared for a new way to know*" there is currently too much information, thus how it should be coded and the decision-making in terms of information and language use are important for the student to achieve good learning. [10]

On the other hand, Julio Cabero mentions, that learning can be justified by the number of senses that can be stimulated and the potentiality in withholding the information. There are also classical studies, which have shown that you remember 10% of what you see, 20% of what you hear, 50% of what you see and hear, and 80% of what you see, hears and do, which lends support for the use of new technologies that are conducive to the retention of information through multimedia, interactive and symbolic systems where the student must perform different activities.[11]

This is why the idea of using Virtual Reality as a tool in the teaching of the subject of Orthodontics I and II of the dentistry degree from the National Autonomous University of Mexico emerged.

Teaching material in the form of stereoscopic 3D video has been developed in order to help the learning of the students and to understand the difficulties of different subjects such as proteins for the Biochemistry; bones of the face and skull Anatomy; diagnosis and treatment planning in orthodontics.

Methodology

The teaching material that was used in this study was created with the following tools: Stereoscopic 3D videos of malocclusions of retained and supernumerary teeth in children 6 to 12 years old were recorded, the removable equipment necessary to carry out such treatments was produced.

The clinical practice course was performed with two methods; the traditional method and the stereoscopic 3D imaging method. The traditional method consists of teaching through two-dimensional images projected on the board. The stereoscopic method is through 3D video projected in a special room, where it is necessary to use special lenses. The 3D videos show the different stages in which the dental eruption and malocclusions of different patients are located.

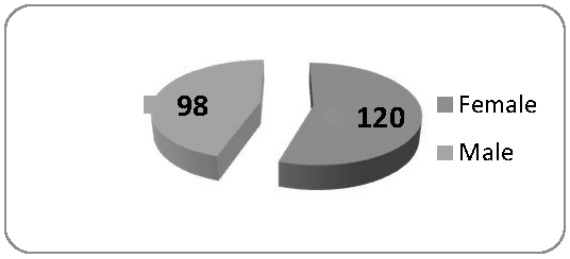
The researcher selected the content and images, for the following topics: diagnosis, malocclusions, and fixed or removable appliances. These materials were selected assuring that both the 3D material method and the traditional one were identical.

Evaluation of the method was made with a test consisting of 24 questions. Each question was validated by experts to ensure content syntax and spelling were optimal. It was produced in accordance with the criteria of the Manual de Elaboracion de Reactivos de la Facultad de Odontología de la Universidad Nacional Autónoma de

México (*Manual for elaboration of Reagents of the Faculty of Dentistry of the University National Autonomous of México).* [12, 13]
The group of students was randomly divided into two groups:
Group 1, which received training using the traditional teaching method. (Presentation and blackboard)
Group 2, which received training in the 3D classroom of the Faculty of Odontology. (Specialized glasses), where they observed through it, the stereoscopic 3D images, videos that show the different stages and places in which the dental eruption and anomalies of different patients are located.
The questionnaire was applied in two phases to both groups. First phase involves a diagnostic test, to see the previous knowledge of the group. Then both groups received training respectively (group 1: traditional, group 2: 3D). The same questionnaire was then applied to both groups (Phase 2). For the 3D method the class was given through different stereoscopic 3D video projections.[15]
The same questionnaire was then applied to both groups (Phase 2). The statistical analysis was made using the statistical package SPSS 20, comparing the results of both phases and measuring if the differences shown in results were statistically significant.
[17]

Results

The total study population was 218 students (98 men and 120 women), consisting of nine 4-year groups of the Bachelor of Dentistry attending the orthodontic course. The average age of the study group was 22.5 years with a minimum of 21 and a maximum of 34 years (Graphic 1).



Graphic 1. Distribution of 4 year students by gender.

The sample contained 106 students for the traditional method and 112 students for the 3D one (Table 1).

Table 1. Distribution for teaching method.

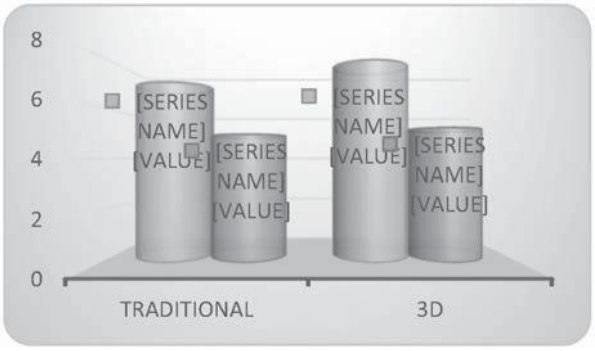
Teach meth	Traditional	3D
Frequency	106	112
Per cent	48.62	49.08
Total	218	100 %

The results were obtained through the Shapiro-Wilk W in a normal distribution. Pretest: 245 observations, with a W=0.99560, z=-0.564. The prob>z is 0.71349. Posttest: 218 observations, W=0.96012, z=4.295, the prob> z is 0.00001 (Table 2). There is a difference in the number of students in pretest and posttest, because some did not participate in the second test.

Table 2. Tests Shapiro-Wilk W for a normal distribution in 4° year.

Variable	Obs	W	V	Z	Prob>Z
Pretest	245	0.99560	0.785	-0.564	0.71349
Posttest	218	0.96012	6.414	4.295	0.00001

The results obtained in the traditional teaching method were for a mean X = 4.91 with a SD=1.4752 in the pretest and X= 6.96, SD 1.26622, St Error 0.12318 for the posttest. The 3D method had a mean 5.21, SD 1.996779 St Error = 0.193936 for the pretest and X= 7.82, SD 0.963963, St Error 0.09319 for posttest (Graphic 2); the analysis of Variance between groups was F=5.60 Prob> 0.0000 and Bartlett´s test for equal variances 21.0640 Prob>Chi^2 =0.007.



Graphic. 2. Distribution of mean by teaching method.

Discussion

The results that were obtained for learning of the nine groups of students who were studying the 4th year of the orthodontics course showed that when they use the stereoscopic 3D technique, they obtained better knowledge. However it is necessary to reinforce the same technique at the end of the course because this study was conducted at the beginning of the course of the 4th year and some students can forget the concepts, in this way they won't obtain the knowledge needed for a professional lifetime. In the literature we did not find authors that measured the knowledge acquired by using stereoscopic technology in 3D for teaching in dentistry. However B Schwartz, made a qualitative study in pre-doctoral students at the Schulich school of Dentistry using a questionnaire to ask the student his/her perspectives by using a strengths, weaknesses, opportunities and threats approach.[18]

Conclusions

Our findings suggest that the stereoscopic 3D method lead to improved student learning compared to traditional teaching.

The use of stereoscopic 3D as an educational support helps us reinforce the theoretical knowledge for the students that are exposed to different clinical problems present in patients; those can be projected via 3D. Thanks to these resources, they can later apply the theoretical knowledge more effectively when they are working in the clinic training with patients.

Clinical Training and learning in orthodontics becomes very difficult in larger groups, therefore it is not possible to standardize the knowledge as they depend in the anomaly presented on the patient for their learning.

However, with stereoscopic 3D, students can see all possible treatment options in different patients when they are in the 3D room as compared to the Clinical classroom. The stereoscopic 3D allows students to observe different treatments in a way closer to reality; it helps us to teach more students at the same time and in this way they can observe a greater number of treatments.

Finally, they will not depend on random requirements from a patient to patient basis to complete the course and they will get a more accurate and complete knowledge of the way a treatments may go.

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The Effect Of 3D Audio And Other Audio Techniques On Virtual Reality Experience

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Abstract. Three studies were conducted to examine the effect of audio on people's experience in a virtual world. The first study showed that people could distinguish between mono, stereo, Dolby surround and 3D audio of a wasp. The second study found significant effects for audio techniques on people's self-reported anxiety, presence, and spatial perception. The third study found that adding sound to a visual virtual world had a significant effect on people's experience (including heart rate), while it found no difference in experience between stereo and 3D audio.

Keywords. 3D audio, audio, presence, anxiety, spatial perception.

Introduction

A recent meta-analysis showed a positive association between self-reported level of presence and anxiety [6]. The ability to elicit anxiety is considered a key ingredient in the success of virtual reality exposure therapy in the treatment of anxiety disorders. This has motivated research into factors that influence presence such as individual characteristics [5], or technology factors such as stereoscopic viewing [3] or the field of view [4]. Relatively little is known about the impact different audio techniques have on people's feeling of presence in a virtual world. Several audio techniques exist, such as mono (1-channel), stereo (2-channels), Dolby surround (multiple-channels), and 3D audio (realistic audio representation). Unlike the other audio techniques, 3D audio provides information about the sound source location outside the observer's head on a horizontal and vertical plane and also information about the distance toward the sound source. For this it can use several elements, such as binaural cues, head-related transfer function (HRTF), head movement, and reverberation. 3D audio can be offered using speakers or a headphone. This paper examines the effect of different audio techniques on how people experience a virtual world that used sound, specifically a flying wasp.

1. ABX perceptual difference listening study

The first study tested whether people are able to hear the difference between 3D audio, Dolby surround, stereo and mono with headphones. This study was setup as an ABX discrimination test, which is a double blind method to compare two stimuli. Participants were presented with three audio fragments: A, B and X, whereby X could either be A or B which was randomly chosen. Participants were asked to determine whether audio fragment X was similar to fragment A or B. While listing they could

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directly switch between the 3 sound fragments. They were asked to do this four times for the six combinations of four audio techniques resulting in 24 trails for each participant. To control for potential order and learning effect the order of the trails was balanced following Balanced Latin square. The experiment was performed in an acoustically isolated room. Participants wear a Beyerdynamic DT 770 headphone (frequency response 5 – 35.000 Hz, 250 Ohms impedance, ambience noise reduction approximately 18dB(A)). A mono-recorded sound fragment of flying wasp[2] was placed in 3D world using the 3D audio tool SoundLocus. The 3D audio was created using HRTF, human hearing modeling, and a small Doppler effect. A 57 seconds sound fragment of a flying wasp was created with a constant movement path. Details of the 3 studies can be found in [2]. Twenty-two individuals (15 males, 7 females) with a mean age of 27.7 years (*SD* = 8.4) participated. None of the participants suffered from total deafness in one of their ears. Only one participant indicated to have hearing capacity of 5% in the left ear. All other participants indicated to have no hearing impairments. The university human research ethics committee approved all 3 studies.

1.1 Results

The comparison of two sound techniques were regarded as a Bernoulli trail, where a participant either matches a stimuli correct or incorrect with a 50% gamble chance. For each combination this resulted in 88 tests. For mono – stereo comparison 84 correct matches were made, for mono – Dolby surround comparison 86 correct matches were made, for all other comparisons all 88 matches were correct. All comparisons were significant ($p. < .001$) above mean gamble chance of 44 correct matches.

1.2 Conclusion

The nearly perfect matching found shows that participants were well able to hear a distinction between the four different audio techniques.

2. Sound experience study without visuals

As participants were able to distinguish between sounds produced by different techniques, the next question was whether the four audio techniques had a different impact on people's experience, i.e. level of anxiety, presence, and spatial perception. The same participants, equipment and stimuli material were used as in the previous study. In additions participants' heart rate was measured with a Mobi8 device from TMSi with a Xpod Oximeter. Participants wear a black eye-mask to blindfold them, and placed their head on a chin-rest to keep their head on a fixed position and orientation. Participants were exposed to the wasp sound fragment four times, each time using a different sound technique. Again the order in which conditions were presented was balanced following a Balanced Latin square. After each sound fragment participants were asked to rate their level of discomfort on the Subjective Units of Discomfort (SUD) [8] scale, their level of presence on the Igroup Presence Questionnaire (IPQ) [7], their fear of wasps on, for this study created, the Fear of Wasps Scale (FWS), and their spatial perception on the Spatial Perception

[2] Fragments from www.audiosparx.com/sa/summary/play.cfm/crumb.31/crumc.0/sound_iid.407163

Questionnaire (SPQ) [2]. SPQ was created for this study to measure perceptual strength of the spatial attribute in the perceived stimuli. SPQ includes 10 items related to localization, distance/depth, externalization, movement, sense of space, and quality. FWS is a single 10-point scale with the question: Do you have a fear of wasps? ranging from 0 (no fear at all) to 10 (very much). To establish a baseline heart rate measurement, participants had to sit in total silence for 5 minutes at the start of experiment, after which they were asked for a SUD score. Data of one participant was discarded because of an administrative error.

2.1 Results

A Friedman test on the mean IPQ score found a significant (^{2}(3) = 12.26, n = 22, p = .007) effect for the four audio techniques. Wilcoxon Signed-Rank Tests showed a significant higher level of presence for 3D audio (*Mdn* = 1.29) compared to (Z = 2.90, p. = .004) Dolby surround (*Mdn* = 0.71), and (Z = 3.51, p. < .001) mono (*Mdn* = -0.86) sound. Furthermore, significant higher level of presence was found for stereo (*Mdn* = 0.29) compared to (Z = 2.71, p. = .007) mono, and for Dolby surround compared to (Z = 2.67, p. = .008) mono.

A Friedman test found a significant (^{2}(3) = 19.75, n = 22, p < .001) effect for the audio techniques on SPQ score. Wilcoxon Signed-Rank Tests showed a significant higher spatial perception score for 3D audio (*Mdn* = 1.6) compared to (Z = 3.74, p. < .001) mono (*Mdn* = -0.9), and (Z = 2.11, p. = .035) Dolby surround (*Mdn* = 1). On the other hand, significant lower special perception score was given for mono compared to (Z = 3.27, p. = .001) stereo (*Mdn* = 1.3), and (Z = 2.67, p. = .007) Dolby surround.

A Friedman test found a significant effect (^{2}(4) = 31.44, n = 22, p < .001) for the four audio techniques and the baseline conditions in SUD scores. Wilcoxon Signed-Rank Tests showed a significant lower SUD score for baseline (*Mdn* = 1) compared to (Z = 2.91, p. = .004) mono (*Mdn* = 2), (Z = 3.18, p. = .001) stereo (*Mdn* = 3), (Z = 3.06, p. = .002) Dolby surround (*Mdn* = 3), and (Z = 3.75, p. < .001) 3D audio (*Mdn* = 4). Significant higher SUD score was also found for 3D audio compared to (Z = 3.09, p. = .002) Dolby surround, and (Z = 2.29, p. = .022) mono sound.

After visually inspecting the histogram of the FWS score, two groups were identified: a lower fear group with scores between 0 and 2 (n = 16) and a higher fear group with scores between 4 and 8 (n = 5). Mann-Whitney tests found significant difference between two groups on SUD score for (Z = 2.25, p. = .025) mono (Mdn_{lower} = 2, Mdn_{higher} = 5), (Z = 2.06, p. = .039) stereo (Mdn_{lower} = 2.5, Mdn_{higher} = 4), (Z = 2.22, p. = .027) Dolby surround (Mdn_{lower} = 2, Mdn_{higher} = 5), and (Z = 2.00, p. = .046) 3D audio (Mdn_{lower} = 3, Mdn_{higher} = 6) conditions.

A repeated measure ANOVA on heart rate found for the four audio techniques and the baseline conditions (taking only last 2 minutes) an effect (F(3, 60) = 2.41, p = .076) with a p-value that only approached the threshold level of .05.

2.2 Conclusion

Anxiety reported for the stimuli material seems related to people's fear for wasps as anxiety differences were found between the lower and higher wasp fear groups. Furthermore, significant variations found in the level of the presence, anxiety, and spatial perception, showed that the four audio techniques had different impact on how the participants experienced the sound fragment. Surprisingly, a significant lower level

for presence was found for Dolby headphones compared to stereo. This might be a consequence of the 5.1 channel Dolby Headphone algorithm used to simulate a sense of Dolby surround with headphones, instead of actually reconstructing it by using multiple loudspeakers.

3. Sound experience study with visuals

The last study tested whether the different sound techniques have a different impact on people's experience when sound is integrated into a visual virtual environment. The study included three conditions: no sound (only visual environment), stereo, and 3D audio. The visual environment consisted of a 3D wasp flying in an in-door town hall environment, which was taken from the Vizard tutorial on stereoscopic panoramas. The wasp flew and crawled for 51 seconds, following the same path in all three conditions. The pathway consisted out of the following four elements: 1) far away in front of the observer, 2) close in front of the observer landing near the left ear, 3) close in front of the observer landing near the right ear, and 4) wasp sitting and walking on the table. SoundLocus was used to create the sound for the wasp to match its visual fly path.
One member of the new group of 25 participants (9 female, 16 male), consisting of mainly students and university staff with average age of 28 years (SD = 8.2), reported to suffer from 30dB loss on both ears. Three other mentioned to have small hearing impairment. Participants wore the Beyerdaynamic DT 770 headphone, a Sony HMZ-T2 head mounted display, and Mobi8. Participants again placed their head on a chin-rest to keep their head on a fixed position and orientation. Also, head tracking was not supported. The order of the three conditions was again balanced using a Latin square. Before exposure to the town hall world, baseline SUD and heart rate measurement was collected in 3 minutes exposure in a neutral virtual reality environment of a waiting room [1]. After each exposure conditions participants completed IPQ, SPQ and SUD score. SUD scores were collected at the start and end of the exposure.

3.1 Results

A Friedman test on the mean IPQ score found a significant ($^2(2) = 24.15$, $n = 25$, $p < .001$) effect for the 3 audio conditions. Wilcoxon Signed-Rank Tests found a significant lower presence level for the no sound condition (Mdn = -0.29) compared to (Z = 3.54, $p.$ < .001) stereo (Mdn = 0.64), and the (Z = 3.79, $p.$ < .001) 3D audio condition (Mdn = 0.43).
A Friedman test found no significant effect ($^2(1) = 0.73$, $n = 25$, $p = .394$) between stereo and the 3D audio condition on the SPQ scores.
A Friedman test found a significant ($^2(2) = 12.22$, $n = 25$, $p = .002$) effect for 3 conditions on the increment SUD scores i.e. post – pre exposure SUD score. Wilcoxon Signed-Rank Tests found a lower increment SUD score for the no audio condition (Mdn = 0) compared to (Z = 2.68, $p.$ = .007) stereo (Mdn = 1) and (Z = 3.04, $p.$ = .002) 3D (Mdn = 1) condition. Splitting the participants group based on the median FWS score of 3, resulted in lower and higher fear for wasp group. Mann-Whitney tests found significant (Z = 1.99, $p.$ = .047) difference for two groups on increment SUD score only in the 3D audio (Mdn_{lower} = 0, Mdn_{higher} = 2) condition.
Heart rate of 5 participants were not recorded successfully. Furthermore, probably because of anticipation anxiety, the heart rate of one participant was considered an

extreme outlier (> 90 BMP) in the baseline measurement and first wasp exposure condition. This participant was therefore removed for heart rate analysis. A Friedman test found a significant ($^2(2) = 9.79$, $n = 19$, $p = .007$) effect for the 3 conditions on the heart rate. Wilcoxon Signed-Rank Test found a significant lower heart rate for the no audio ($Mdn = 70.41$) condition compared to ($Z = 2.58$, $p. = .010$) the stereo ($Mdn = 73.73$) and the ($Z = 2.01$, $p. = .044$) 3D audio ($Mdn = 71.15$) condition.

3.2 Conclusions

The significant variants found in the level of the self-reported presence, anxiety and heart rate between no audio and the audio conditions suggest that adding audio to a visual stimuli environment has added value. No significant difference was however found between the stereo and 3D audio condition.

Discussion and Conclusion

A number of conclusions can be drawn in the case of this wasp virtual world. First, sound on its own can elicit anxiety. Second, if only audio stimulus is provided, people's experience is affected by the type of audio technique. Third, adding sound to a visual environment can enhance the experience. Four, it seems unlikely that compared to stereo sound, 3D audio will add much to individuals' experience when exposed to either an audio only stimuli world, or an audio combined with visual stimuli world.

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The Role of Expectations in Game-Based Training

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Abstract. The present work seeks to examine the importance of expectancies in computer-mediated treatment and training programs. Two studies examining the role of patient and trainee expectations are presented. Study 1 investigated how expectations of a training game for military surgical teams influence training performance outcomes. The findings have implications for the administration of game-based treatment and training systems. Study 2 explored how pre-treatment expectancies influence post-treatment reactions to a game-based intervention for post-traumatic stress disorder (PTSD). Results indicate that self-efficacy plays a mediating role in the relationship between expectancies and reactions. Together, these studies offer implications regarding the critical role of attitudes towards game-based training and treatment mechanisms.

Keywords. Games for health, serious games, technology for therapy

1. Introduction

With the rise of serious games as instructional tools, researchers have begun to assess how to maximize their effectiveness within a variety of settings. Serious games afford players the opportunity to practice real-world situations in a safe, synthetic environment. Gameplay elements are likely to engage learners, leading to the development of cognitive maps, ultimately resulting in high levels of retention [1] and are thus a mechanism of knowledge acquisition, attitude change, and behavioral change. Despite their growing popularity, game-based training and therapy is still fairly novel, and research examining attitudes toward this approach is scarce.

Researchers of motivation and attitudinal change have demonstrated the importance of expectations and reactions. Not surprisingly, preconceptions of information technology intervention impact the user's acceptance the technology and willingness to even utilize it in the first place [2]. Likewise, reactions after interacting with technology have been shown to predict future usage [2, 3].

Research conducted within the training field has suggested a strong relationship between expectations a multitude of post-training outcomes, including reactions [4]. The implications of this notion are two-fold. Firstly, it would suggest that expectancies influence training performance outcomes. Secondly, it would suggest that attitudes remain fixed from pre- to post-training, despite the actual utility of the intervention. Research is needed to determine if these findings translate to the context of serious

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games, as a change in skill and/or behavior is the objective of game-based interventions. Therefore, the purpose of Study 1 is to determine if pre-training expectations predict training performance outcomes. The purpose of Study 2 is to examine how video game self-efficacy (VGSE) influences the relationship between expectancies and reactions.

2. Methods and Materials

Study 1

Participants initially completed a pre-training expectancies scale consisting of ten items. The participants then played a serious game designed to enhance communication skills within military surgical teams. After interacting with the game, participants completed two performance measures: a declarative knowledge test and a training transfer measure in which trainees had to respond to questions corresponding to multiple vignettes.

A total of 74 individuals at a large Southeastern conference were recruited to participate in this study. Of these, 73% were male, with an average age of 40.26 years (*SD*=12.68). The average expectancy score was 38.39 (*SD*=6.21) out of a possible 50 points. Participants scored an average of 3.55 (*SD*= 1.25) out of a possible 5 on the declarative knowledge test. Participants scored an average of 6.55 (*SD*=1.78) out of a possible 8 on the training transfer measure.

Study 2

Participants completed a demographic information survey, a modified version of the pre-training expectancies scale, and a VGSE. The participants then played "Walk in My Shoes", a serious game designed to familiarize military members with mental health resources and coping skills. After completing the intervention, participants immediately completed the technology acceptance model scale.

A total of 60 undergraduate students participated in this study in exchange for extra credit. Of these, 37% were male, 63% were female, and were on average 19.65 years old (*SD* = 2.86). VGSE scores were an average of 39.87 (*SD* = 10.02) out of 60 points, with higher scores indicating higher levels of self-efficacy. Participants had an average expectancy score of 37.37 (*SD* = 3.89) out of 50 points. Finally, reactions quantified by the Technology Acceptance Model Scale were an average of 57.56 (*SD* = 8.54) out of 80 points.

3. Results

Study 1

A linear regression established that expectations significantly predicted performance b= .31, $t_{(72)}$= 2.75, p=.008 as measured by a declarative knowledge post-test. Additionally,

expectations explained a significant proportion of variance in declarative knowledge scores, R^2= .10 ($F_{(1,72)}$= 7.57, p=.008).

Expectancies significantly predicted the degree of training transfer b=.41, $t_{(72)}$= 3.77, p=.000. Expectations also explained a significant proportion of variance in training transfer, R^2= .16, ($F_{(1, 72)}$= 14.17, p=.000.

Study 2

The regression-based approach to mediation developed by Baron and Kenny [5] was used to test the mediating role of VGSE in the relationship between pre-training expectancies and post-training reactions.

The first linear regression suggested that expectations significantly predicted post-training reactions, b=.39, $t_{(58)}$= 3.29, p= .000, and also accounted for significant amount of variance in reactions, R^2= .15 ($F_{(1,58)}$= 10.83, p=.002).

The second regression analysis demonstrated that expectancies predicted VGSE, b= .38, $t_{(58)}$= 3.21, p= .002, and also accounted for a significant proportion of variance in VGSE scores, R^2= .15 ($F_{(1,58)}$= 10.33, p=.002).

At step one of the last regression, reactions were regressed onto VGSE. VGSE accounted for a significant amount of variance in post-training reaction scores, R^2= .23, ($F_{(1,58)}$= 17.09, p=.000). At step two of the last equation, expectancies still significantly predicted reactions when controlling for VGSE, b= .25, t= 2.04, p= .046, indicating a partial rather than a complete mediation.

4. Discussion

Trainee expectations have been found to play a critical role in training outcomes such as motivation, commitment, and reactions. An earlier study [4] found several training outcomes (e.g. commitment, self-efficacy) to be related to the development of such post-training attitudes. Thus, in Study 1we set out to explore how attitudes towards the training (i.e. expectancies) influenced training performance. Indeed, expectations predicted training performance in terms of both declarative knowledge and the ability to transfer this knowledge and apply it to a novel situation. In other words, those who had more favorable expectations prior to beginning the training scored higher on both performance measures. This finding has implications for the administration of game-based training. In particular, training can invoke positive or negative perceptions. These attitudes will follow the trainee into the workplace, and those attitudes will subsequently impact their work performance. Thus, expectations of trainees should be met, if not exceeded, in order to maximize training effectiveness. Given the critical role that expectations appear to play in training effectiveness, future research should examine ways that organizations can frame trainee expectations.

The mediating role of VGSE in the expectancy-reaction relationship has implications for game-based therapies. Since self-efficacy impacts post-training reactions and reactions influence training performance (i.e. effectiveness) then it is reasonable to expect that individuals high on VGSE will reap greater benefits from game-based interventions than those who are not. However, unlike personality traits which are relatively stable over time, self-efficacy is malleable and can be increased [6]. Bandura has noted several ways in which self-efficacy can be strengthened. In particular, enactive mastery, vicarious learning and even verbal persuasion have been

shown to increase self-efficacy [6]. Therefore, serious game designers should take care to implement a reward system for meeting goals throughout the virtual therapy session. Moreover, these games should be made as engaging and user-friendly as possible, in order to create an enjoyable experience for the learner. Finally, clinicians should demonstrate how to play the game, and use simple verbal persuasion to foster positive expectations. Given the malleability of self-efficacy, game-based therapies have the potential to be widely accepted, despite initial skepticism or resistance. Thus, future research should explore the most efficacious approaches to manipulating self-efficacy levels within a clinical setting.

Taken together, our studies emphasize the crucial role of expectations within a variety of game-based interventions. Although often overlooked, we demonstrate that patient and trainee expectations should be taken into consideration in order to optimize attitudes towards and effectiveness of virtual interventions.

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Decision Making and Cognitive Behavioral Flexibility in a OCD Sample: a Study in a Virtual Environment

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Abstract. Neuropsychological disorders are common in Obsessive-Compulsive Disorder (OCD) patients. Executive functions, verbal fluency and verbal memory, shifting attention from one aspect of stimuli to others, mental flexibility, engaging in executive planning and decision making, are the most involved cognitive domains. We focus on two aspects of neuropsychological function: decision making and cognitive behavioral flexibility, assessed through a virtual version of the Multiple Errand Test (V-MET), developed using the NeuroVR software.
Thirty OCD patients were compared with thirty matched control subjects. The results showed the presence of difficulties in OCD patients with tasks where the goal is not clear, the information is incomplete or the parameters are ill-defined.

Keywords. Obsessive-Compulsive Disorder, decision making, cognitive behavioral flexibility, Virtual Multiple Errands Test, neuropsychological assessment

Introduction

Obsessive-Compulsive Disorder (OCD) is a psychiatric disorder involving distressing intrusive thoughts and related compulsive behaviours [1]. Neuropsychological studies have also shown that patients with OCD show deficits in cognitive abilities that are strictly linked to the functioning of the frontal lobe and its related fronto-subcortical structures, such as executive functioning deficits and insufficient cognitive-behavioral flexibility [2]. Individuals with OCD have been observed to experience difficulties in shifting attention from one aspect of stimuli to others, engaging in executive planning [3]. A relevant cognitive skill linked to the executive functions is decision-making. It is a cognitive mechanism that can be related to different executive processes and involves the ability to evaluate environmental information of various options that ensures actions are taken in the light of positives and negatives of each option. The effectiveness of decision-making requires some degree of predicting outcome certainty

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of each option in relation to particular situations. Decision making appears to be dysfunctional in the OCD, in the context of doubting and uncertainty as well as in dual and sequencing tasks.

The role of uncertainty in decision-making has yet to be fully investigated systematically in OCD [4]. However, clinical decision-making performance reveals that OCD participants request more information about, and spend more time deliberating over low-risk scenarios and OCD-relevant decisions compared to non-anxious controls [5]. OCD patients seem to require more information before making a decision and excessive worry and doubt, core features of OCD, could mediate difficulties in decisions-making [5].

The present study is aimed to explore and assess the decision-making and the mental and behavioral flexibility in OCD patients trough complex tasks of virtual version (VR) of the Multiple Errands Test (MET) [6, 7, 8] developed based on the NeuroVR software. The virtual environment is a supermarket, performed in a shopping setting and involves the completion of various tasks of different complexity levels (e.g. buy a sponge or two products from the refrigerated products aisle as going to the beverage aisle and asking about). To complete the task, participants must follow several rules: "*you are not allowed to enter any aisle unless it is a part of a task, you are not allowed to go into the same aisle more than once, you are not allowed to buy more than two items for item category*". The time is stopped when the participant says: "*I finished*". After the tasks and the rules have been explained, patients are able to plan and choose the sequence of actions needed to complete the tasks. In this way, many different executive functions are stimulated: ability to plan a sequence of actions, problem solving and cognitive and behavioral flexibility.

Based on this, the virtual version of the Multiple Errands Test (VMET) has been recently developed and tested in different clinical populations [9, 10, 11].

Methods

Participants

We evaluated 30 OCD patients (M=15, F=15; mean age=33,07 years, std.dev.= 9,906) and 30 healthy controls (M=16, F=14; mean age=34,00 years, std.dev.=10,841) with no history of psychiatric disorder. Patients, selected from the Outpatient Unit of Psychiatry of Palermo University Hospital, were excluded from the study if they had a severe cognitive impairment (MMSE<19), a severe motor impairment which did not allow subjects to perform the procedure, auditory language comprehension difficulties (Token Test<26,5), object recognition impairments (Street Completion Test<2,25), excessive state and trait anxiety (STAI>40) and excessive depression state (Beck Depression Inventory>16).

Instrument and procedure

Decision making and cognitive behavioral flexibility were assessed by a 1) validated classic neuropsychological battery and by 2) Virtual Multiple Errands Test (V-MET), with uncertain goal, lacking information and undefined parameters.

The neuropsychological battery including: Trail Making Test (TMT, Forms A, B and B-A) to assess selective attention and task switching; Frontal Assessment Battery (FAB) to assess executive functions including ability to initiate and stop actions, to monitor and change behavior as needed, and to plan future behavior when faced with novel tasks and situations. Executive functions allow to anticipate outcomes and adapt to changing situations. Furthermore, to evaluate multi-tasking and cognitive flexibility, Phonological verbal fluency and Semantic verbal fluency were employed. Second assessment stimulates many different executive functions such as planning a sequence of actions, problem solving and cognitive and behavioral flexibility.

Results and conclusions

One-way analyses of variance (AnOVAs) were used to compare patients and controls performance.
Results showed a statistical significant difference between two groups. Both evaluation revealed a significantly poorer performance of OCD patients.
Regarding the neuropsychological evaluation, OCD patients show deficits in the attention function TMT A (F= 10,806, p= .002) and in task switching TMT A-B (F= 6,004, p= .018); difficulties in executive function, FAB (F= 13,857, p= .001) and in mental flexibility, Phonemic Fluencies (F= 11,212, p= .002), Semantic Fluencies (F= 18,288, p= .000).
In order to investigate differences in VMET, analyzed variables were the execution time for the entire task; the errors in executing the tasks; partial tasks failures, inefficiencies. Specific items of task failures regarding divided attention, self-correction, and no evidence of perseveration. After virtual reality assessment the clinical sample show a performance significantly lower (table 1).
First of all, in regard the time used by participant to complete the task, analysis showed significant differences between groups and indicated that the healthy control group took significantly less time compared with OCD patients (F=4,069, p= 0,040). Indeed the execution time for the whole task was higher in patients with OCD compared to controls, suggesting that patients with OCD need more time in planning than controls.
Concerning the task failure, results showed significant differences between groups, too. Patients showed errors in tasks requiring a change in the primary goal and the ability to respond simultaneously to multiple task demands (sub-tests 6, buying two products from the refrigerated products aisle), (sub-tests 7, going to the beverage aisle and asking about what to buy). Regarding inefficiencies (less capacity of planning) and errors of perseveration (persevering in errors is a clear sign of reduced flexibility) data revealed significant differences between groups. Patients showed poorer ability in using effective strategies that facilitate the carrying out of the tasks; for example, accurate planning before starting a specific subtask or using the map to move into the virtual supermarket. These executive deficits may reflect a specific deficit in cognitive flexibility; namely, ability to change selectively to effectively respond to external/internal stimulation. More, scores for divided attention are lower in controls (lower is the score, better is the performance).
On the basis of these results OCD patients showed difficulties in mental flexibility and in the task requiring divided attention. Consequently, patients are not able to recognize their own errors and autocorrect (reduced cognitive flexibility typical in OCD patients), modifying their behavior and their strategies based on the goal to reach. In conclusion,

Table 1. Virtual reality assessment

	OCD patients	Healthy control	
	Mean ± SD	*Mean ± SD*	*ANOVAs*
Time	10,77 ± 5,345	8,230 ± 4,284	F= 4,069, p= 0,040*
Sub test 6 *Buy two products from the refrigerated products*	9,66 ± 1,951	8,27 ± ,691	F= 13,457, p= 0,001†
Sub test 7 *Go to the beverage aisle and ask what to buy*	10,52 ± 2,181	8,77 ± 1,431	F= 13,373, p= 0,001†
Inefficiencies range: 8 (great ineff.) to 32 (no ineff.)	22,55 ± 4,733	25,57 ± 4,415	F= 6,407, p= 0,014*
Divided attention range: 7 (no errors) to 14 (great errors)	10,448 ± 2,667	8,333 ± 1,647	F= 13,531, p= 0,001†
Self-correction range: 7 (no errors) to 14 (great errors)	9,241 ± 1,902	7,833 ± ,833	F= 13,718, p= 0,000†
No perseveration range: 7 (no errors) to 14 (great errors)	8,724 ± 1,830	7,733 ± ,944	F= 6,896, p= 0,011*

†. Correlation is significant at the 0.01 level (2-tailed).*. Correlation is significant at the 0.05 level (2-tailed)

our results showed that VMET appears sensitive to evaluate the functional status of OCD with normal cognition, as manifested in terms of executive deficits. In particular, VMET allows the possibility to evaluate some subcomponents of executive functions in ecological settings, giving an accurate analysis of patients' deficits as well as traditional tests. Our data, confirming previous study, provide support for the feasibility of using the Virtual Multiple Errands Test (VMET) as an assessment tool of executive functions.

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Measuring Co-Presence and Social Presence in Virtual Environments – Psychometric Construction of a German Scale for a Fear of Public Speaking Scenario

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Abstract. Virtual reality exposure therapy (VRET) applications use high levels of fidelity in order to produce high levels of presence and thereby elicit an emotional response for the user (like fear for phobia treatment). State of research shows mixed results for the correlation between anxiety and presence in virtual reality exposure, with differing results depending on specific anxiety disorders. A positive correlation for anxiety and presence for social anxiety disorder is not proven up to now. One reason might be that plausibility of the simulation, namely including key triggers for social anxiety (for example verbal and non-verbal behavior of virtual agents that reflects potentially negative human evaluation) might not be acknowledged in current presence questionnaires. A German scale for measuring co-presence and social presence for virtual reality (VR) fear of public speaking scenarios was developed based on a translation and adaption of existing co-presence and social presence questionnaires. A sample of N = 151 students rated co-presence and social presence after using a fear of public speaking application. Four correlated factors were derived by item- and principle axis factor analysis (Promax rotation), representing the presenter's reaction to virtual agents, the reactions of the virtual agents as perceived by the presenter, impression of interaction possibilities, and (co-)presence of other people in the virtual environment. The scale developed can be used as a starting point for future research and test construction for VR applications with a social context.

Keywords. Co-presence, social presence, social anxiety, virtual environments, psychometrics

Introduction

Virtual Reality Exposure Therapy (VRET) has been proven to be a successful means and a promising supplement for conventional interventions like cognitive behavioral therapy [1]. Applications for anxiety disorder treatment often use high levels of fidelity with the goal of producing a realistic experience for the user, thereby creating high levels of presence [2]. Researchers state that presence has a key role in VRET for anxiety disorders [1]. It is assumed that presence leads to the experience of fear and

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anxiety as emotional states in virtual environments [1, 3]. These states have to be induced in order for the clients to confront them and train certain skills to overcome their fear [4]. However, state of research shows mixed results for a correlation between anxiety and presence. Maybe key triggers for social anxiety - verbal and non-verbal behavior that reflects potentially negative human evaluation – might not be acknowledged in current presence questionnaires [3]. The paper presented deals with the psychometric development of a German scale measuring co-presence and social presence for a fear of public speaking scenario, intending to do a first step in order to close this research gap.

Related Work and Rationale

Presence can be described as a user's subjective psychological response to a VR system or the sense of "being there" [5]. Virtual presence is well researched, which has led to many proposed measures (especially self-report questionnaires; for an overview see [6]). However, a meta-analysis [3] found a medium correlation between presence and anxiety, but the effect size differed strongly across anxiety disorders, with a null-effect for social anxiety. Ling et al. [3] argue that "one might conclude that subjective presence measures do not capture the essential sense of presence that is responsible for activating fear related to social anxiety in individuals." (p. 8f.), as most presence questionnaires focus on virtual presence or place illusion [7]. According to Slater [7], another presence component has to be taken into account: plausibility refers to the impression that what happens in the virtual world really happens - in spite of the knowledge that it is mediated by technology [3]. In the case of social anxiety, a simulation should include virtual human behavior actions that can be used as indicators for positive or negative human evaluation. Recent developments include more or less realistic virtual human behavior actions (for fear of public speaking see for example [8]), and the state of research underlines the effectiveness of VRET and training applications for fear of public speaking treatment [9, 10]. In order to capture related presence experiences in this social context, researchers recognize two additional types of presence: co-presence and social presence [6] that are seen as interrelated [11].

According to Youngblut [6], co-presence is defined as "[…] the subjective experience of being together with others in a computer-generated environment, even when participants are physically situated in different sites." (p. 4). The "others" named in the definition don't have to be human beings but may also be computer-generated agents [6]. Social presence goes a step further than co-presence to address the social psychological idea of personal interaction. Youngblut defines social presence following Biocca's suggestion [12] as follows: "Social presence occurs when users feel that a form, behavior, or sensory experience indicates the presence of another individual. The amount of social presence is the degree to which a user feels access to the intelligence, intentions, and sensory impressions of another". Following Biocca, Harms, and Gregg [13], social presence is a multidimensional construct in itself, comprising perception of co-presence, psychological involvement, and behavioral engagement.

In the following sections, a psychometric questionnaire construction for co-presence and social presence for a virtual fear of public speaking scenario is presented.

Method

Items from the Networked Minds Measure of Social Presence [13], GlobalED Questionnaire [14], Para-Social Presence Questionnaire [15], as well as items from related work [11, 16–19] measuring co-presence and social presence were translated into German and adapted to a fear of public speaking scenario. The questionnaire draft focused on audience behavior cues, the speakers perception of the audience, and perceived speaker-audience interaction possibilities. A student sample (N = 151) used a virtual training application for fear of public speaking by giving a presentation in front of a virtual audience and was then asked to rate co-presence and social presence by means of a 28-item questionnaire. The subscales were derived by item- and principal axis factor analysis (PFA) with Promax rotation **(** = 4). Fourteen items were deleted due to cross-loadings and theoretical plausibility, another item was deleted during the item analysis due to corrected item-total correlation < .30.

Results

Four correlated factors (r > .08) were derived in accordance to the eigenvalue criterion > 1, explaining a total of 55.55 % of variance (see Table 1). Factor loadings for the four resulting subscales and their respective items are illustrated in Table 2.

Table 1. Eigenvalues, Percentages of Variance, and Cumulative Percentages for PFA Promax Four-Factor Solution for Co-Presence and Social Presence (KMO = .75).

Factor	Eigenvalue	% of variance	Cumulative %
1. Presenter's Reaction to Virtual Agents	3.68	24.53	24.53
2. Perceived Virtual Agents' Reaction	2.25	15.01	39.54
3. Impression of Interaction Possibilities	1.26	8.40	47.94
4. (Co-)Presence of other people	1.14	7.61	55.55

The first factor can be summarized as the presenter's reaction to the virtual agents, measuring behavioral engagement (that the audience's behavior influenced the speaker's style of presentation), the speaker's psychological involvement, including emotional (mood) as well as cognitive responses (distraction).

The next factor measured the virtual agents' reactions to the speaker, or rather as they are interpreted by the speaker. Again, behavioral engagement (the audience is perceived as being influenced by the speaker's actions) and psychological involvement (the audience is influenced by the speaker's mood) load on this factor. It has to be noted though, that some of the items loading on this factor are mirror items for factor 1: addressing the same aspects of social presence, but the speaker attributes psychological and behavioral involvement to the virtual agents.

The third factor addresses what social presence distinguishes from co-presence, the perception of interaction possibilities that go beyond the mere acknowledgement of other people's presence in a virtual environment. The factor addresses that the speaker

is perceived by the audience, as well as feelings of connectedness, and potential interaction.

The last factor corresponds to the definition of co-presence given above: the feeling that other human beings share the same virtual space, with a negative item of feeling alone in the environment.

All items showed sufficient corrected item-total correlations > .41 for their respective scales, with a decrease of Cronbach's alpha if items would have been excluded.

Table 2. Factor Loadings for PFA Promax Four-Factor Solution for Co-Presence and Social Presence Scales (Items translated into English)

Item	Factor Loading
Factor 1: Presenter's Reaction to Virtual Agents (= .85; n = 141)	
The people's behavior influenced my style of presentation.	.869
The people's behavior had an influence on my mood.	.799
I reacted to the people's behavior.	.729
I was easily distracted by the people.	.628
Factor 2: Perceived Virtual Agents' Reaction (= .81; n = 82)	
Sometimes the people were influenced by my mood.	.875
Sometimes the people were influenced by my style of presentation.	.821
The people reacted to my actions.	.734
I was able to interpret the people's reactions.	.500
Factor 3: Impression of Interaction Possibilities (= .80; n = 139)	
I had the feeling to interact with other human beings.	.796
I felt connected to the other people.	.762
I had the feeling that I was able to interact with people in the virtual room.	.753
I had the impression that the audience noticed me in the virtual room.	.625
Factor 4: (Co-)Presence of other people (= .71; n = 140)	
I was aware that other people were with me in the virtual room.	.699
I had the feeling that I perceived other people in the virtual room.	.680
I felt alone in the virtual environment.	.543

Note: N = 75 (due to listwise case exclusion) and = .77 for entire measure.

Factor 1 to 3 showed sufficient reliability with Cronbach's > 80. This criterion was not met by the fourth factor (Presence of other people), showing Cronbach's = .71, probably due to the low item number. However, the other dimensions of social presence (psychological involvement and behavioral engagement) as postulated by Biocca et al. [13], are also presented in the factor structure. Therefore, co-presence was included nevertheless, forming a basis for further item development and future scale construction.

Discussion

A German scale measuring co-presence and social presence for fear of public speaking scenarios was developed based on items of existing questionnaires and items from the state of research. Four correlated subscales were derived, measuring the presenter's

reaction to virtual agents, perceived virtual agents' reaction to the presenter, impression of interaction possibilities, and presence of other people in the virtual space (co- presence). However, the work presented has several limitations. A student sample rated co-presence and social presence with a German questionnaire. Further, the questionnaire was used to evaluate an alpha-version prototype of a fear of public speaking application including an audience of 30 people. Different settings (raters, VR applications and cultural background and questionnaire language) as well as a more advanced prototype may lead to different ratings. Future research should replicate and supplement our test construction findings for different settings. Still, the study can serve as a starting point for future research and on-going test construction, helping to analyze the interrelations between social anxiety and presence in more detail.

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Being Present In Space: The Role Of Allocentric And Egocentric Reference Frames

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Abstract. The general aim of the present study was to investigate the effect of an interactive aerial view of the experienced environment during the encoding and retrieving of spatial information on the feeling of presence. Our findings showed that this real-time interactive aerial view (both small and large) during the encoding and retrieval of spatial information seems to led to a greater sense of presence. It is argued that the use of this aerial view, which provides a real-time allocentric viewpoint-dependent spatial representation, would ease the translation of a stored allocentric representation into an egocentric one, and this process, consequently, would help individuals to feel present in space.

Keywords. Presence, Allocentric Reference Frame, Egocentric Reference Frame, Virtual Reality

1. Introduction

Far from being only a technological issue, in recent years the concept of presence has emerged as an interesting topic in different research fields, from psychology to neuroscience. Within this perspective, presence is a broad psychological phenomena not necessarily linked to the experience of a technology: An individual is present in a space –real or virtual– when he/she can successfully act in and perform according to his/her intentions [1]. Therefore, the experience of presence is strictly related to a spatial one; however, the relationship between presence and space is seldom investigated in the scientific literature. First, it is crucial to understand how we organize spatial information to build a cognitive model of our environment. The starting point requires considering the distinction between two reference frames used to organize spatial information, egocentric and allocentric [2]. An egocentric reference frame represents subject-to-object relationships, while an allocentric reference frame constitutes object-to-object relations, which are unrelated to an individual's orientation. From a neuroscience perspective, Burgess and colleagues provided an interesting

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framework to explain how the continuous interaction between these crucial spatial relationships allows individuals to navigate the surrounding environment effectively and locate themselves in space [3, 4]. When prompted by a retrieval cue, the individual can retrieve the full representation of an experienced spatial environment from long-term memory through the process of pattern completion. This allocentric spatial representation is translated into an egocentric representation in the medial parietal areas using contributions from other cells. Starting with Burgess and colleagues' model, Serino and Riva [5, 6] proposed that it may be critically important to include another neurocognitive process (namely, the *mental frame syncing*) in spatial processing to consider the role of the alignment of viewpoints. When we orient ourselves in an environment or when we retrieve the position of an object in a scene, we must first encode and memorize an abstract structure of the spatial scene, including all relevant landmarks and their reciprocal relationships (namely, an allocentric viewpoint-independent representation). Second, we must impose a specific viewpoint on this abstract allocentric scene (namely, an allocentric viewpoint-dependent representation) to ease its translation into an egocentric representation. The general aim of the present study was to investigate the effect of an interactive aerial view of the experienced environment during encoding and retrieving of spatial information on the feeling of presence. It was hypothesized that this aerial view, which provides a real-time allocentric viewpoint-dependent representation, would ease the translation of a stored allocentric representation into an egocentric one, and this process, consequently, would help individuals feel present in space. To achieve this aim, spatial layouts were encoded and retrieved in a Cave Automatic Virtual Environment (CAVE) because this setup provided the possibility to introduce an interactive aerial view of the experienced environment, in immersive conditions.

2. Material & Methods

A total of 30 participants (15 females and 15 males) from the Institute of Movement Sciences Etienne-Jules Marey (Marseilles, France) participated in the study. Participant mean age was 29.03 years (SD = 8.90). A virtual city was developed as the test environment. At the start of the experimental session, participants were placed in the centre of the computer-assisted virtual environment (CAVE) display of four projection screens: frontal, ground, and lateral projections. Each frontal and lateral screen had a projection surface of 3 meters wide by 4 meters high. The three vertical walls were back-projected, and the ground received direct projection with a 1400 x 1050 resolution and a 60 Hz frame rate. Starting from the centre of the city, participants were required to find a plant that was hidden in the city (encoding phase). The first group of participants navigated in the virtual city within an egocentric frame. For the second group, an interactive small aerial view of the virtual city was always available within the field of view. Finally, the third group of participants had a larger interactive aerial view of the virtual city within the field of view.

In the second phase, named the "retrieval phase," all participants were invited to retrieve the position of the plant they had discovered in the three different conditions beginning from a different starting point: with an egocentric frame, with the small aerial view, and with the large aerial view (see Figure 1). Three retrieval sessions were thus performed by each subject.

Figure 1: In the retrieval phase, participants were asked to retrieve the position of the hidden plant in three different conditions: 1) Retrieval without the interactive aerial view; 2) Retrieval with the small interactive aerial view; 3) Retrieval with the large interactive aerial view

The order of conditions was randomized for each participant. After each condition, the Igroup Presence Questionnaire (IPQ) [7] was administered to measure the feeling of presence experienced during encoding and the retrieving of spatial information. The IPQ consists of 14 items rated on a 7-point Likert scale with three sub-scales: spatial presence (i.e., the sense of being in the virtual environment), involvement (i.e., attention devoted to the real and the virtual environment), and realness (i.e., reality judgment about the virtual environment).

3. Results

To investigate differences in the feeling of presence between groups (i.e., Group 1: egocentric encoding; Group 2: encoding with a small interactive aerial view; Group 3: encoding with a large interactive), three analyses of variance were conducted on the three subscales of the IPQ (i.e., spatial presence, involvement, and realness). LSD post-hoc were used to compare significant differences between groups. Results were summarized in Table 1.

Encoding Phase	Group 1	Group 2	Group 3	F	*p*	η_p^2	G1 vs. G2	G1 vs. G3	G2 vs. G3
Spatial presence	0.80 (0.88)	1.75 (0.53)	1.64 (0.92)	4.00	*	.235	*	*	N.S
Involvement	0.14 (0.72)	1.10 (1.21)	0.75 (0.90)	2.33	N.S	.152	N.S	N.S.	N.S
Realness	-0.97 (0.72)	0.22 (0.80)	0.10 (0.69)	7.29	**	.359	**	**	N.S

Table 1: Differences between the three subscales of the IPQ (i.e., spatial presence, involvement, and realness) after the encoding phase.

Then, three repeated measures analyses of variance were conducted to investigate differences in spatial presence, involvement and realness with Retrieval (i.e. "egocentric frame" vs. "small interactive aerial view" vs. "large interactive aerial view") as within variable and groups as between variable.
Findings [$F(2,27) = 3.15$; $p = 0.59$, $\eta 2 = .189$] revealed a differences in the experience of spatial presence between the groups in favor of the role of the small [1.66 (0.25)] and large interactive aerial views [1.78(0.25)] when compared to the condition "egocentric frame" [0.97 (0.25)], although it was not statistically significant .
Concerning realness, the analysis yielded a main effect for group [$F(2,27) = 6.06$; $p < 0.05$, $\eta 2 = .310$]. Post-hoc comparisons demonstrated that participants with the small [0.46 (0.29)] and large interactive aerial views [-0.25 (0.29)] experienced significantly more realism when compared to the first group [-0.95 (0.29)]. Moreover, it was noted a main effect of Retrieval $F(2,27) = 7.99$; $p < 0.001$, $\eta 2 = .228$]. Simple contrasts indicated that participants experienced significantly more realness when had the possibility to visualize a small interactive aerial view [0.01 (0.17)] in respect to the larger one [$F(2,27) = 13.67$; $p < .001$, $\eta 2 = .336$; -0.30 (0.18)]. Finally, as concerns involvement, findings showed no main effect of groups, but a significant differences within the retrieval conditions [$F(2,27) = 3.79$; $p < .05$, $\eta 2 = .123$]. Simple contrasts indicated that participants experienced significantly more involvement in the third retrieval condition [0.56 (0.21)] when compared to the first retrieval condition [$F(2,27) = 4.59$; $p < .05$, $\eta 2 = .145$; 0.95 (0.14)] and to the second retrieval condition $F(2,27) = 6.14$; $p < .05$, $\eta 2 = .185$; 0.92 (0.18)]

4. Discussion

To the best of our knowledge, our experimental study was the first attempt to investigate the role of a real-time presentation of allocentric viewpoint-dependent representations on the feeling of presence. Our findings showed that a real-time allocentric viewpoint-dependent representation (both small and large) during the encoding and retrieval of spatial information seems to lead to a greater sense of presence. Specifically, as concerns the encoding phase, our data indicated that the presence of an additional navigational aid conveying viewpoint-dependent information seems to enhance the sense of spatial presence and the judgment about the realness of the experienced virtual environments. During the retrieval phase, our findings showed that the presence of this kind of information influences specifically the involvement and the realness perceived during the virtual navigation. As concerns the difference between the sizes of the "map", only one difference was found: participants judged more similar to the real world (i.e. realness) the presence of a "small" interactive aerial view during the virtual experience. Taken together, these data, although preliminary, suggest that a real-time allocentric viewpoint-dependent representation may lead to more effective organization of spatial information and [8], consequently, may help individuals feel present in the experienced space.

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Combining Face-to-face Therapy with Computerized Techniques: A therapists' Attitudes Survey

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Abstract. Therapists' attitudes towards the use of computerized therapies have been the focus of numerous studies. Nevertheless, little is known about therapists' perception of a combined model that uses computerized methods as adjuncts to face-to-face (FTF) therapy. Current study surveyed 87 Israeli therapists' attitudes towards such combined model. Results show that more than half of therapists find it as potentially more effective than regular therapy, better for providing feedback and maintaining continuity of care. More than a third of the therapists found it may elicit better patient satisfaction and engagement. With respect to different modalities, therapists indicated that e-mail correspondence are better suited for combining with FTF treatments. Theoretical orientation had little effect on practitioners' attitudes. Finally, more than half of the therapists showed willingness to undergo training for a combined model. Compared to previously researched computerized interventions, current study indicates more positive attitudes and acceptability among therapists towards an integrative model.

Keywords. Computerized therapy, Self-help application, Cyber therapy

1. Introduction

1.1 Combining FTF therapy and computerized techniques

Integrating computerized techniques within face-to-face (FTF) therapies has been examined in numerous studies [1-3]. Castelnuovo and colleagues [2] viewed the incorporation of technology as a mean to enhance traditional therapy by offering new communication opportunities and better assessment and feedback options. A combined therapy that uses technology as an adjunct along with traditional therapy offer several advantages compared to therapies that use technology as a replacement to FTF therapy such as being more effective [3], with better patient engagement [4] and better adherence [1,5]. The combined model does not require extreme modifications to the existing practices since clinicians merely add a set of tools to an already working FTF

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model. In light of this, it should be better accepted and less threatening to therapists than computerized therapy with no FTF contact.

1.2 Therapists' attitudes

Although many studies examined therapists' attitudes towards computerized therapies, most of them either asked about therapies with no FTF sessions, or did not refer specifically to a combination of FTF and computerized techniques [6-10].

Generally, therapists have shown moderate levels of endorsement and acceptability of computerized therapies [6,11-13], with more positive attitudes among cognitive-behavioral (CBT) therapists [7,14] and among therapists who have already experienced in computerized therapies [8,9]. Though surveys indicate a preference to use computerized techniques as adjuncts to FTF therapy [6,11,15], therapists' perception of combined therapies, especially compared to traditional FTF therapies, remain unclear.

1.3 Current study

In this study we referred to combined therapy as any traditional FTF therapy that incorporates technology (e.g. e-mail, chat, video conversations or self-help applications).

Building on previous studies, which examined attitudes towards computerized therapies [6-12], this descriptive study surveyed therapists' attitudes towards the combined therapy idea. We examined therapists' willingness to use a combined model across various contexts and for different mental disorders. We were also interested in whether attitudes towards such therapy would be related to different demographic variables such as age and theoretical stance. Finally, we considered which technological modalities would be more accepted in combination with traditional therapies.

2. Method

2.1 Participants

Participants were 87 (58 women, 29 men) trained Israeli therapists chosen through convenience sampling. Ages ranged from 24 to 70 (M=41, SD=11.7). We approached therapists from public and private practices and sent them either paper copies of the survey or a link to a web-based survey (other demographic variables are shown in Table 1). Current research was approved by the Bar-Ilan University ethics committee. All participants signed/ checked a box, stating they read and agreed to the informed consent form, and received the researchers' contact information. Surveys were anonymous.

2.2 2 Measures

All participants read a short paragraph describing how technology may be used in psychotherapy as an adjunct to traditional FTF sessions.

Combined therapy vs. regular FTF therapy: Participants were asked to compare between a regular FTF therapy and a regular therapy that incorporates computerized tools. Therapists indicated whether the combined therapy was worse, the same or better than regular therapy at different measures such as effectiveness, therapeutic alliance and satisfaction (for full list see table 2).

Willingness to use a combined therapy: Participants were asked to rate (on a 1-5 Likert scale) their willingness to combine computerized tools with their FTF therapeutic work in various contexts: Psycho-education, relapse prevention, mild/ moderate symptoms, monitoring and feedback. Therapists were then asked to address separately to Email, Chat conversation, Video conversation and Self-help internet application. For each modality, participants rated their willingness to use it as an adjunct along with FTF therapy. Therapists were also asked to indicate their willingness to undergo training on how to use and integrate computerized tools into FTF therapy.

Table 1. Participants' descriptive statistics.

Variable *(N=87)*	Descriptive statistics
Degree	
Masters	77
PhD	10
Training	
Clinical social worker	12
Clinical psychologist	41
Neuropsychologist	5
Educational psychologist	19
Medical psychologist	1
Psychotherapist	9
Therapeutic Orientation	
Psychoanalytic	1
Psychodynamic	45
Cognitive Behavioral	36
Family	2
Humanistic	3

3. Results

Most therapists (56.5%) found the combined therapy to be potentially more effective than FTF therapy while only 10% stated it would be less effective. Therapists also agreed that the combined therapy would be better at maintaining continuity of care (65.5%) and monitoring and providing feedback (80.5%). Most therapists stated it has

the potential to elicit equal (49.5%) or better (37.0%) client satisfaction. Most therapists agreed a combined therapy is not more harmful to the patient than regular FTF therapy (67.0%), they do think it poses more threat to information security (72.5%). See table 2 for all frequencies.

Only 19.0% of cognitive behavioral (CBT) therapists stated the combined therapy would result in diminished therapeutic alliance compared to FTF therapies. In contrast, 46.0% of therapists with other therapeutic stances (mostly psychodynamic) were in agreement that the combined model offers inferior alliance (χ^2 (df=2)= 6.3, p< .05).

Inclination to use the combined therapy was generally high. Therapists were most willing to use it for psycho-education and feedback purposes and less supportive of using it in cases of moderate/severe symptoms. E-mail was the modality most therapists were willing to use as an adjunct along with FTF therapy (see table 3).

Table 2. Combined therapy vs. FTF therapy frequencies.

	Less than FTF Therapy	Equal to FTF therapy	More than FTF therapy
Effective	9 (10.0%)	29 (33.5%)	49 (56.5%)
Maintaining continuity of care	7 (8.0%)	23 (26.5%)	57 (65.5%)
Providing feedback	1 (1.0%)	16 (18.5%)	70 (80.5%)
Client satisfaction	12 (13.5%)	43 (49.5%)	32 (37.0%)
Harmful to the patient	11 (12.5%)	58 (67.0%)	18 (20.5%)
Threat to information security	4 (4.5%)	20 (23.0%)	63 (72.5%)
Therapeutic alliance	32 (37.0%)	39 (45.0%)	16 (18.0%)

Demographic variables showed differences between Cognitive-behavioral and Psychodynamic therapists on two other measures (other orientations were added to the Psychodynamic group): CBT therapists showed significantly (F(1,84)= 8.74, p<.05) higher willingness to use the combined therapy for moderate/sever symptoms (M=3.50, SD=1.41) compared to Psychodynamic therapists (M=2.61, SD=1.23). CBT therapists were also significantly (F(1,85)=8.27, p<.001) more inclined to undergo training (M=4.00, SD=.98) than Psychodynamic therapists (M=3.21, SD=1.26). No other demographic relationships were found.

Table 3. Willingness to use a combined therapy in various conditions, disorders and modalities (1-5 Likert)

	% Not willing (1)	% Willing to very willing (4-5)	M(SD)
Psycho-education	5.7	60.9	3.82(1.22)
Relapse prevention	4.6	58.1	3.65(1.12)
Mild symptoms	8.0	51.7	3.51(1.21)
Moderate/severe symptoms	17.2	36.7	2.94(1.36)
Monitoring /feedback	8.0	60.9	3.64(1.35)
Integrate e-mail	6.9	43.0	4.0(1.23)
Integrate chat	25.3	12.6	2.36(1.09)
Integrate video	11.5	29.9	2.95(1.25)
Integrate self-help app	13.0	33.3	3.01(1.31)

4. Discussion

Current study aimed to investigate therapists' attitudes towards a combined therapeutic model, in which technological methods are used as adjuncts to FTF therapy. We revealed positive attitudes and high acceptability of the combined model. Compared to regular FTF therapy, the majority of therapists find a combined therapy as more effective, better at maintaining continuity of care and more suitable for monitoring and providing feedback. Results show more positive attitudes than in other surveyed computerized therapies that mostly offer either all (computer) or nothing (FTF) approach [7,9,12]. Therapists were willing to use FTF therapies assisted by technology in a variety of contexts: psycho-education, monitoring, relapse prevention and for mild symptoms. Similar to previous attitudes surveys [9,14], they were less inclined to use the combined therapy for moderate/severe symptoms. As for different technological modalities, therapists found e-mails to be the most suitable medium in combination with FTF sessions, similar to previous studies [6,13].

CBT oriented therapists differed from their Psychodynamic counterparts only in their view of the therapeutic alliance of the combined therapy, in their willingness to undergo training and to use this therapy in cases or severe symptoms.

Despite positive attitudes found in several surveys [8,12,14], most therapists do not use technology in psychotherapy on a regular basis [7,14]. Current survey suggest that offering them a more integrative approach, that enables to supplement rather than replace FTF practices would result in better acceptability and uptake.

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Virtual Reality to Train Diagnostic Skills in Eating Disorders. Comparison of two Low Cost Systems

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Abstract. Enhancing the ability to perform differential diagnosis and psychopathological exploration is important for students who wish to work in the clinical field, as well as for professionals already working in this area. Virtual reality (VR) simulations can immerse students totally in educational experiences in a way that is not possible using other methods. Learning in a VR environment can also be more effective and motivating than usual classroom practices. Traditionally, immersion has been considered central to the quality of a VR system; immersive VR is considered a special and unique experience that cannot achieved by three-dimensional (3D) interactions on desktop PCs. However, some authors have suggested that if the content design is emotionally engaging, immersive systems are not always necessary.
The main purpose of this study is to compare the efficacy and usability of two low-cost VR systems, offering different levels of immersion, in order to develop the ability to perform diagnostic interviews in eating disorders by means of simulations of psychopathological explorations.

Keywords. Virtual reality, virtual patients, education, eating disorders, diagnostic skills.

Introduction

The diagnostic interview in psychology involves a series of skills that require sound training. Enhancing the ability to perform differential diagnosis and psychopathological exploration is important for students who wish to work in the clinical field, as well as for professionals already working in this area. This training should be provided under guidance from a professor in controlled settings that mimic real-life situations as closely as possible. In the initial stages, interaction with real patients should be avoided.

A variety of learning mechanisms are available, but many of them are not used adequately in traditional educational methods and fail to address a particular student's "preferred" learning style. We all learn more and retain more when information is

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presented to us multiple times, preferably through multiple channels. Virtual reality not only adds to the variety of educational delivery mechanisms, but specifically addresses the areas in which traditional methods are least successful; VR can draw students inside the simulations, immersing them totally in educational experiences that cannot be carried out using other methods [1].

Virtual Reality (VR) environments are engaging, and facilitate comprehension by situating learning materials in a context. Learning in a VR environment can also be more effective and motivating than traditional classroom practices [2, 3, 4]. The evidence of its use in training (aircraft simulators, military training, etc.) is compelling. VR provides trainees with simulations of real life situations where they can learn by doing in a safe educational context, and allows trainers to gradually increase the difficulty of the problems be solved in training tasks, thus facilitating the process of learning by guiding students towards their optimal performance.

Traditionally, immersion has been considered central to the quality of a VR system. Immersive VR is considered a special and unique experience which is not achieved by three-dimensional (3D) interactions on desktop PCs. In other words, high levels of immersion increase the realism of the experience, which in turn enhances its effectiveness. However, authors are also interested in looking for situations in which highly immersive systems are unnecessary. Although specific immersive technology displays can improve outcomes, other factors may be equally or more beneficial. Indeed, some authors have suggested that if the content design is emotionally engaging, immersive systems are not always necessary [5]. Therefore, although immersive systems undoubtedly play an important role in reproducing life-like situations, other aspects are equally important.

Typical VR systems comprise different graphical user interfaces for human–computer interaction that vary according to the level of immersion required. The most basic level involves exposure to virtual environments on computer screens, with peripheral input devices (e.g., a keyboard or a computer mouse) used to interact with them. At the other extreme are technologically advanced systems such as Head Mounted Displays (HMD) that simulate binocularly overlapped images and create the illusion of a three-dimensional world. Although HMDs can increase the user's immersive experience, they have several drawbacks. For example, they may be impractical in the educational setting; educational centers are often reluctant to include VR interventions in their daily practice if this involves the use of expensive or technically complex instruments. Another concern is the possible side effects of HMDs, such as simulator sickness or visual fatigue. In addition to these practical issues, the price of immersive HMDs with a good tracker system is generally prohibitive. However, low-cost immersive HMDs have appeared on the market in recent years, among them the Oculus Rift and Samsung VR Gear. These devices allow greater immersion at relatively economical prices. However, despite the development of low-cost HMDs, a certain level of technical knowledge is still needed to use them properly and may present a barrier to their wider educational use.

The main purpose of this study is to compare the efficacy and usability of two low-cost VR systems offering different levels of immersion for training students in diagnostic interview skills by means of simulations of psychopathological explorations in patients

with eating disorders. Previous research has shown these simulations are more effective in training differential diagnosis skills than traditional methods based on role-playing [6].

Methods

In the virtual environment created, learners conduct a clinical interview with different Virtual Patients (VPs). Each VP presents a specific eating disorder. In this simulation, skills of differential diagnosis are taught via a series of diagnostic interviews conducted with the VPs. The objective of the interviews is to obtain enough data to formulate a diagnosis. To do so, users select the most suitable question at each stage of the interview; the system informs them how accurate their choice is, and the VP responds to their questions. At each stage users decide whether to continue asking questions or whether they have enough information to formulate a diagnostic hypothesis. If they select the correct diagnosis at any given time during the interview, the system will only accept it if the VP has been fully examined (fig. 1)

Figure 1. Virtual interview: The VP appears on the left screen while the question choices and the diagnosis hypothesis are displayed on the right screen.

Fifty-two undergraduate students participated in the study. Participants were randomly assigned to one of the following conditions: differential diagnosis skills training using the simulated interviews with an immersive system (Oculus Rift DK1), or training using the simulated interviews with a non-immersive system (stereoscopic computer screen: Acer Aspire 5738DG laptop with a 15.6-inch screen).

Figure 2. Oculus Rift DK1 (left), and Acer Aspire 5738DG laptop (right)

Students in both groups were requested to attend one 50-minute session in the laboratory. Each student received from the professor in charge a basic explanation of the main characteristics of eating disorders. Later, students had to interact with the VPs who presented the disorders.

The effects of the two different training systems on the students' learning were compared. Students in both groups carried out a diagnostic interview skills test (50 written questions; the final score was calculated taking into account the correct answers converted onto a 10 point-scale). Usability was assessed with the Software Usability Measurement Inventory (SUMI) [7]. Only the items on the inventory that were applicable to our software were considered for data analysis: *2. I would recommend this software to my colleagues; 3. The instructions and prompts are helpful; 5. Learning to operate this software initially is full of problems; 7. I enjoy my sessions with this software; 12. Working with this software is satisfying; 13. The way that system information is presented is clear and understandable; 17. Working with this software is mentally stimulating; 19. I feel in command of this software when I am using it; 26. Tasks can be performed in a straightforward manner using this software; 27. Using this software is frustrating; 29. The speed of this software is fast enough; 32. There have been times in using this software when I have felt quite tense; 42. The software has very attractive presentation; 44. It is relatively easy to move from one part of a task to another; 48. It is easy to see at a glance what the options are at each stage.*

Results

Effectiveness

After confirming the homogeneity of the two groups in age and gender, a t-test for independent samples was conducted to evaluate the differences between the scores obtained by students in the HMD and computer screen groups in the diagnostic interview skills test. The scores obtained by the two groups were very similar. Mean scores were 8.5 points (SD=1.27) in the immersive system (HMD displays) group and 8.07 (SD=1.26) in the non-immersive system (stereoscopic computer screens) group. The difference between the mean scores was shown to be non-significant by the t test ($t=1.20$; $p=0.23$)

Usability

In each of the items on the SUMI, participants had to select one of three options: agree, undecided, or disagree. Table 1 shows the distribution of choice observed for each of these options in each question.

To obtain an overall usability score, on items 2, 3, 7, 12, 13, 17, 19, 26, 29, 42, 44, and 48 positive answers (agree) scored 1 point, "undecided" answers scored 0 points, and negative answers (disagree) were assigned a score of -1. In items 5, 27 and 32, on the other hand, negative answers (disagree) were assigned a score of 1, positive answers (agree) a score of - 1, and "undecided" answers scored 0 points.

Table 1. SUMI frequencies

	Frequency (%)					
	Agree		Undecided		Disagree	
	HMD	CS	HMD	CS	HMD	CS
2. I would recommend this software to my colleagues	92.3	84.6	7.7	15.4	0	0
3. The instructions and prompts are helpful	100	92.3	0	7.7	0	0
5. Learning to operate this software initially is full of problems	0	0	7.7	3.8	92.3	96.2
7. I enjoy my sessions with this software	80.8	73.1	19.2	23.1	0	3.8
12. Working with this software is satisfying	76.9	80.8	19.2	19.2	3.8	0
13. The way that system information is presented is clear and understandable	96.2	92.3	3.8	7.7	0	0
17. Working with this software is mentally stimulating	76.9	69.2	23.1	19.2	0	11.5
19. I feel in command of this software when I am using it	80.8	76.9	15.4	15.4	3.8	7.7
26. Tasks can be performed in a straightforward manner using this software	84.6	84.6	11.5	7.7	3.8	7.7
27. Using this software is frustrating	3.8	0	15.4	7.7	80.8	92.3
29. The speed of this software is fast enough	61.5	73.1	34.6	19.2	3.8	7.7
32. There have been times in using this software when I have felt quite tense	19.2	15.4	0	3.8	80.8	80.8
42. The software has very attractive presentation	84.6	57.7	11.5	30.8	3.8	11.5
44. It is relatively easy to move from one part of a task to another	69.2	76.9	19.2	15.4	11.5	7.7
48. It is easy to see at a glance what the options are at each stage	61,.5	53.8	23.1	38.5	15.4	7.7

HMD: Head Mounted Display; CS: stereoscopic computer screen

The scores on this global measure of usability were similar in the two groups (mean= 8.8, SD= 3.74 in the HMD group; and mean= 8.69, SD= 2.13 in the computer screen group; t test: t=0.13, p=0.89).

Discussion

No differences were found in either effectiveness or usability in this study of the immersive and non-immersive systems of skills training in psychopathological exploration of eating disorders through virtual simulations. Given the greater complexity and higher cost of immersive systems, non-immersive systems appear to be a promising VR alternative for developing these skills in trainee professionals.

Nevertheless, although the difference was not statistically significant the immersive system was slightly more effective. These results indicate the need for further studies in this field using larger sample sizes.

Although the HMD used in this study can be considered immersive, its features are still those of a prototype (Oculus Rift DK1). Although it has a wide viewing angle, its resolution is reduced. Recently, versions have appeared with enhanced features at no extra cost. The present study needs to be replicated with larger sample sizes and using newer versions of this type of HMD, such as the Oculus Rift DK2 or Samsung Gear VR devices, in order to confirm the existence of differences in effectiveness and usability compared to non-immersive devices.

Acknowledgments

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How To Protect Children From Internet Predators: A Phenomenological Study

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Abstract. Teenage Internet users are the fastest growing segment in the Internet user population. These teenagers are at risk of sexual assault from Internet predators. This phenomenological study explored teacher and counselors' perceptions of how to prevent this sexual assault. Twenty-five teacher and counselor participants were interviewed. A modified van Kaam method was used to analyze the data and develop themes. Participants stated that mainly the lack of parental support and social networking website were the circumstances leading to teenage Internet sexual assault, while teen needs and gratification usually played a role in teen encounters with predators on the Internet. There were 5 emergent themes in this phenomenological study and those themes were; lack of parental support, social networking websites and chat rooms, teenage need for relationships, instant gratification among teenagers, improved parental support.

Keywords. Teenagers, Internet, Sexual Assault, Social Media

1. Introduction

The Internet has become very important in society; it is present in the majority of households in America, but it is also becoming a new venue for sexual predators. According to van Manen (2010) sharing personal information (online) can be unexpectedly risky—in part because sexual predators and pedophiles prey on unsuspecting social network users. Places such as chat rooms are becoming places where child predators meet 13 to 17 year olds in order to solicit them for sex. According to Wolak, David, Mitchell, and Ybarra (2008), the Internet is becoming an increasingly dangerous place for children.

Social networking websites such as Facebook®, MySpace™, Twitter© and instant messaging can open the door for teen exploitation on the Internet. For example, according to anonymous (2011) the federal authorities are seeking access to multiple e- mail and Facebook® accounts, including some bearing the name of slain North Carolina teen Phylicia Barnes, as part of a child pornography and sexual exploitation of children investigation. This qualitative, phenomenological study may increase the knowledge in the law enforcement, educator, mental health professionals and the parental community on how to reduce this relatively new threat to children.

An exhaustive review of the literature helped to determine that the current available research does not provide adequate information to educators, parents, mental health professionals and law enforcement. It is also inadequate when educating 13 to 17 year-olds on how to avoid predators on the Internet. This qualitative, phenomenological study consisted of interviews with teachers/counselors who have worked with teen victims of sexual assault from someone whom they met on the Internet

2. Method

2.1 Participants

The sample comprised of 25 teachers and counselors (9 male, 16 female) in a suburban school district in the Midwest. To participate in this study, they were required to have had experience working with teenagers who have had one or more sexual experiences with someone they met on the Internet. The participants' responses provided a source of opinion on the teen Internet assault phenomenon. To explore any ethnic anomalies, the sample also consisted of members from White (n = 19), Black (n = 2), Hispanic (n = 2), Pacific Islander (n = 1) and Mixed Ethnicity (n =1) ethnic groups.

2.2 Instrument

Participants were interviewed using a semi-structured guide that included open-ended questions concerning the perceived causes of teen Internet sexual assault among 13 to 17 year-olds. There were 5 interview questions which centered on two themes: (a) which type of student the participant believed would most likely be a rape victims following initial contact on the Internet, and (b) what were potential solutions to the teen Internet sexual assault problem.

3. Data Analysis

Data analysis used the modified Van Kaam method of phenomenological analysis described by Moustakas (1994) to capture the essence of the participants' experience regarding teen Internet sexual assault. Because the modified Van Kaam method was used in this study, data analysis software was not be used.

This modified Van Kaam method, described by Moustakas (1994), has seven steps to use for each participant interview. The steps in this modified Van Kaam method are: (1) listing and preliminary grouping; (2) reduction and elimination; (3) clustering and thematizing the invariant constituents; (4) final identification of the invariant constituents and themes by application; (5) constructing an individual textural description of the experience; (6) constructing an individual structural description, and (7) constructing a textural-structural description for each participant.

In qualitative research, information is organized and a coherent picture or reflection of intertwined concepts is created by following a process (Neuman, 2003). Through a text analysis, this study attempted to identify trends in teen introversions and extroversions. The analysis also included the role of anonymity in the teen Internet sexual assault phenomenon.

4. Results

Following data transcription and analysis, five themes emerged. These include: (1) lack of parental supervision, (2) social networking websites and chat rooms, (3) need for a relationship, (4) instant gratification, and (5) improved education.

4.1 Them 1 – Lack of Parental Supervision

Participant responses cited lack of parental supervision (12/40 or 30%) as the primary circumstance most likely lead to teenage sexual encounters with someone whom they meet on the Internet (See Figure 1). Lack of parental support was the mo t common circumstance cited by participants (12/40) that lead to teenagers meeting predators on the Internet. Some participants stated that a dysfunctional family, lack of parental supervisi n and caring can facilitate a teen gravitating to the Internet to meet a potential predator. Participant D stated that, "dysfunctional families and lack of caring environment in the home can lead to teens meeting predators on the Internet". According to Participant H, "loneliness and a wish to connect, low self-esteem and no parental uidance" are circumstances which lead to teens meeting predators on the Internet. Participant N states that "opportunity and a lack of parental guidance" can lead to a teen meeting a predator on the Internet.

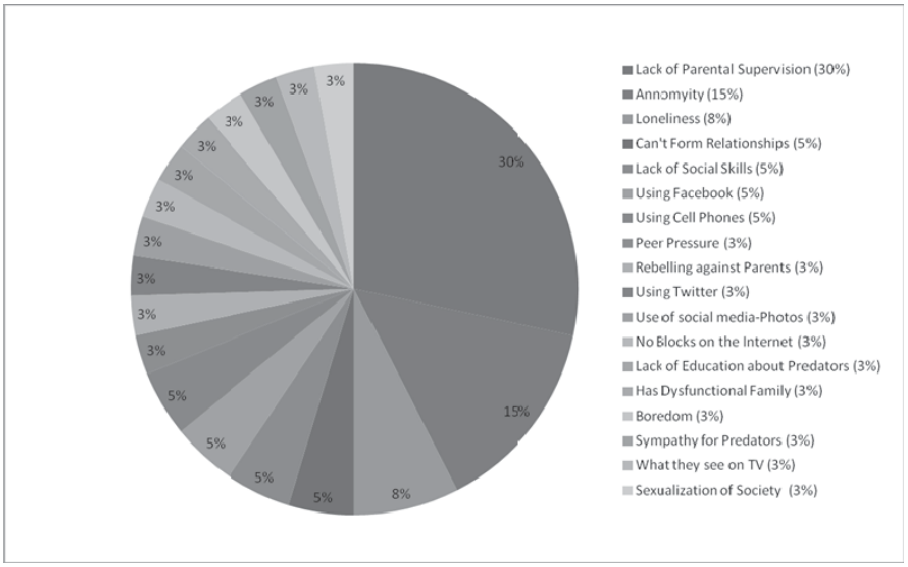

Figure 1. Circumstances Leading to Teen Internet Sexual Assault.

4.2 Theme 2 – Social Networking Websites and Chat Rooms

Nearly a third of the participants (37%) reported Facebook® as the tool used by predators to lead teenagers into meetings via the Internet (See Figure 2). Participant A mentioned that, "our daughter used Facebook®, Yahoo chat rooms, Teenchat, MSN Messenger, and Xat chat". Myspace™ was also one of the most common websites cited by participants (14/39) as a means for teenage encounters with Internet predators. Participant O believes that, teenagers meet Internet predators on "MySpace™ and Facebook®, or social networks that nyone has access to".

Eleven percent (11%) of the sample felt that Internet predators used chat rooms to try to meet teens for sex. According to Participant G, teenagers meet predators in "chat rooms; anyone can use them and on Facebook® where you have to accept friendships". Teenagers are likely to meet Internet predators on "Facebook®, Twitter© [or other sites that are] easily accessible or possibly Craig's Lis (Participant C).

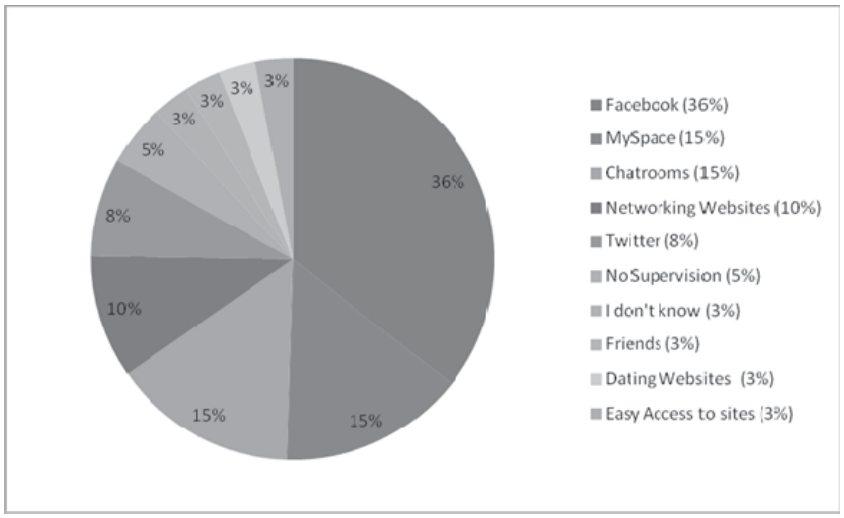

Figure 2. Tools used by the Predators.

4.3 Theme 3 – Need for a Relationship

Nearly one-third (12) of the respondents cited "a need for relationship" as the greatest teenage need leading them to meet someone on the Internet (See Figure 3). Participant K mentioned that some teenagers are "looking for relationships online [and are] more susceptible to what others say online". Some teachers and counselors felt that teenagers often fall victim to Internet predators while going online to fulfill their need for a relationship. The participants stated that teens frequent websites seeking relationships. Participant K further explains that "teens go online seeking communication and someone to have a relationship with".

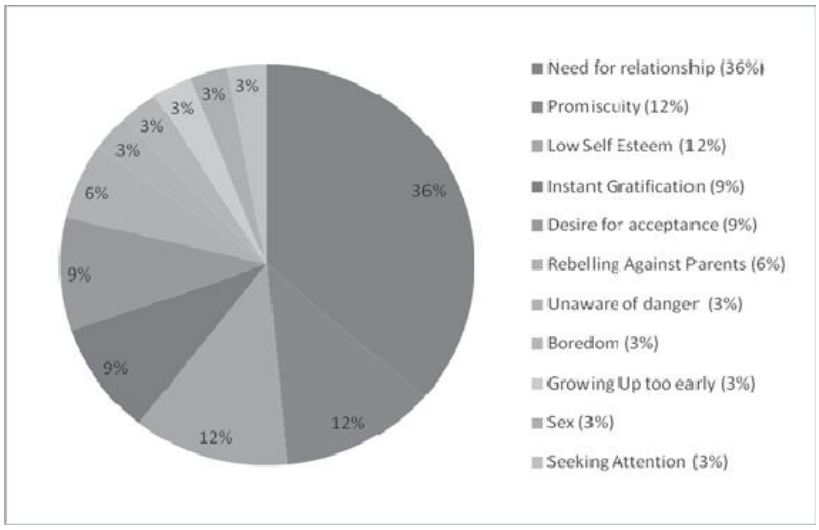

Figure 3. Need for a Relationship and Instant Gratification.

4.4 Theme 4 – Instant Gratification

Nearly 12% (3) of the respondents stated that teenagers seek Internet relationship as a form of instant gratification (See Figure 3). Participant C stated that teenagers needed "immediate gratification and that they try to have the adult relationship that they see on TV". According to s me of the teachers and counselors, teenagers often go online seeking immediate gratification and pleasure from relationships on social websites and in chat rooms. These relationships often lead to sexual assault. Participant T states that "kids go to Chat Rooms because they get bored and need someone to talk to/reach out to".

4.5 Theme 5 - Improved Parental Support

Over half of the respondents (19/36, 53%) cited better parental support as their main source of support needed to prevent teenage Internet sexual assault (See Figure 4). Participant K mentioned that, "parental support and connections in school - parents need to know." Some of the participants believe that additional parental support and supervision would help reduce the likelihood that a teen will meet an Internet predator. Participant H stated that "additional parental supervision was needed - kids will do what they want on the internet." One mother attended a parenting class with her toddler, while another participated in a free weekend martial arts program with her daughters.

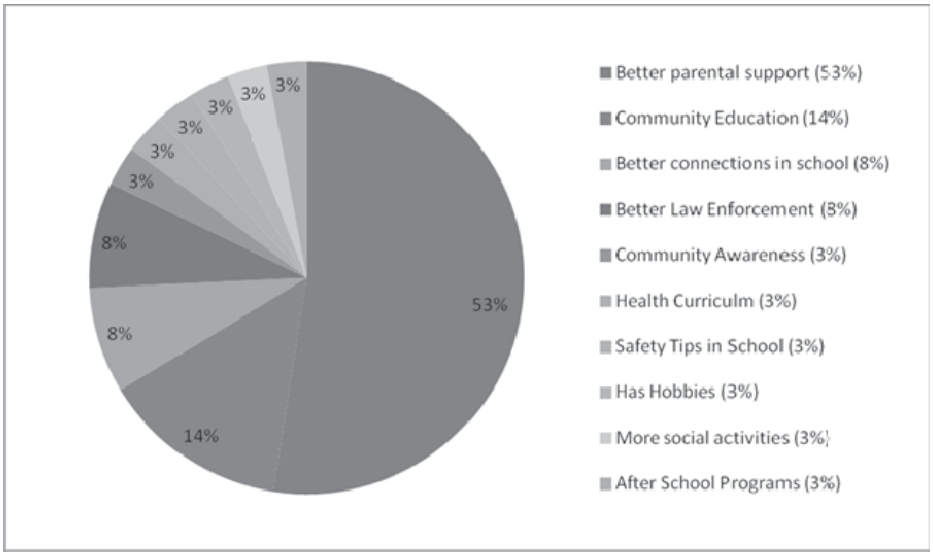

Figure 4. Improved Parental Support.

A numbe (4 or 16% and what percentage?) of the teachers mentioned that education would help prevent teen Internet sexual assault. Participant E mentioned that, "more community education and awareness and parental supervision were needed." Participant A stated that, "we have cut off Internet access for our daughter for now.

One parent is home at all times, but most of her interactions with the man took place after we went to bed".

Finally, 3 teachers or 9% stated that improved law enforcement was needed to help stem teen Internet sexual assault. According to Participant A, "as soon as we found out we notified law enforcement, but they have been unable to trace the Internet Protocol (IP) addresses and he closed all accounts that he was using to interact with our daughter. Some teachers stated that parents need to supervise their teenager's use of the Internet to prevent the teen from falling victim to Internet predators.

5. Discussion

The purpose of this study was to investigate the perceptions of school teachers and counselors with knowledge of adolescent experiences of sexual assault occurring via the Internet. The main finding of this study showed that a lack of parental supervision is a key circumstance which leads to teen Internet sexual assault. Through social networking websites and chat rooms are how most Internet predators meet teens on the Internet. The findings also show that some teens visit these websites to try to fulfill their need for a relationship and to gain instant gratification. Finally, the majority of participants stated that improved parental support is the main factor that is necessary to help prevent teenage Internet sexual assault.

Teenagers are a vulnerable population with challenging issues and needs. This current study investigated the circumstances, tools, personality, and needs which lead to teenage sexual encounters with Internet predators. Although the Internet has many positive aspects, one of the most pernicious is its potential use for online sexual predation (Dombrowski et al., 2004). A qualitative, phenomenological design was used to hear directly from 25 high school teachers and counselors concerning how they chose social supports.

Notably, 53% of respondents stated that parental support was a major source of support and assistance for teenagers. This finding was interesting because 16% of participants reported community education and 9% reported law enforcement as the main source of support for teenagers in the prevention of Internet sexual assault, respectively. In 2009, among Arizona youth in 9th through 12th grades, 14% of girls and 7% of boys reported being physically forced to have sexual intercourse when they did not want to (Arizona Department of Education, 2011). Therefore, sexual assault on teenagers continues to be an issue.

6. Conclusion

In summary, the participants of this study stated that the lack of parental supervision gives teens the opportunity to develop relationships on the Internet. Teens seeking relationships on social networking websites and in chat rooms to satisfy their need for relationships often fall victim to Internet predators, according to the participants. Improved parental supervision of their teenager's Internet activities would is the main support needed to help prevent teen Internet sexual assault.

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SECTION IV

ORIGINAL RESEARCH

Health care is one of the areas that could be most dramatically reshaped by these new technologies.

Distributed communication media could become a significant enabler of consumer health initiatives. In fact they provide an increasingly accessible communications channel for a growing segment of the population.

Moreover, in comparison to traditional communication technologies, shared media offer greater interactivity and better tailoring of information to individual needs.

Wiederhold & Riva, 2004

The Identity Mapping Project: Demographic differences in patterns of distributed identity

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Abstract. The advent of cloud computing and a multi-platform digital environment is giving rise to a new phase of human identity called[15] "The Distributed Self." In this conception, aspects of the self are distributed into a variety of 2D and 3D digital personas with the capacity to reflect any number of combinations of now malleable personality traits. In this way, the source of human identity remains internal and embodied, but the expression or enactment of the self becomes increasingly external, disembodied, and distributed on demand. The Identity Mapping Project (IMP) is an interdisciplinary collaboration between psychology and computer Science designed to empirically investigate the development of distributed forms of identity. Methodologically, it collects a large database of "identity maps" -- computerized graphical representations of how active someone is online and how their identity is expressed and distributed across 7 core digital domains: email, blogs/personal websites, social networks, online forums, online dating sites, character based digital games, and virtual worlds. The current paper reports on gender and age differences in online identity based on an initial database of distributed identity profiles.

Keywords: Identity; Online Identity; Distributed Self; Cloud Computing; Computer Visualization.

1. Introduction

Historians of psychology and personality have identified three phases in the development of human identity (i.e., a person's conception and expression of the self) and noted the relationship between evolving models of the self and revolutionary developments in culture and technology. For instance, the Pre-Modern or Feudal conception of identity as external and rooted in the individual's place in the social order (The Social Self) gave way to a Modernist view of the self as stable personal, unique, and internal (The Psychological Self) in the centuries following the Enlightenment (with its emphasis on internal processes of reason and cognition) and the rise of Industrial Capitalism (with its emphasis on private property and individual rights). The Modernist view of identity is reflected in most of the major 20th century models of personality including classical psychoanalysis [1], neo-analytic theories [2, 3, 4]

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humanistic conceptions [5]; trait theory; and cognitive social learning theory [8]. Subsequently, in the later half of the 20th century, modernist views of the self were challenged by Post-Modern conceptions of identity as fragmented and constantly shifting (The Multiple Self). This multifaceted, shifting conception of the self was closely aligned with forces of globalization, an explosion in media sources, and the introduction of the windows operating system that enabled continuous shifts between active and latent programs in response to different needs and contexts [9, 10. 11].

In a series of recent empirical and conceptual papers, Gilbert and his colleagues [12, 13,14] have argued that the advent of cloud computing and a ubiquitous, multi-platform digital environment is giving rise to a 4th phase of human identity called "The Distributed Self." In this conception, consciousness and aspects of the self are increasingly externalized and distributed into a variety of 2D and 3D digital personas (e.g. email, blogs, personal websites, online forums, social networks, digital games, virtual worlds) with the capacity to reflect any number of combinations of now malleable personality traits. Within this new model, the source of identity remains internal and embodied, but the expression or enactment of this consciousness becomes increasingly external, disembodied, and distributed on demand. In this way, the operation of The Distributed Self is analogous to that of "cloud computing," where digital resources are stored in the Internet (analogous to our central consciousness) and distributed on demand to multiple digital platforms and devices (similar to the distribution of multiple personas across a range of 2D and 3D environments). As the number and variety of ubiquitously available digital platforms continues to grow, creating and coordinating a diverse identity system involving a physical self and multiple online identities across a variety of 2D and 3D virtual platforms will increasingly become a normative process in human development and personality.

The Identity Mapping Project (IMP) is an interdisciplinary collaboration between psychology and computer science designed to empirically investigate the development of distributed forms of identity. Methodologically, it seeks to acquire a database of "identity maps" -- computerized graphical representations of how active someone is online and how their identity is expressed and distributed across 7 core digital domains: email, blogs/personal websites, social networks, online forums, online dating sites, character based digital games, and virtual worlds. As part of this ongoing project, statistical analyses of identity profiles are conducted periodically in order to assess 1) aggregate trends in online identity and 2) potential differences in online identity as a function of demographic variables such as age, gender, education, and nationality. The focus of the current study is to report on gender and age variations in identity maps during an initial phase of data collection.

2. Method

2.1. Participants

Two hundred and seventy participants were recruited via word-of-mouth, posting on social media cites, and micropayments to individuals who complete surveys on Mechanical Turk, a crowdsourcing Internet marketplace run by Amazon. Approximately 58% of participants were male (n=156), 40% were female (n=108), and 2.5% (n=7) were transgendered. The average age of participants was slightly above 33

years, with approximately 37% of the sample under 30 (n=100) and 63% (n=170) over 30 years of age. Because this early sample was not sufficiently varied with respect to nationality or educational level (the large majority of participants had at least some college education), demographic analyses were restricted to gender and age in this first project report.

2.2. Procedure

Each participant completed a relatively brief (10-20 minute), anonymous, online questionnaire called the Identity Mapping Survey. In Part 1 of the 3-part survey, participants provide basic demographic information about their physical self and a broad overview of their involvement in 7 core digital domains of email, blogs/personal websites, social networks, online dating sites, online forums, character/avatar-based digital games, and 3D virtual worlds; in Part II they provide more detailed information about their involvement in each digital domain where they have had a presence in the last year; and in Part III they indicate if they have any "crossover accounts" in their digital identity A crossover account exists when a participant (1) creates a user name *that is different from his or her physical name* in one digital application (e.g., email, Facebook, Twitter, a virtual world, etc.) and (2) later uses this persona in a different digital application. In this case, new digital persona has "crossed over" or migrated from an initial digital domain into one or more other digital domains. The Identity Mapping Survey can be viewed at: http://mapmyidentity.cs.lmu.edu
Following completion of the survey, participants are able to view a graphical representation or "map" of their current digital identity using D3, a data visualization software program. In addition, the survey allows them to share a link to the site and/or their identity map via email and a variety of social media channels (e.g. Facebook, Twitter, Google Plus, etc.) in an effort to drive traffic to the site.

3. Results

Overall, as depicted in Table 1 below, the data support the concept of distributed identity in that over half of the sample had a presence in 4 of the core digital domains (email, blogs/personal websites, social networks, and online forums) and nearly half had a presence in a fifth domain (virtual worlds), with email and social networks being the most highly used digital domains by far. Moreover, within every digital domain, the average number of accounts exceeded 1.0, indicating that participants tended to have multiple accounts or profiles within domains they utilized. Multiple accounts were especially prevalent in the domains of email (2.48); social networks (3.34) and character-based gaming sites (2.26).
The overall percent of the sample that created crossover accounts and the average number of crossover accounts used by participants will be the subject of later analyses.

Table 1. Percent Utilization and Average Number of Accounts for 7 Digital Domains across Total Sample (n=270)

Digital Domain	Percent Utilization	Average Number of Accounts
Email	98	2.48

Blogs/Personal Websites	54	1.20
Social Networks	96	3.34
Online Dating Sites	15	1.83
Online Forums	52	1.54
Avatar-Based Gaming	26	2.26
Sites	45	1.41
Virtual Worlds		

Within these aggregate trends, there was a high degree of variability in the amount and complexity of participant's digital utilization. The following links provide examples of identity maps that convey the range of online identity patterns:

Low Utilization:
http://mapmyidentity.cs.lmu.edu/identitymap/54d9606583680fcf61000024
High Utilization:
http://mapmyidentity.cs.lmu.edu/identitymap/54e20bc483680fcf6100004d
Intermediate Utilization (with Crossover Accounts):
http://mapmyidentity.cs.lmu.edu/identitymap/54d9987583680fcf61000029

With respect to demographic variables, gender and age differences in the utilization of the 7 digital domains are reported in Table 2 and Table 3, respectively. The results reveal considerable similarity in the utilization of the digital domains for each demographic variable. For gender, the vast majority of male and female participants utilized email and social networks more than any other domain, and about half of each group participated in online forums. The main gender differences were that woman demonstrated substantially lower utilization of blogs/personal websites, digital gaming sites, and virtual worlds than men.

Table 2. Gender differences in overall and ranked utilization of 7 digital domains.

Digital Domain	Male % Utilization and Rank		Female % Utilization and Rank	
Email	99	1	95	1
Blogs/Personal Websites	59	3	31	5
Social Networks	96	2	95	2
Online Dating Sites	15	7	16	6
Online Forums	51	4/5	55	3
Avatar-Based Gaming	33	6	9	7
Sites	51	4/5	37	4
Virtual Worlds				

With regard to age, both younger and older participants also demonstrated the highest utilization rates for email and social networks (in the 90 percent range), with moderate utilization of blogs/personal websites (49 and 58, respectively). Similarly, both age groups indicated the lowest levels of utilization for online dating and digital gaming sites (less than 30%). The main age differences found were that the percentage of participants in the younger group who used online dating services was more than double that of the older participant group and the opposite was true with respect to participation in 3D virtual worlds.

Table 3. Age differences in overall and ranked utilization of 7 digital domains.

Digital Domain	Under 30 % Utilization and Rank		Over 30 % Utilization and Rank	
Email	97	1	99	1
Blogs/Personal Websites	49	3	58	3
Social Networks	93	2	98	2
Online Dating Sites	23	6/7	11	7
Online Forums	48	4	54	5
Avatar-Based Gaming	23	6/7	28	6
Sites	29	5	55	4
Virtual Worlds				

4. Conclusion

While The Identity Mapping Project is in an early initial phase of data collection, it has the potential to make several contributions to the understanding of identity in the current digital age. First, by combining the perspectives of psychology and computer science, it adds a multi-disciplinary component to the body of scholarship that explores the relationship between models of the self and developments in science and technology. In addition, the current work is distinct in its effort to use empirical methods to study complex ideas regarding human identity and the self rather than relying solely on conceptual analyses. Finally, the project involves a novel application of data visualization software to graphically represent a subjective/behavioral construct such as digital identity.

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Using A Facebook Group As An Adjunct To A Pilot mHealth Physical Activity Intervention: A Mixed Methods Approach

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Abstract. In the United States, most adolescents do not obtain the recommended amounts of physical activity for optimal health. Around 80% of adolescents own a mobile device, and social media is frequently used by adolescents on mobile devices. Few studies have examined the use of social media as part of an intervention to promote physical activity. The purpose of this study was to evaluate the use of a Facebook group as part of a mHealth physical activity intervention trial. Adolescents, ages 14-18 years, were recruited for a four week physical activity intervention using the FitBit Flex. Participants were also given the option to join a private Facebook group where they could interact and were given badges for fitness accomplishments. The research assistant moderator posted on the Facebook group an average of 25.3 times (SD=7.2). Post-intervention, participants completed a phone interview about their experience. Of 30 intervention participants (avg age 16.0 (SD=1.1), 60.0% female), 17 opted to join the Facebook group (avg age 16.3 (SD=1.2), 47.0% female) of which 10 completed a qualitative interview. Participants averaged 4.9 interactions (SD=8.7) on the Facebook group wall throughout the intervention. From the interview responses, major themes included enjoying the badge feature of the Facebook group and wanting more content and interaction. In conclusion, participants used and enjoyed having the Facebook group, particularly the badge feature of the group, as an adjunct to the physical activity intervention.

Keywords. Facebook group, intervention, physical activity, adolescents, teenagers

1. Introduction/Problem

In the United States, most adolescents do not obtain the recommended amounts of physical activity for optimal health. [1] Regular physical activity helps reduce risk of many diseases [2], promotes psychological well-being [2], and is associated with better academic performance. [3] For high school students, the United States Department of Health and Human Services recommends at least 60 minutes of physical activity every day. [2] A study done in 2013 found that 27.1% of high school students had been physically active for only 60 minutes in the past seven days and only 15.2% had been active on all seven days. [4] Innovative tools, such as new technology, are needed to promote physical activity in this age group.

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Mobile phone ownership, specifically smart phone ownership, continues to climb in the adolescent population, and social media frequently is used on these devices. In 2013, 78% of adolescents owned a cell phone and almost half (47%) owned a smart phone. [5] Smart phone use in adolescents rose by 14% from 2011 to 2013. [5] Smart phones offer nearly ubiquitous access to social media. Social media websites are frequently used among this age group as well: 94% use Facebook, 26% use Twitter, and 11% use Instagram. [6] Facebook, in particular, remains the most widely used social media to date. [7]

Facebook groups serve a useful function in adolescent's lives. Some adolescents state they use their Facebook solely to find out about events or school activities through a page or group on Facebook. [8] Studies have explored the use of a Facebook groups as adjuncts to interventions in the areas of sexual health, mental health, and education in adult populations. [9, 10, 11] One study to date has examined using a Facebook group as part of an intervention to promote physical activity in undergraduate students. This study found social support or physical activity measures increased over the intervention time period among all participants, however there were no differences in social support and physical activity between participants in the Facebook group compared to those who were not. [12] There remains a lack of studies on the use of a Facebook group as part of an intervention for promoting physical activity in adolescents.

The purpose of this study was to evaluate the use of a Facebook group as an adjunct to a mHealth physical activity intervention using the FitBit Flex. Our first aim was to examine user engagement on a Facebook group promoting physical activity. Our second aim was to explore adolescents' views on participating in the Facebook group as part of a physical activity intervention.

2. Method/Tools

This mixed methods study was conducted from May 2014 to September 2014 in the metro area of a large city in western United States. This study was part of a pilot randomized control trial, and received approval from the Western Institutional Review Board.

2.1 Participants

Adolescents, ages 14 to 18 years, were recruited for the mHealth physical activity intervention using both in person and online recruitment methods. Those who enrolled had to be active without restrictions by a medical provider, be willing to download the FitBit application on their phone, and be able to fill out a survey in English. Parental consent was obtained for individuals under 18 years old.

Upon enrollment, participants were assigned to one of the three waves of the four-week intervention and were asked if they wanted to be part of a private Facebook group as part of their intervention experience. Each wave of the intervention had its own Facebook group.

2.2 Data Collection

For the intervention, participants were given a Fitbit Flex to wear for four weeks. The Fitbit Flex is an activity tracker that can measure amount of steps taken among other fitness measures.

Participants who opted into the Facebook group at enrollment were friended by a profile administered by a research assistant on Facebook and added to the private group. This group was a place where participants could ask questions, interact with both the moderator and the other participants, as well as receive weekly badges (i.e. virtual acknowledgements public to the group) for their fitness accomplishments. The moderator was a trained research assistant. The moderator posted an average of 25.3 times overall (SD=7.2) for each of the three waves of the intervention; on average 20.7 (SD=3.2) of these posts consisted of wall posts, 4.7 comments (SD=4.2) and no "likes". An average of 17 badges (SD=4) were awarded to participants per intervention wave. The badges included text, memes, or video clips that corresponded with the type of badge earned. Example badges included: Trendsetter- Most days wearing the Fitbit, Ironman/woman- Most days with over 12,000 steps, and Socialite- Most interactions on Facebook about the Fitbit. At the end of the study, participants were invited to complete a phone interview about their experience in the intervention, including their experience in the Facebook group.

Data was collected from the Facebook group with Microseft Excel by a research assistant through counts of wall posts, comments, likes, and views.

3. Analyses

Variables to examine user engagement on the Facebook group wall included type and number of interactions (e.g. posts, comments, likes and views). To examine participant responses to being part of a Facebook group as part of the intervention, themes were identified in participants' interviews.

Descriptive statistics were used to examine user engagement on the Facebook group wall. Three investigators performed qualitative analyses, in which an iterative process was applied to interview responses about the Facebook group to identify themes. [13] Three rounds of review occurred until thematic saturation was reached.

4. Results

A total of 30 adolescents enrolled in the study, 60.0% were female, 70.0% were Caucasian, and participants had an average age of 16.0 (SD=1.1). A total of 17 participants opted to join a Facebook group as part of their intervention experience, 47.0% were female, 76.5% were Caucasian, and had an average age of 16.3 (SD=1.2). Of the 17 in the Facebook group, 10 participants completed the follow-up phone interviews.

Over the four week intervention, participants averaged 4.9 interactions (SD=8.7) in the form of wall posts (avg 0.3 (SD=0.8)), comments (avg 0.6 (SD=1.1)), and likes (avg 1.6 (SD=2.0)), and viewed the content posted on the Facebook group an average of 17.1 times (SD=10.0). See Table 1 for more details.

Table 1. Median, mean, and standard deviations of Facebook group user engagement among participants.

Intervention Wave	Participants	Posted on Wall			Commented on Post			Liked Content			Viewed Content			Total Interactions		
		Med	*Mean*	*SD*	*Med*	*Mean*	*SD*	*Med*	*Mean*	*SD*	*Med*	*Mean*	*SD*	*Med*	*Mean*	*SD*
1	5	0	0	0	0	0	0	1.0	1.4	2.1	18.0	14.6	7.6	0	4.0	7.3
2	5	0	0	0	0	0.4	0.9	1.0	1.4	1.5	19.0	15.4	9.7	0	4.3	8.0
3	7	0	0.7	1.3	0	1.1	1.5	2.0	2.0	2.5	26.0	20.0	12.1	2.0	6.0	10.1
Total	17	0	0.3	0.8	0	0.6	1.1	1.0	1.6	2.0	18.0	17.1	10.0	0.0	4.9	8.7

Qualitative interviews revealed that participants had a positive view on being part of the Facebook group.

> "It gave me a positive outlook on the whole [experience]. Like the whole Facebook thing [did]. Cause it was—if the Facebook page was just there I would never go on there… But like seeing the badges and seeing the improvements that I have made, it help[ed] a lot."

The participants specifically reacted positively to the badge feature. They felt it provided a tangible way to see goals reached, as one participant expressed the badges "reinforce[d] the fact that you ha[d] been working".

The badges also offered a comparison to the participants' peers in the group, which in turn was motivating and offered an additional way to track their improvement.

> "Overall I thought it was pretty cool 'cause I was still able to see what other people were doing and like what they were getting rewards for. [I saw posts] telling them good job, and I was like oh cool I could maybe do that, like work at it."

Participants discussed a perceived sense of support and membership to the Facebook group. They felt they could ask questions to not just the moderator, but those experiencing the intervention as well.

> "I saw what everyone was up to, and like the badges everyone was getting. It was pretty cool to see how we were working as a community to go forward and work on it together."

Participants also felt that this group membership held them accountable. For example, one participant mentioned it was "good to know that someone was following up".

Finally, viewing but not contributing was a consistent theme; one participant noted "everyone looked at it but no one said anything". Many participants also expressed a desire for more contribution to the group from both the other members of the group as well as the moderators. Suggestions for moderator on how to increase interaction included a "motivational quote of the day" or "giving [group members] ideas of what to post".

Conclusion

In conclusion, over half of adolescent participants enrolled in a mHealth intervention voluntarily opted to join a Facebook group. The participants in the Facebook group interacted occasionally, but viewed most of the content posted by the moderator or

other participants. Participants enjoyed being part of the Facebook group and frequently mentioned that it was motivating and provided a tangible way to see their progress; however, they specifically expressed a desire for more content and interaction.

Previous studies on online discussion forums have found that structured discussions elicit more responses and are more engaging to participants. [14] While that finding was among a sample of university students, it may inform promoting interaction in a similar type of forum for high school students. As moderators, making it a study requirement to post to the Facebook group wall and offering prompts to elicit responses may be beneficial.

Although this small pilot study has limited generalizability, the descriptive quantitative results and the qualitative analyses may inform future, larger studies that seek to promote physical activity using Facebook groups among youth.

Using Facebook groups as adjuncts to interventions in adolescents may be beneficial to motivate and encourage adolescents to obtain the recommended amounts of physical activity. Future studies should test whether requiring interaction, posting more content, or having a larger group would directly impact physical health outcomes.

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Chasing The 'Like': Adolescent Use Of Social Networking Sites In Australia

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Abstract. The current study investigated how adolescents behave on Social Networking Sites (SNSs) and how they interpret the feedback they receive online from others. Thirty-four Australian adolescents (26 girls, 8 boys) aged 13 to 17 years participated in the study. Five semi-structured focus groups (3 mixed groups, 2 all-girl groups) were conducted to explore how adolescents perceive their own and others' SNS behaviours, the motivation underlying these behaviours, and the expected outcomes related to particular behaviours. Teenagers reported that they spend a good deal of time planning their SNS posts, felt that the information they posted was a true reflection of them as a person, and thus interpreted feedback ("likes") as measuring their self-worth. In contrast, some teenagers were perceived as "chasing the like" for status and popularity while not caring about how accurately their posts represented them as a person. A potential gender bias in these findings is discussed.

Keywords. Social Networking Sites, Adolescents, Qualitative Research, 'Like', Social Feedback

1. Introduction

There has been considerable research on the role of digital technologies and use of social network sites (SNSs) during adolescence. These studies have explored the effects of new methods of online communication on identity formation [1,2,3], self-presentation [2], impression management [4], and implications for self-concept [1,5,6] using predominantly quantitative analysis of self-report data. While there are mixed feelings in the academic literature and the popular press with respect to the positive or negative influence of SNSs on adolescent social development, these sites continue to grow in popularity and the number of SNS profiles maintained by adolescents has increased [7].

A recently published and very comprehensive qualitative study of American teenagers and their use of social media [8] questions the validity of commentary that ignores the different goals that parents and academics have for teenagers (focused on safety and future success) compared with the goals of teenagers themselves (focused on social relations and the development of identity and autonomy). boyd argues that, while social interaction through the "networked publics" of social media offer different affordances from social interaction in physical space, the goals of contemporary teenage life are not very different from teenage life in other generations [8].

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The current study was motivated by a similar desire to understand social networking behaviour from the perspective of teenagers to inform a larger study of social media use and identity formation in adolescence. The study used focus groups with a small sample of Australian teenagers to investigate adolescent perceptions of their own and others' SNS behaviours, the motivations underlying those behaviours, and the expected outcomes and feedback related to those behaviours.

2. Method

2.1 Participants

Participants in this study were 34 Australian teenagers (26 girls, 8 boys) aged 13 to 17 years (M=15.18) who each took part in one of five semi-structured focus groups (3 mixed groups, 2 all-girl groups). Participants lived in Victoria, New South Wales, and Western Australia and attended Private, Catholic, and Public high schools (1 participant was home-schooled). All but one of the participants (Male, 16 years) were regular users of SNSs. Adolescents were recruited via Facebook advertising and predominantly through snowball sampling methods [9]. It should be noted that we are currently recruiting all-boy groups to extend the findings of this study, particularly in light of some of the possibly gendered themes that emerged.

2.2 Materials

Focus group questions covered adolescent perceptions of SNS behaviours (*What SNS do you use and what are some of the typical behaviours you see on your newsfeeds, Instagram feeds etc.?),* the motivations underlying those behaviours (*Why do you think people do these things? Why do you think some people behave differently?),* and the expected outcomes and feedback related to those behaviours (*What happens if you behave like that/or differently? Do some of these behaviours ask for a specific type of feedback from your peers?)*

2.3 Procedure

This study received ethical clearance from an Australian University. Adolescents wishing to take part were required to obtain signed parent/guardian consent in addition to providing their own consent. Focus groups were held in private meeting rooms at public facilities such as gyms, scout halls, and other public centers. The focus groups lasted approximately one hour and no specific incentives were offered to participants to take part. The first author conducted the focus groups, which were recorded (audio only) and transcribed prior to analysis. A thematic analysis using Braun and Clarke's [10] guidelines was used to interpret the data.

3. Findings and Discussion

Snapchat, Instagram, and Facebook were the most commonly used SNSs within the focus group participants, with fewer participants using Twitter and Tumblr. While there are many layered nuances in the type of information and audience envisaged across

different social media platforms which will be reported elsewhere, this paper focuses on two broad themes that emerged from the data, 1) the degree of planning that goes into online posts, and 2) the impact of feedback ("likes") on posts.

3.1 Theme 1: Planned and carefully considered postings

The majority of participants carefully considered the information they posted on SNSs, such as the nature and content of the post, the ideal time to post, and the most appropriate SNS on which to share the post. Teenagers in this study seemed to be conscious of the social context of the social media they use, and to have their own perception of the social norms associated with those contexts and media.

3.2 Theme 2: Like as the most important SNS metric

Positive feedback on posts, delivered through a 'like' on Facebook, Instagram, and Tumblr and as a 'favourite' on Twitter, was very important to the majority of participants. This form of feedback was seen as more important than a "comment" or other text-based feedback. The teenagers in this study described "likes" as representing their likeability, popularity, and self-worth. They discussed the power of the "like" as a metric of peer judgment, which '*boosts*' and '*approves*' them.

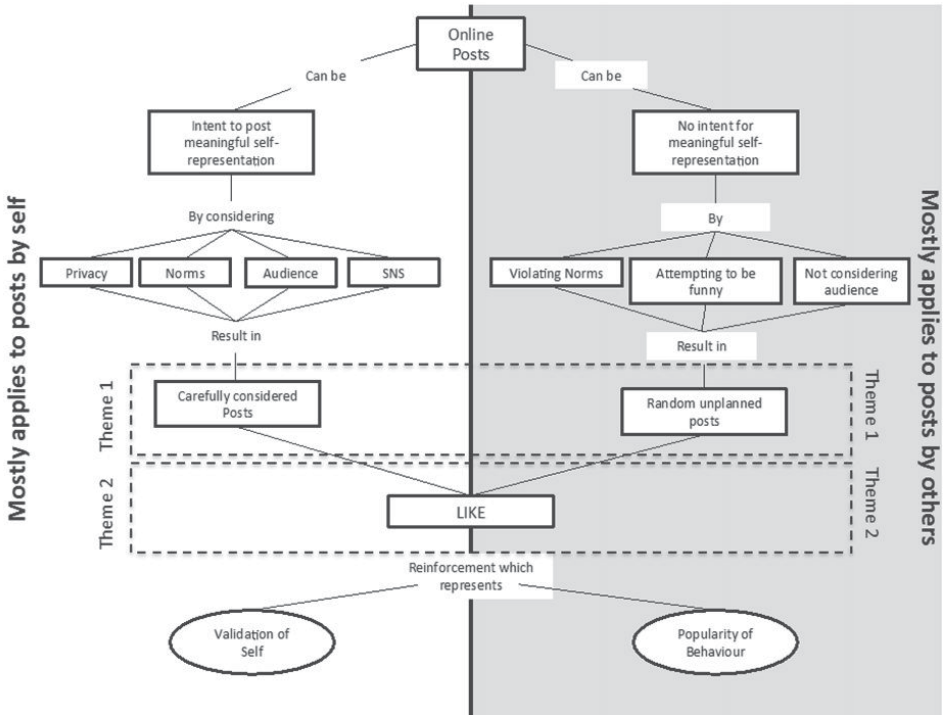

Figure 1. Concept map outlining some behaviours identified as relating to the two major themes reported in this paper. See text for further discussion and note that the sample for this study was predominantly female.

The relationship between the theme of carefully considered posts (Theme 1), and of the peer-approval metric of "likes" (Theme 2) is further explored in Figure 1. Figure 1 depicts the thought processes identified by teenagers as guiding their online posting behaviour and their interpretation of online feedback. The left-hand side outlines the thought processes assumed by teenagers who carefully consider the content of their posts and identify their social media behaviour as meaningful self-representation. These teenagers carefully consider the SNS they are posting on, their intended audience, their perception of the norms associated with online communication, and their use of privacy controls. They believe they are presenting truthful information about themselves that is meaningful to them and will accurately portray them to others. To this end, the "like" on SNSs (Theme 2) is interpreted as validation or acceptance of the self-information they present and is seen as important to their self-concept and emotional state.

The right-hand side of Figure 1 depicts the thought processes attributed to teenagers who post "to try to be funny" or to "cause trouble" by violating norms. These teenagers were described as "not caring about what they post", and their behaviours were not interpreted as disclosing meaningful self-information by our predominantly female participants. In this context, the "like" metric served as peer reinforcement of status associated with engaging in particular behaviours rather than validation of an accurate portrayal of self.

It is important to note that when teenagers in this study were discussing their own behaviour, they were most likely to describe themselves as carefully considering the material they posted (as per the left-hand side of Figure 1) and others as posting randomly (right-hand side of Figure 1). While it is possible that the depiction of "self" as carefully considered and "others" as ill-considered and random may be a form of self-serving attribution bias, it has been noted that the sample was predominantly female, and the attributions of intent may be gendered. The teenagers in this study did not appear to have considered the fact that attempted humour and deliberate violation of norms requires a good understanding of audience and considerable planning and thought. This type of punking or pranking behaviour has been associated with teenage boys whereas the "drama" associated with social relations has been associated with teenage girls in both physical and virtual teenage life [8]. We are currently extending our study with a sample of all-boy focus groups.

4. Conclusion

The predominantly female sample of teenagers in this study reported that they spend a good deal of time planning their SNS posts and believed that they appropriately considered the repercussions of their behaviour online. Those who spent a considerable amount of time considering their posts were more likely to feel that the information they posted was a true reflection of them at that time, and more generally, as a person, and were thus more likely to internalize the feedback they received online as measuring their likeability, popularity, and self-worth.

In contrast, some teenagers were perceived as "chasing the like" for status, while apparently not caring about how meaningful their posts were, or how accurately their posts represented them as a person. However, given the female gender bias of the sample and the tendency for this sort of "punking" or "pranking" behaviour to be associated with teenage boys [8], it is possible that our predominantly female sample

was not aware of the degree of thought and care required to successfully violate norms and be seen as funny by the selected audience, while simultaneously accumulating "likes". The successful execution of "edgy" humour requires an awareness of the social norms being violated, and a nuanced understanding of audience so that there is a degree of discomfort, but a balance in favour of accumulating "likes" and only occasional negative reactions.

The findings from this exploratory study will be extended by further data from all-boy focus groups and will inform the next stage of our research. While this study investigated the thought processes of teenagers in posting and interpreting the posts of others, the next phase of research will more closely examine the degree to which these thought processes accurately reflect the actual behaviour and self-concept of teenagers using social media, and to see whether the goals of teenage life in terms of social relations and identity formation are much different from teenage life in other generations.

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Being in an Avatar: Action and Embodiment in a Digital Me

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Abstract. This paper provides an empirical research about virtual reality users' avatar embodiment. According to literature, users that are embodied/incarnated in their avatars show a tendency to perceive avatars' failures as their own mistakes. Therefore, they are likely to monitor their own hands on the device they're using (e.g.: keyboard) when they perceive a failure in the interaction (a behavior named "focus shift"). We hypothesize that the phenomenon of focus shift is sensitive to different types of failures that can affect the multiple elements involved in the interaction. Thirty participants guided an avatar through a videogame-like virtual environment. The participants were exposed to three experimental manipulations (defective keyboard, defective avatar, defective virtual environment). We counted the number of focus shifts that participants showed in response to these three manipulated anomalies. Results showed a significantly high number of focus shifts in the condition with defective virtual environment. The findings are discussed with reference to mediation theory, explaining the role of action/feedback matching in the phenomenon of avatar embodiment.

Keywords. Embodiment, Avatar, Focus Shift, Virtual Reality, action, agency

1. Introduction

Research showed that the experience of an interaction failure while guiding an avatar is related to an interesting phenomenon, that is, the user has the sensation that the failure was a mistake on his own part [1,2]. For example, as Carijó and colleagues say [2], if the avatar in a virtual environment meets with an impassable virtual obstacle, the player would perceive that he/she cannot progress. It seems that the tendency of virtual reality (VR) users to find the cause of a perceived error in themselves, even when the error has clearly occurred due to malfunctions in the technology, gives us an important clue about the perceived cohesion between a user and his avatar, namely embodiment/incarnation [3].

Therefore, we could say that a successful incarnation in an avatar is related to the impression of the agent that he/she is responsible of avatar's errors.

This impression can be associated to a peculiar behavior, the *focus shift* (f.s.) [4,5].

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F.s. is related to the experience of errors/failures in the context of interaction, and entails the user moving the eyes away from the screen (1), watching his own hands on the device to verify if the perceived error was due to a wrong command by himself (2), re-pressing the correct keys (3), moving back the eyes on the screen to verify if the action correctly worked this time (4); see figure 1 for a visual description of f.s. dynamics.

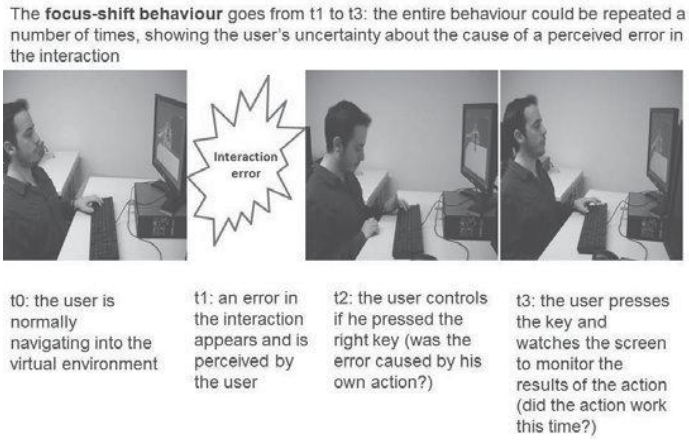

Figure 1. The dynamic of a focus shift following a perceived interaction error.

The described process could be repeated a number of times in a few seconds; the observation/counting of f.s. has been already used in the context of Human-Computer Interaction usability evaluations [6], according to the idea that a high number of f.s. observed during the interaction identifies usability issues. Given that the f.s. behavior implies that the user is attributing an error to his own action, we designed a research to verify whether f.s. are actually sensitive to different types of malfunctions and can be considered a measure of the avatar embodiment by interactive VR users. But what is embodiment?

Embodiment in Avatars

In the present research, we refer to embodiment phenomena as they are described by mediation theory [3,7]. According to this theory, an action that is mediated (i.e., performed thanks to the use of tools) can be first order or second order. A first order mediated action features an agent using the body to directly-control a proximal artifact (for example: a raquet) to achieve his own intention (striking the ball). A second order mediated action features an agent using the body to directly control a proximal artifact (for example: a videogame joypad) to guide a distal artifact (for example: a tennis playing avatar) to achieve his own intention (striking the virtual ball in the tennis videogame).
In this sense, guiding an avatar into a pc-based virtual environment is a second order mediated action, the keyboard being the proximal artifact and the avatar itself being the distal artifact. According to mediation theory, when a second-order mediated action is ongoing, the proximal artifact (for example, the keyboard) extends the personal space

of the user so that the proximal artifact is incorporated by the agent (fist step of embodiment); incorporation is sensitive to the tactile feedback coming from the proximal artifact use (for example: feeling the key-pressing under the fingertips).
Differently, the distal artifact (for example: the avatar) is the object of an incarnation process (second step of embodiment), the user feeling a new personal space around the distal artifact in the distant/virtual location; incarnation is sensitive to visual feedback coming from the distal artifact which behaves as expected or not (for example: the avatar walks when the user is pressing the walk-key).
In this sense, a second order mediated action such as the virtual environment used in the present research is composed by a number of elements the user interacts with: the keyboard (the proximal artifact), the avatar (the distal artifact) and the virtual environment itself, where the action may generate effects or not. The present research will test whether manipulated anomalies affecting the three elements will generate distortions in the embodiment processes, the latter being measured according to the quantity of f.s. (i.e.: how much the user attribute the perceived anomaly to his own action).

2. Methods

Thirty students between 20 and 27 years (mean age=22.96 ± 1,62) participated in the experiment, exploring a virtual environment similar to a video game with keyboard-based interaction and a human-like avatar (see figure 2 for a screenshot from the virtual environment).

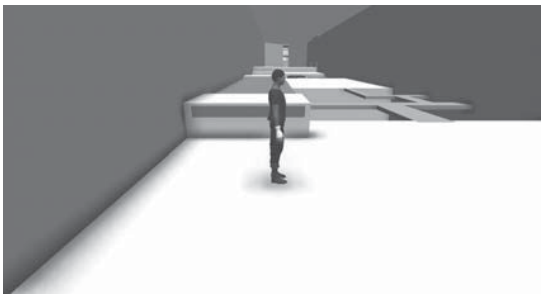

Figure 2. A screenshot from the virtual environment used in the experiment.

The participants were randomly assigned to one of the three experimental groups, each of them featuring one of the three types of interaction failures related to the components of a mediated action [3] (defective device vs. defective avatar vs. defective virtual environment). Precisely, the three interaction failures were:

- First condition/defective device: the participants had to use an unusable keyboard with inverted keys (i.e.: press right to go left, and vice versa)
- Second condition/defective avatar: the keyboard was easy to use (usual commands of personal computer videogames), but the avatar sometimes ceased to respond to commands such as there was a connection problem between the device and the software

- Third condition/defective virtual environment: the keyboard was easy to use and the avatar responded to all of the user's commands, but sometimes it met with impassable virtual obstacles (i.e., invisible walls)

A camera filmed the participants' behavior and a video-recorder program registered their performance inside the virtual environment.
The focus shifts resulting from the experience of the manipulated anomalies were observed and counted by three independent judges, whose observations were later checked for reliability.

3. Results

The between subjects ANOVA revealed an effect of the experimental conditions on the quantity of focus shift-behaviors, $F(2, 27) = 14.788$; $p < .001$, $2 = .523$. LSD post-hoc test showed that all the experimental conditions differed significantly from each other.
Precisely, the defective device condition showed a mean of 1.70 focus shifts (SD=1.63); the defective avatar condition showed a mean of 6.60 focus shifts (SD=3.13); the defective virtual environment condition showed a mean of 10.50 focus shifts (SD=5.19).

4. Conclusion

This research assumes that when one experiences an interaction failure, he watches his own hands on the device, tries to re-perform the action, and watches the screen again to observe the result (focus shift). This can be considered as a clue about the avatar embodiment phenomenon, since it shows the tendency by the user to attribute the cause of a perceived error to his own movement.
The experiment has led to two main findings:
First, f.s. in response to perceived errors/anomalies emerged in every condition of the experiment, implying a general tendency of the participants to monitor their own movement to identify the source of a perceived failure when using a complex mediation, as suggested by the literature [1,2].

Second, a significantly higher number of f.s. was observed in the third condition (defective virtual environment). In other words, it seems that the participants interpreted the third type of anomaly rather than other anomalies as their error (and not of the technology). From a "rational" point of view, this seems paradoxical. I am guiding an avatar that correctly responds to all my commands through the proximal tool (the keyboard), so I should know that the distal tool (the avatar) is working as it should. When I press "jump", it jumps, and this feedback is immediately perceivable on the screen. Thus, when the avatar is not able to go over the obstacle, I should understand that the error is in the technology (i.e., in the functioning of the virtual environment) and not in the course of my action. Considering the observed behaviors, the opposite happens; in this condition, more than in the others, the participants controlled the peripheral to verify that they pressed the right key. To understand the

differences between the experimental conditions, it is important to consider what is included in the sensory representation of the action.

The action being successful in the moment of breakdown (the avatar actually jumps), the user monitors it in an intuitive process, without consciously-reasoning about it [3]: incarnation happens in this way. The proximal artifact (the keyboard) correctly gives tactile information about key-pressing; hence, the distal artifact (the avatar) correctly gives visual information about the ongoing jump. Thus, the user can be successfully incarnated into the avatar, that is, the avatar is perceived as a direct extension of the body. Consequently, the agents perceive its failures are as failures of their own body. For this reason, the agent is more likely to instinctively explore his own hands-in-action looking for the source of the error and re-perform the action many times.

Why did the participants show less focus shift behaviors in response to the other two technical anomalies?

In the first condition, they guided the avatar using a defective keyboard. They needed to press difficult inverted keys, and so the incorporation of the proximal tool (the keyboard) that is based on the tactile information suffered continuous distortions.

In the second condition, the avatar sometimes blocked, and the visual information about the distal tool's (the avatar) response was inconsistent with the actions performed on the keyboard. In this case, the incarnation into the avatar was hindered.

Anomalies in conditions 1 and 2 actually affected the mediated action at the basic levels of the mediation course. If the proximal tool (here, the keyboard) and/or the distal tool (here, the avatar) are directly affected by malfunctions and are limited in providing tactile and visual information, respectively, the embodiment processes become continuously distorted. For this reason, the anomaly in the third condition, that affected the environment and not the two tools that were directly involved in the mediation, tended to be interpreted by the agents more as an error of themselves. This result supports mediation theory in that it shows how avatar embodiment is sensitive to tactile and visual feedbacks coming from the different devices involved in the mediated action.

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Language in Online Dating Texts: Trait Identification, Homophily, and their Effect on Attraction

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Abstract. Research has indicated that online daters may pick up on language cues connected to personality traits in online dating profile texts, and act upon those cues. This research seeks to investigate the level of accuracy of detection of personality in dating profile texts, and the extent to which perceived or actual similarity of personality has an effect on attractiveness of the author. An online survey was conducted collecting the Ten Item Personality Inventory (TIPI) for each participant and text author, a peer-report TIPI score by participants for each text author, and an attractiveness rating on a Likert scale for each author. Participants correctly identified Extraversion, though the effect size was small. Contrary to the hypotheses, participants preferred texts when written by an author with a personality they perceived as dissimilar to their own, specifically in Openness and Conscientiousness, and no relationship was found between actual similarity of personality and attractiveness. Online daters may choose partners with complementary or desirable traits rather than similar traits, or other factors in attraction may be more salient in the initial stages of determining attraction.

Keywords. Online dating, language, personality, homophily, interpersonal attraction.

Introduction

Computer mediated communication (CMC) through text alone results in a lack of non-verbal cues, however it is argued that people imbue textual communication with information about characteristics, attitudes, and emotions [1]. There is evidence that shows a connection between our personality traits and how we express ourselves through language [2, 3]. Previous research has indicated that online daters may pick up and act upon language cues connected to personality traits in online dating profile texts. Fiore and colleagues [4] found that men higher in general caution used more positive emotion words, and were contacted less frequently on a dating site.

Individuals are highly effective at judging the personality of those known to them in face-to-face situations [5, 6]. However, with strangers, and particularly in CMC situations, accuracy is reduced. Extraversion and Openness are the most accurately detected traits in text-based communication, and in zero acquaintance CMC communication Extraversion is still detectable by participants [7, 8].

Homophily is the tendency for people to bond with others similar to themselves. Online daters demonstrate this across a range of lifestyle and life course characteristics such as ethnicity, marital status and religion [4, 9]. Additionally, people have been shown to prefer partners that they perceive to have similar personalities to their own. In

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lab and stranger interactions actual and perceived similarity leads to attraction, however the effect of actual similarity reduces after short interactions, and does not have an effect in existing relationships [10]. Perceived similarity on the other hand, is found to have an effect in existing relationships, but the direction of the relationship is unclear, attraction may increase perceived similarity, or vice versa [10].

This research seeks to investigate the level of accuracy of detection of personality in online dating profile texts by participants, and the extent to which perceived or actual similarity of personality has an effect on the attractiveness of the author.

As suggested by the literature, detection of personality in CMC texts will be difficult for participants. Extraversion and Openness remain the most detectable traits in CMC and it is hypothesized that participants will most accurately detect these two traits in dating profile texts. Both actual and perceived similarity have been shown to have an effect on stranger and non-interaction attraction, thus it is hypothesized that both will have a positive affect on attractiveness ratings of the profile text authors.

Method

This study was conducted online and was a between-participants, independent-samples design in which 404 English speaking participants (72% female) were recruited using convenience and snowball sampling. The participants answered demographic questions including gender, age, relationship status, and sexual orientation, and completed a self-report Ten Item Personality Inventory [TIPI; 11] before being presented with one of 124 dating profile texts generated by participants in a previous study.

The previous study asked a convenience and snowball sample of participants (N = 160, 74% female) to create an online dating profile of at least 60 words. The instructions for doing so were based on typical dating site directions for profile creation. The authors of the texts supplied a self-report TIPI at the time of writing the texts. The mean word count of the texts was 92.77 (SD =45.5).

In this study a random dating profile text appropriate for the participant's age band, gender and sexual orientation was shown to each participant. They completed a peer-report TIPI for the author of the text and scored the author on a seven point Likert scale of attractiveness.

Results

To determine the accuracy of trait identification, correlations were conducted between the trait scores for each participant's peer-report TIPI for the author, and the author's self report on the TIPI. Participants correctly identified Extraversion, r = .279, N = 342, p < .001, though the correlation was weak and explains only 7.8% of the variation (r^2 = .078). Three other traits had negligible correlations; Conscientiousness, r = .113, N = 344, p < .05; Neuroticism, r = .156, N = 338, p < .01; and Openness, r = .150, N = 327, p < .01, each explaining 1–2% of variation, and Agreeableness was not detected at all, r = .067, N = 343, p > .05.

Regression analysis found no correlation between author personality traits and attraction scores, nor rater personality traits and attraction scores.

The effect on attractiveness scores of actual similarity between the author's personality and the rater's personality was investigated. The mean difference was

calculated between the self-report TIPI scores on each trait for the author and participant rater, where a smaller mean difference indicated more similarity of scores on the TIPI and greater actual similarity of personality. Regression analysis using the enter method found no significant model for the effect of actual similarity of personality on attraction scores.

The effect of perceived similarity between the author's personality and the rater's personality on attraction was examined. The mean difference was calculated between the rater's self-report TIPI score, and the rater's peer-reported TIPI scores for the author on each trait. A smaller mean difference indicated more similarity of scores on the TIPI and greater perceived similarity of personality. An analysis of standard residuals was carried out, which showed that the data contained no outliers (Std. Residual Min = -2.84, Std. Residual Max = 2.18). Tests for assumption of collinearity indicated that multicollinearity was not a concern (Extraversion, Tolerance = .93, VIF = 1.08; Agreeableness, Tolerance = .83, VIF = 1.21; Conscientiousness, Tolerance = .82, VIF = 1.21; Neuroticism, Tolerance = .81, VIF = 1.24; Openness, Tolerance = .89, VIF = 1.13). The histogram of standardised residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardised residuals, which showed points that were not completely on the line, but close. Regression analysis using the enter method found a significant model for the effect of perceived similarity on attraction: $F(5, 311) = 13.733$, $p < .001$, accounting for 18% (Adjusted $R^2 = .168$) of the variance in attractiveness scores. Significant predictors were Conscientiousness and Openness which both have a negative relationship with attractiveness scores of the author, but not Extraversion, Agreeableness or Neuroticism. Table 1 gives information for the predictor variables entered into the model.

Table 1. Perceived similarity of personality traits as predictors of attractiveness.

	Unstandardized Coefficients		**Standardized Coefficients**		
	B	**SE B**		**t**	**Sig.**
Constant	5.529	.190		29.064	.000
Extraversion	-.020	.032	-.033	-.624	.533
Agreeableness	-.058	.046	-.072	-1.277	.203
Conscientiousness	-.161	.039	-.231	-4.085	.000
Neuroticism	.039	.042	.053	.920	.358
Openness	-.187	.035	-.288	-5.285	.000

Note. Dependent variable: attractiveness.

Discussion and Conclusion

It was hypothesized that participants would detect Extraversion and Openness in online dating texts, but that other traits would not be detected. This was partially supported by the results. Participants detected Extraversion, though with a weak correlation and

accounting for a low percentage of the variance. Openness was not detected beyond a negligible degree, as with Neuroticism and Conscientiousness. Agreeableness was not detected at all. We know that impression management occurs in online dating [4], and perhaps people highlight socially desirable traits such as Agreeableness making it more difficult to detect their true traits. This study was also conducted at zero acquaintance, where participants had no previous knowledge of the author of the texts, and had no interaction with the author. Only a single online dating text sample was used for each participant, and these samples were shorter than text samples previously studied for trait detection. Additionally, a recent finding that textspeak influences and changes perceptions of personality traits in text, could explain why traits are more difficult to accurately detect in online dating profile texts [12].

The language we use affects perception of an author's personality, and thus affects liking and attractiveness of the author. Although participants were able to detect Extraversion, that ability had no effect on their preference for similar others. The hypotheses that both actual and perceived similarity would have a positive effect on the attractiveness rating of the author were not supported. Contrary to previous research which found that actual similarity has a short-term effect on attraction; actual similarity had no effect here. However, perceived similarity did have an influence, though not in the direction that was hypothesized. Perceived similarity of both Openness to Experience and Conscientiousness were negatively correlated with ratings of attractiveness of the author. While much research supports the fact that daters prefer others with similar traits [13, 14], there are many other factors affecting romantic attraction in interpersonal interactions.

It is possible that aspects of Openness such as being imaginative, curious and adventurous are characteristics that online daters seek out as desirable in a potential new dating partner. Carson's Principle of Complementarity, expanded upon by Kiesler [15], suggests that interpersonal behaviors invite complementary responses, which can have an influence on attraction and relationship satisfaction. Studies have found some support for this theory, though most often in long-term relationships or extended interactions rather than initial impressions on zero acquaintance [14, 16]. However, a study on speed-dating, which found no relationship between homophily and attraction, proposed that the ecologically realistic setting of the study, in comparison to controlled lab studies on attraction, may have affected the salience of mate characteristic preferences, reducing the influence of homophily in favor of other factors [17]. The researchers suggest that while homophily in partner selection is important, it is only one factor in the attraction process, and that similarity may not carry as much weight in realistic situations in comparison to lab experiments. It is possible that determining attraction from non-manipulated online dating profiles more closely resembles the realistic context of speed-dating than that of controlled experiments, and thus may explain the lack of findings for similarity of personality in this study. Alternatively, in Fullwood *et al.*, [12] perceptions of Openness and Conscientiousness, along with Emotional Stability, shifted when texts were manipulated to contain textspeak. Schoendienst and Dang-Xuan [18] found that online daters subconsciously evaluate linguistic properties of messages they receive on dating sites, and use those evaluations to make choices about potential mates. It is possible that the language used by the authors in creating the dating profiles contained textspeak which altered perception of their traits, or that linguistic properties unrelated to traits were subconsciously influencing attraction in participants, and thus negated the effect of similarity of traits on attractiveness.

While Extraversion was detected in this study, the effect size was small. Neither actual nor perceived similarity of traits had the expected correlation with attraction. However, it appears that dating profile texts differ from controlled experiments when examining the relationship between personality traits and attractiveness. Profile texts may offer more, or different, information and cues about an author's characteristics than other forms of online or offline text, and it is possible that factors other than homophily of traits are more salient when determining attractiveness in that context. Further research is needed to determine how the processes of attraction play out in the arena of online dating.

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External Eating as a Predictor of Cue-reactivity to Food-related Virtual Environments

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Abstract. The objective of this study was to assess the association between external eating style and food craving experienced during exposure to food cues in virtual reality (VR) environments in both clinical and non-clinical samples. According to the externality theory, people with external eating experience higher reactivity when exposed to food cues, which in turn increases the probability of overeating. Forty patients with eating disorders (23 with bulimia nervosa and 17 with binge eating disorder) and 78 undergraduate students were exposed to 10 different food cues in four VR environments (kitchen, dining room, bedroom, and café). After 30 seconds of exposure to each VR environment, food craving was assessed using a visual analog scale. External, emotional and restrictive eating styles were also assessed using the DEBQ. The results showed a strong association between external eating and cue-elicited food craving. After controlling for the presence of eating disorder diagnosis, external eating was the best predictor of reported food craving. The results lend support to the externality theory but highlight the need for further research in specific patterns of functioning in patients with bulimia nervosa and binge eating disorder.

Keywords. External eating, food craving, virtual reality exposure, bulimia nervosa, binge-eating disorder.

Introduction

Obesogenic environments have been repeatedly and strongly associated with the increase in overeating patterns in Western societies. The continuous exposure to high calorie foods in every-day life leads some individuals to increase their food intake and thus raises the risk of obesity. However, despite the increase in overweight adults and

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children in recent years, not everybody reacts to the availability of food by overeating. According to van Strien et al. [1, 2] there are three main psychological theories that explain differences in overeating behavior: the restrained eating theory [3], the psychosomatic theory [4], and the externality theory [5].

The restrained eating theory states that unsuccessful dieting can cause overweight due to bingeing. The psychosomatic theory proposes that some individuals eat as a response to negative emotions in order to reduce levels of stress and anxiety. Finally, according to externality theory, individuals eat in response to food-related stimuli, regardless of their internal state of hunger and satiety. Despite their limitations, these theories have been widely used in research to explain overeating in cases in which individuals are not hungry and there is no physical need for food intake. It has also been suggested that knowing the eating style of patients could facilitate the tailoring of treatments according to their specific characteristics. Therefore, the predominance of one eating style or another should be taken into account when choosing the most appropriate intervention.

Cue exposure therapy (CET) with prevention of bingeing has been proposed as an effective treatment for bulimia nervosa (BN) patients [6, 7]. The rationale behind this intervention is based on the conditioning process [8]. In this model, the intake of binge food is the unconditioned stimulus, and all the stimuli associated with this binge-behavior are the conditioned stimuli. Exposure to conditioned stimuli (for example, chocolate) elicits physiological responses, which are subjectively experienced as food craving, and this in turn leads to excessive food intake. It is reasonable to think that patients with high external eating will show higher reactivity when exposed to food cues and, consequently, the likelihood of excess intake will increase. In these cases, CET may be an appropriate treatment option [9]. Previous research has assessed the relation between external eating and craving for food. Burton et al. [10] found that an external eating style, assessed with the Dutch Eating Behavior Questionnaire (DEBQ), was the main predictor of food craving in a sample of adults. However, in that study craving was assessed using a self-report questionnaire and participants were not exposed to food cues. Therefore, a further step forward would be to assess whether external eating is associated with the food craving experienced during exposure to specific foods in virtual reality (VR) environments.

Objectives

The main objective of this study was to assess the relation between the external eating style and the food craving experienced during exposure to food cues in VR environments. The results of previous research suggest that high scores on external eating will be strongly associated with craving and will be a good predictor of this response during exposure to virtual food cues. Differences between non-clinical and clinical populations were also explored.

A secondary objective was to assess the usefulness of VR technology as an exposure technique for inducing food craving in external eaters.

Methods

Participants and procedure

The sample consisted of two groups: a non-clinical group, comprising 78 undergraduate students without eating disorders (nine males and 69 females), and a clinical group, comprising 23 bulimia nervosa and 17 binge eating disorder (BED) patients according to DSM-5 criteria (ten males and 30 females).
After signing a consent form, all participants were administered the Dutch Eating Behavior Questionnaire (DEBQ), a self-reported questionnaire that assesses three different eating styles in normal weight and overweight adults: external eating (DEBQ-EX), emotional eating (DEBQ-EM), and restraint eating (DEBQ-RE) [1]. Participants were also measured to obtain their body mass index (BMI), and were then exposed to 40 VR environments. These virtual environments were the result of combining four VR scenarios (kitchen, dining room, bedroom, and bakery/café) and the 10 foods that each participant assessed as the ones that produced the highest levels of craving from a list of 30 foods. First, participants were exposed to the foods that provoked the lowest levels of food craving in the four VR scenarios. In the later exposure steps, they were exposed to the foods that provoked the highest levels of food craving in the four virtual scenarios. Once in the VR scenario, participants were asked to sit at a table. On the table there was one of the selected foods according to the hierarchy. Participant could manipulate the food with the mouse of the computer. After 30 seconds of exposure to food, craving was assessed by means of a visual analog scale (from 0 to 100).

Statistical analyses

Correlation analyses were conducted to assess the association between food craving and the scores obtained in the external, restraint, and emotional eating scales of the DEBQ. Multiple regression analysis was also used, including scores of external, restraint, and emotional eating scales as predictor variables and mean craving experienced during exposure to the 40 VR environments as a dependent variable. Correlation analyses were conducted separately in control and clinical samples in order to explore differences between the two groups. However, a multiple regression analysis could not be conducted in the clinical group because of its small size. Instead, a hierarchical multiple regression was conducted with the whole sample, introducing the variable *Group* (control versus clinical) in the first step of the analysis in order to control the effect of the presence or absence of an eating disorder (ED) diagnosis.

Results

Bulimia nervosa and BED patients showed significantly higher BMI, age, mean food craving in the VR environments, and higher scores on emotional, external and restrictive eating than controls (Table 1).

Table 1. Between-subjects *t*-test, means, and standard deviations for age, BMI, and DEBQ subscale scores in control and clinical groups.

	Control group		**Clinical group**		*t*	*p*
	Mean	*SD*	Mean	*SD*		
Age	22.67	2.75	33.45	9.77	-6.840	<.001*
BMI	21.83	3.07	27.46	5.37	-6.137	<.001*
DEBQ-EM	28.55	10.69	34.15	12.26	-2.560	.012*
DEBQ-EX	31.54	6.80	36.55	4.86	-4.146	<.001*
DEBQ-RE	21.51	8.44	27.42	9.84	-3.403	.001*
Food craving	51.36	22.12	77.32	19.92	-6.236	<.001*

*p<.05

As expected, positive correlations were found between external eating scores and food craving experienced during VR exposure in both the control and the clinical group (Table 2). This correlation was the only significant one in the control group; however, in the clinical group a strong negative correlation between emotional eating and mean food craving was also found.

Table 2. Correlations between mean food craving experienced in the VR environments and scores obtained on the three scales of the DEBQ in the control and the clinical group.

		DEBQ-EM	DEBQ-EX	DEBQ-RE
Mean Food Craving	Control group	.086 (p=.453)	.345** (p=.002)	.006 (p=.958)
	Clinical group	-.599** (p<.001)	.328* (p=.039)	-.153 (p=.347)

*p<.05 (bilateral); ** p<.01 (bilateral)

The results of the hierarchical multiple regression analyses are summarized in table 3. The variable *Group* (model 1) predicted food craving and explained 25% of the variance. The overall model 2, consisting of the variable *Group* and the three DEBQ scales, also predicted the food craving experienced in the VR environments and explained 39% of the variance. After controlling for the effect of the *Group*, the three DEBQ scales still explained 13% of the variance. Without considering the *Group*, external eating made the strongest single contribution to the model; and emotional eating also made a statistically significant contribution.

Table 3. Hierarchical multiple regression analyses, introducing group, emotional, external and restrictive eating as predictors, and food craving in the VR environments as dependent variable.

Model	Predictors	Beta	*t*	*p*	R^2	$R^2_{adj.}$	R^2_{change}	F_{change}	p_{change}
1	Group	.501	6.236	<.001**	.251	.245	.251	38.888	<.001**
2					.386	.364	.135	8.258	<.001**
	Group	.422	5.204	<.001**					
	DEBQ-EM	-.226	-2.625	.010**					
	DEBQ-EX	.385	4.659	<.001**					
	DEBQ-RE	-.022	-.261	.795					

*p<.05); ** p<.01

Discussion and conclusions

The main objective of this study was to assess the relation between external eating style and the craving experienced during exposure to food cues in VR environments. As expected, external eating was strongly associated with food craving both in participants without eating disorders and in patients with BN and BED. In accordance with previous studies [10], after controlling for the effect of having an ED diagnosis or not, externality was the best predictor of food craving. These results corroborate the externality theory [5], which states that certain individuals are more sensitive to external food cues than others and may overeat in response to these stimuli. In such cases, cue-exposure therapy could be a particularly useful intervention for reducing binge eating.

Another objective was to explore differences between clinical and non-clinical populations. The results showed higher levels of emotional, external and restrictive eating in patients than in controls, as well as higher levels of food craving, which would contribute to the occurrence of binge episodes and the higher BMI in this group. The present study suggests that lower emotional eating is related with food cue-reactivity in VR environments in BN and BED patients. Early studies noted the relationship between emotional and external eating [2], and overlapping between the two eating scales has frequently been reported. Indeed, Jansen et al. [11] suggested that the only pure external eaters were the ones with high scores in external eating and low scores in emotional eating.

The results obtained underline the usefulness of VR technology as an exposure technique for inducing food craving in BN and BED patients. They also highlight the need for further research on contextual and emotional variables related with bingeing in order to develop and apply more specific and appropriate treatments. Gender differences and specific diagnosis should also be considered in future research.

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GETSmart: Guided Education and Training via Smart Phones to Promote Resilience

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Abstract. Posttraumatic stress disorder (PTSD) is common in U.S. military service members (SMs) returning from Afghanistan and Iraq. SMs with PTSD symptoms that fall short of meeting full diagnostic criteria also experience devastating effects on their quality of life and daily functioning. Though evidence based treatments are indicated for those meeting diagnostic criteria, less attention has been given to interventions for those with subthreshold symptoms. The advent of novel technologies affords a unique opportunity to meet these intervention needs. Here we describe the feasibility and preliminary findings testing a smartphone-based intervention program to reduce PTSD symptoms in post-deployment SMs. Participants were randomized to a control or intervention condition. Those in the intervention condition engaged in one Skype session and six weeks of daily directive text messages guiding application (app) use. Apps primarily included those developed by the Department of Defense or VA. Participants completed the PTSD Checklist online at baseline, post-intervention, and 3-month follow-up. Overall, participant feedback was positive, regardless of treatment condition. Preliminary findings (with 10% of the overall target population having enrolled) indicate PCL scores decrease significantly from baseline to post-intervention, and these effects are maintained at 3-month follow-up. Additional analyses will be performed upon completion of the study. The present findings demonstrate the feasibility and acceptability of a smartphone-based resiliency training program for those with subthreshold PTSD.

Keywords. Smart phone applications, posttraumatic stress disorder, trauma, resilience, Skype

The opinions expressed are solely those of the authors and are not to be construed as those of the U.S. government, Department of Defense, or Uniformed Services University.

Introduction

Posttraumatic stress disorder (PTSD) has been identified in 10-20% of U.S. military service members (SMs) returning from Afghanistan and Iraq [1], and is associated with impaired physical health, mental health, and overall functional status. Resilience is frequently discussed, yet proven methods for promoting resilience, and protecting SMs from PTSD, have yet to be established. One easy and effective way of identifying those at higher risk for development of PTSD is through the one-page, 17-item self-administered PTSD Checklist (PCL), which has been validated as a measure of symptom change over time [2]. The total score can range from 17 to 85, and a score of 50 is the best cut-off for making a diagnosis of PTSD, but there are many military SMs

with functional impairment associated at scores below this level [3;4] and subthreshold symptoms are associated with impairment that is similar to those who meet full diagnostic criteria [5-8]. Those with subthreshold symptoms are also more likely to progress to full-blown PTSD. Fortunately, recent evidence that low-intensity treatment may be sufficiently effective for subthreshold PTSD (though not full PTSD) [9] underscores the potential value of screening and developing new target inventions for subthreshold symptoms.

Targeting those with subthreshold PTSD symptoms has the potential to be far more effective in enabling SMs to remain in the military, and trauma-exposed civilians to remain in their respective jobs, through the reduction of symptoms and prevention of progression to full-blown disorders, thereby reducing chronic disability and impairment. We believe that success can best be achieved through a well-designed resilience enhancement program which is accessible and portable to account for military life, but validation is essential to determine with a controlled trial. Recent evidence suggests that a lower intensity intervention might be effective in those with subthreshold PTSD, even though it does not necessarily successfully treat fully developed PTSD. Novel technologies afford the opportunity to promote resilience from a distance, including the ability to see and interact with patients through programs such as Skype and FaceTime, as well as to advise patients via text messages on the use of potentially beneficial applications (apps) that are available through their personal "smart" cellular phones. While there have been publications addressing the feasibility of apps for addressing medical problems, there is very little that has been published to date documenting improvements in outcomes as a result of their use. Therefore the Guided Education and Training via Smart Phones to Promote Resilience (GETSmart) program was designed to meet SM need. The GETSmart program is a telehealth, smartphone app driven intervention rooted in a cognitive-behavioral framework. Here, we present preliminary results, and participants' subjective reports, from the GETSmart study.

Methods

The GETSmart study has a targeted enrollment of 144 participants with subthreshold PCL scores (28 to 49), either within five years after their return from Afghanistan or Iraq, or after being affected in some significant way by a traumatic incident such as a bombing or shooting, or a major natural disaster that results in significant loss of life such as a hurricane, tornado, or earthquake. All participants complete an informed consent process, either in person, or via video chat after the form is mailed to them, and in the latter case they transmit it back to us via email, fax or text. Half of the participants are randomized to the resilience enhancement group, which is initiated with a single 90-minute Skype or FaceTime-based introduction to both cognitive behavioral therapy (CBT) techniques and the use of smart-phone based apps that promote increased resilience through relaxation, engagement in social activities, psychoeducation and other efforts. The CBT approaches incorporate psychoeducation and cognitive restructuring, such as drawing relationships between thoughts, feelings and behaviors; looking at previous times in which they have coped successfully with fear, stress, and anxiety; examining maladaptive thoughts and behaviors that developed in response to traumatic events; and identifying effective coping methods (e.g. weighing evidence and developing alternative coping thoughts). The psychologist

conducts a similar, though abbreviated, introductory session to the other half of the study participants who are randomized to the control group, which incorporates a description of the rationale for the study, app accessibility, encouragement to use the apps, and available resources, such as telephone hotlines and websites that can provide assistance if their symptoms progress. Over the subsequent six weeks, study team members deliver text messages to all participants every day of the week to maintain positive rapport and contact.

Messages to the resilience enhancement group provide specific instructions on what app the participants should access on their smart phone each day, sometimes even directing them to a specific aspect or element of an app. For example, they may be directed to apps like PE Coach and Life Armor to foster psychoeducation; each of these apps were developed by the National Center for Telehealth and Technology (T2) at Joint Base Lewis-McChord in Washington, and they are available for both the iPhone and Android platform phones. The PE Coach app was originally designed to facilitate the conduct of prolonged exposure, one form of imaginal exposure, by enabling patients to record aspects of treatment sessions that they could then play back, facilitate the conduct of between-sessions homework, and even includes the PCL to provide an assessment of current symptoms. However, we felt that for a subthreshold population, this could provide utility even in the absence of ongoing psychotherapy sessions. The Life Armor app features 17 different content areas, including anger, anxiety, depression, posttraumatic stress, and mild traumatic brain injury. Within each of these sections, there are both text-based and videotaped messages that include testimonials of service members and civilians who have experienced such symptoms or conditions, there are "tools" that include suggestions and techniques for helping one cope, and there are pertinent questionnaires that can provide relevant assessments. Tactical Breather (also developed by T2) is both a stand-alone app and incorporated in Life Armor and some other apps; it provides very basic, easily followed, instruction on how to engage in and practice relaxation breathing, even counting aloud to be able to time how long to inspire, hold a breath, and expire. Some apps are not available on both iPhone and Android platforms, so we chose a different one for each. For example, for meditation and yoga apps (example, Simply Yoga for the iPhone), we identified free but well-designed and effective independently developed apps for each platform. Similarly, to facilitate identification of, and engagement in, potentially beneficial social activities such as going to the theater or a movie, eating at a restaurant, or attending a music concert, we use Eventful and Positive Activities Jackpot, for the iPhone and Android platform, respectively. They can use your location to help you find things nearby. Eventful can even review your Facebook® page or iTunes account to alert you to coming appearances by your favorite musical groups, actors or authors, can link you to a site to purchase tickets, and can give you directions to the venue.

All of the same apps are provided to those randomized to the control group, who receive daily texts with inspirational sayings or positive aphorisms for six weeks. While they do not receive specific instructions on the use of apps, this approach controls for contact time with them, and may serve as reminders to access study apps. Thus, this design should provide a valid approach for comparing the actual impact of the guidance, compared to those who just have the apps available to them without guidance. The primary outcome measure is the PCL score, which is re-assessed at the end of each week in the 6-week training period via the secure National Institutes of Health [1] Clinical Trials Survey System (CTSS) website, which participants can access by personal computer (PC), tablet or smartphone. In addition, the PCL, PHQ-9

and GAD-7 are administered via the CTSS at baseline, at the end of the intervention period, and 3, 6 and 12 months later.

Currently, 13 participants have completed the GETSmart program and 3-month follow-up assessment. Two participants missed one PCL item. Mean substitutions were used to replace these two values. Paired sample *t*-tests examined PCL score differences across time points. Independent-sample *t*-tests examined treatment group differences.

Results

Preliminary review after the completion of the intervention by 13 participants (approximately 10% of the overall targeted study sample) indicates uniformly high compliance with study procedures and satisfaction with the intervention. Those in the intervention group (mean=41.7, SD=6.7) had higher baseline PCL scores than those in the control group (mean=26.6, SD=5.7) (t=4.34, p=.001), though as the sample size increases randomization should even this out. In the full sample, PCL scores decreased from baseline (mean=34.7, SD=9.9) to post-intervention (mean=26.5, SD=7.7)(t=4.22, p=.001), as well as from baseline to 3-month follow-up, when modest additional improvement was seen (mean=24.8, SD=5.6) (t=3.91, p=.002). As shown in Figure 1, when divided by treatment group, PCL scores significantly improved in the intervention group from baseline to post-intervention (t=5.30, p=.002) and from baseline to 3-month follow-up (t=4.85, p=.003), while the degree of improvement did not reach significance in the control group (t=1.61, p=.17; t=1.74, p=.14, respectively).

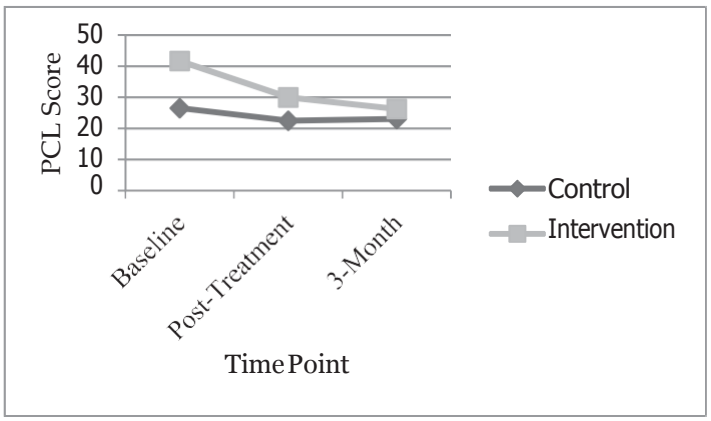

Figure 1. PCL scores across time, by treatment group.

From a qualitative perspective, those completing participation in the control group reported that both the introductory session and the apps were quite useful, even in the absence of specific daily direction on what apps to use. We have also seen anecdotal evidence that life events such as arguments with significant others, or reservist training, can significantly, albeit transiently, increase symptoms of PTSD. Overall, participants have indicated that they preferred the apps that allowed them to do something, including the Tactical Breather app, the yoga and meditation apps, and those that facilitated engagement in social activities, as opposed to those that primarily

provided psychoeducation. We will continue to collect these subjective reports in addition to the objective data, and will also continue to follow all participants over time, to be able to more accurately assess the impact on symptoms, as well as preferences.

Discussion

Telehealth intervention in subthreshold PTSD, utilizing Skype or FaceTime, followed by daily text messaging to encourage the use of smart phone apps to promote relaxation as well as engagement in activities, is feasible, well received, and well tolerated. Preliminary results are also encouraging regarding the ability of such approaches to improve symptoms, but completion of the full study will be necessary to determine whether these findings remain consistent with a full sample. Completion of the study should also help to determine the extent to which guidance is needed on the use of specific apps, or whether simply providing the apps with broad recommendations or encouragement of their use, is sufficient. We believe that demonstration of efficacy in this population could lead to intervention in others, such as those in rural areas where medical resources may be limited, as well as in other medical conditions. With regard to the military, if proven useful after deployment, we believe similar approaches could also be applied prior to, or even during, deployment. In addition, we have found since initiating the study that participants have been very positive, and that much of what they find useful is really not specific to war, terrorism or disaster, so that we have recently broadened the inclusion criteria to include those who have posttraumatic symptoms that are related to a personal trauma, and so far, they seem equally positive about the benefits of participation. If this approach proves as well adopted and beneficial as we hope, a new aphorism for the 21st century may be "An App a Day Keeps the Doctor Away"!

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InSPAL: A Novel Immersive Virtual Learning Programme

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Abstract. In this paper we introduce The Interactive Sensory Program for Affective Learning (InSPAL) a pioneering virtual learning programme designed for the severely intellectually disabled (SID) students, who are having cognitive deficiencies and other sensory-motor handicaps, and thus need more help and attention in overcoming their learning difficulties. Through combining and integrating interactive media and virtual reality technology with the principles of art therapy and relevant pedagogical techniques, InSPAL aims to strengthen SID students' pre-learning abilities, promote their self-awareness, decrease behavioral interferences with learning as well as social interaction, enhance their communication and thus promote their quality of life.

Results of our study show that students who went through our programme were more focused, and the ability to do things more independently increased by 15%. Moreover, 50% of the students showed a marked improvement in the ability to raise their hands in response, thus increasing their communication skills. The use of therapeutic interventions enabled a better control to the body, mind and emotions, resulting a greater performance and better participation.

Keywords. Interactive media, virtual reality, severely intellectually disabled, psychoeducational learning scenarios, attachment theory, triangular relationship, sensitization

Introduction

The Interactive Sensory program for Affective Learning (InSPAL) developed by the AIMtech Centre of City University of Hong Kong is an innovative and unique learning environment and programme designed specifically for Severely Intellectually Disabled (SID) Students. Children with Severe Intellectual Disabilities (SID) constitute an intellectual impairment IQ range from 20 to 35, with marked limitations in conceptual, social and practical domain [1]. InSPAL was built upon AIMtech Centre previous innovations in Smart Ambience Therapy (SAT) – a virtual environment for psychotherapy of abused children and SAMAL - a smart classroom for affective learning [2].

Virtual Reality (VR) is defined as the set of interdisciplinary technologies that enables the creation of three-dimensional representations of real or surreal scenarios, in which users can intuitively interact with the environment. Through sensing a certain degree of presence [3], curiosity and encouragement, users are more willing to express and communicate with the external world in the VR environment [4].

VR is a viable instrument to be used with children with disabilities as it helps to improve social-emotional ability [5] and aids to strengthen mastery and self-control over multisensory stimulation [6]. It also provides structure, an opportunity to be emotionally engaged and is conducive to a process of repetition for children with intellectual disabilities [7]. VR can impact psychotherapy because it provides a technology mediated communication interface that is affectively stimulating [8]. VR supports training for individuals with intellectual disabilities and communication difficulties stimulating independence in everyday life [9].

InSPAL was designed to encourage SID children to express and communicate based on the same paradigm. Due to their intellectual disability and often-accompanied physical disability, these children's mobility and body control are very limited. The specially-designed InSPAL virtual scenarios combined with our self-developed motion tracking and gesture recognition software based on the Microsoft Kinect sensor enabled them to interact with the VR environment in an intuitive way. Eight virtual scenarios have been developed within the framework of four learning domains: safety awareness, cause and effect, balance and coordination, and sensational experience. The specially designed virtual reality learning scenarios help SID students to learn to interact and communicate, increase attention span, engage in self-control and develop a sense of mastery [10]. It is the first of its kind in offering this immersive psycho-educational virtual learning platform to SID students.

Psycho-educational Aspects

Psycho-educational approach to InSPAL stems from humanistic ideologies to changing behaviour patterns based upon mutually positive interactions between the facilitator/therapist and the student/client. Psycho-education is a treatment modality integrating both psychotherapeutic and educational interventions [11].

The psycho-educational aspect of InSPAL incorporates that of experiential learning, an active learning process based upon trial and error through the interaction with the virtual environment and engaging the body in the learning scenario; and the concept of control and focus in relationship to learning. In the InSPAL design, the focus was placed upon creating a learning environment where the students can learn through a process of action based trial and error, and repetition, supported by the trainer, who engaged with the students in a facilitator/therapist role to enable students to interact with the virtual scenarios and achieve more control of their body, mind and emotions. There is a critical need to develop strategies to help severely disabled children develop more adaptive perceptions of control [12]. As SID children have a thwarted internal locus of control, and more externally orientated, therapeutic interventions are integrated into the InSPAL programme.

One therapeutic intervention aimed at bringing a better control to the body, mind and emotions involved psychotherapeutic ideologies around human interaction and the development of a trusting alliance called attachment therapy. Attachment-based psychotherapy is based upon attachment theory, a phenomena where a human bonding experience is developed out of an attachment from a child to 'mother'. Such bonding experiences between a parent and child form the development of trust. Through this trust children can learn to trust and interact within the world, promoting development. Attachment theory provides a lens in which to understand why people with learning

disabilities' exploration of the world is limited and facilitating secure attachment relationships for such clients is an appropriate clinical goal [13].

The development of a positive therapeutic alliance between the therapist and client (child) was contributed by the integration of VR and the therapeutic process, which can activate a process of enablement [8]. In InSPAL the facilitator/therapist worked with the students to gain more control of their learning experience. One factor that contributed to students' success was the notion of trust. Once the student began to trust the facilitator/therapist and the InSPAL environment, they became more interested in engaging. This was a step by step process where the students first drew his/her attention to the facilitator/therapist and then later shifting their attention from the facilitator/therapist, to the virtual scenario. The student could begin to explore the virtual environment and can have direct interaction with the virtual scenario, developing focus and control.

Another level of engagement drew upon art therapy principles, notably the notion of the triangular relationship. Transference and countertransference can be formed between the therapist and client as they interact with each other and with this third party, the image [14]. The child, the therapist and the virtual environment/scenario formed a triangular mode of communication interacting together. The facilitator /therapist and students shared in the experience of viewing and interacting together, and also together with the virtual scene. The development of a healthy therapeutic dynamic can be formed with positive transference shaped by the triangular relationship and deeper engagement, which can lead to personal change. The use of the triangular relationship was integrated into the therapeutic intervention whilst working with the SID students in our programme to engage with them in a deeper way.

This process of engagement, control and autonomy can best be encapsulated within the Cause and Effect Module of InSPAL. In our initial meetings with teachers we noted that a majority of SID students were passive and waited for their teachers and caregivers to carry out tasks and meet their needs. We worked with the notion of hand-raising (a universal symbol) as the visual cue to enable some changes to occur (ie) If I raise my hand (cause) then the teacher will respond (effect) enabling students to have more autonomy in their communication and learning. The facilitator/therapist worked with students to experience and practice this concept of cause and effect in virtual space, and worked with teachers to transfer this skill into the classroom setting.

In Cause and Effect Module, the facilitator/therapist worked to train students to raise their hands to touch the virtual bubbles/balloons (cause); the effect of touching the bubble/balloon was that it would burst. Each time students came to engage in the Cause and Effect Module, they were encouraged to reach for the bubbles independently, giving them autonomy in the cause and effect experience.

Method

In this study 72 SID students from The Mental Health Association of Hong Kong-Cornwall School joined the program and their chronological age ranged from 6 to 20 years (mean = 13.2 years). The students were clustered into eight classes to participate the psycho-educational training sessions in an 18-months period. Altogether, they went through 32 training sessions, experiencing four scenarios of two learning domains.

The School Function Assessment (SFA) [15] was used to examine the performance of SID students' participation and task support needed before starting and

after completing the program. SFA is a criterion-referenced assessment used for students with disabilities or special needs to measure students' performance of active participation and functional task completions. The pre- and post- assessment was completed by the same class teacher of each participating class one week before and one week after the students participated the program. The assessment contained two scales and two sub scales. Scale 1 was the Participation Scale which measured students' participation level in seven major school settings in a six-point scale. Scale 2 Task Supports Scale contains two sub-scales to measure the extent of support that students needed to perform different important functional tasks in a four-point scale. Sub-scale 2-1 Assistance needs and sub-scale 2-2 Adaptation needs measured SID students' needs of assistance or adaption while performing physical or cognitive functional tasks.

Observational data was recorded throughout all training sessions. For Cause and Effect Module the facilitator/therapist worked with the teachers to observe and record each time a student 'raises their hands' in classroom, marking the students' progress.

Result

The SFA results showed that teachers had observed students' overall participation performance was improved in different school settings, statistically significant increments (P <.05) were observed in 4 out of 7 settings and also the total summation score when comparing the pre- and post- means (Table 1). These results revealed a greater level of participation and engagement compared to their previous levels with the pre- and post- assessment.

Setting items	Pre Mean*	sd	Post Mean*	sd	t#	p	Mean compar.
Special Classroom	2.69	1.31	3.08	1.16	3.13	0.003	+15%
Transportation	2.93	1.24	3.32	1.35	3.25	0.002	+13%
Transitions	2.94	1.31	3.24	1.34	2.10	0.040	+10%
Meal/Snack Time	3.29	1.51	3.61	1.44	2.16	0.034	+10%
Total Score	20.32	8.19	22.10	7.67	2.32	0.023	+9%

Table 1. Descriptive Statistics and significant differences on Scale 1
*Higher score indicates a higher level of participation.
#Degree of freedom for each paired t-test = 71

The results of Scale 2-1 also showed that, after going through the InSPAL program, SID students required significantly less assistance support in performing functional tasks in school. In comparing the pre- and post- means of assistance needs scale, a statistically significant increment of 15% (P < .000) was found (higher score

meaning lower level of needs), indicating the students had less assistance needs from adults (teachers and carers) for the tasks support when performing general school functional tasks, improving the effectiveness of daily learning activities; while the Scale 2-2 did not show any significant increment with the adaptation needs level.

Observations from the facilitator/therapist and teachers also revealed that there was around 50% marked increment in self-initiated hand raising in classroom settings in comparison to the students' participation prior to and after completion of the program, thus indicating an improvement in basic communications skills.

Discussion and Conclusion

The students who completed the programme required significantly less assistance in performing functional tasks at school. In comparing the pre-post means of assistance needs scale, a statistically significant increment of 15% was found meaning that the students were able to do things more independently by 15%. Overall, the study shows that students who went through our programme were aroused and showed better attention, participation and engagement in different school settings, and improved in basic communication skills, thus improving the effectiveness of daily learning activities.

With the innovative use of technologies, INSPAL provides an alternate learning strategy for SID students and an innovative learning environment for special education. The psycho-educational approach allowed for an integration of educational and therapeutic input to strengthen interaction, communication and participation. The use of the attachment theory within the therapeutic intervention enabled a process of healthy attachment to develop, and the triangular relationship prompted deeper engagement and an alternative mode of interaction, which lead to enablement and better control, improved performance and greater participation.

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Effect Of Telephone Calls And Text Messages On Goal Attainment In A Ehealth Coaching Service

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Abstract. Yukendu is a personal mobile coaching service that supports people in reaching good levels of psychological and physical wellbeing through the use of an app and a telephone-based relationship with a health coach. The aim of this contribution is to describe the results obtained in a sample of 171 clients (female, n=150) and investigate the main factors in attaining their health-related goals. Results show that 61,98% (n=106) of the sample attained the results they wanted totally or partially. The regression model (number of phone calls, text messages, plan duration, achieved weight loss) accounts for 56,9% of data variance in achieved weight loss. Significant predictors of achieved weight loss are average number of calls (B=.388, p<.05), texts exchange (B=.331, p.<.05) and plan duration (B=.291). These results suggest therefore that in the first phase of health behavioral change, eHealth coaching efficacy lies primarily in the communication between coach and coachee.

Keywords. Health coaching, eHealth, mHealth, telephone calls, text messages, weight loss, well-being

1.Introduction

Coaching are a result-oriented functional equal partnership between coach and coachee, in which a coach assists their client in translating their aims into reachable goals and in developing personal behavioral strategies for their own goal attainment [1]. An effective coaching relationship will result in the client's self-actualization and behavioral changes, obtained thanks to reflections and conversations with the coach. Health-coaching programs are a subset of coaching services oriented to support behavioral changes in individuals who want to improve their psycho-physical well-being. This kind of programs are proved to support and result in positive health behaviors, in opposition to traditional diet programs, that often result in a passing behavioral change [2]. Moreover, health coaching is becoming more and more popular thanks to mobile Information Communication Technologies, which help people track their health behaviors and communicate with each other. Therefore coaching mediated by ICT can be ascribed into the realm of eHealth or mHealth services [3].

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1.1 Yukendu

Yukendu is an eHealth coaching service which successfully integrates a telephone based coaching service with a health tracking and text based chat app [4]. Particularly, Yukendu offers:

- 1-3-6 month programs for people wanting to change their life style;
- access to an app for smartphones and to a web portal, to track health data (weight, BMI) via manual input or connection to a through a wireless body composition scale;
- a set number of calls and unlimited texting with a personal Health Coach, who will support the client in changing life style and attaining their health goals;
- a non-prescriptive dietary recommendation based on the client's biometric data and personal preferences: the objective of this plan is to teach the user how to eat better and healthier;
- a fitness plan consisting of a set of innovative activity options especially designed for those individuals that are less used to physical activity and/or have little time for it;
- a set of audio-guided mindfulness based training sessions, to support clients in understanding themselves better and helping them in their life style change.

The aims of this contribution therefore are:

- Describe the results obtained by a first group of Yukendu's clients;
- Identify the main factors in a eHealth coaching service in attaining health-related goals (weight loss).

2. Methodology

The data considered for the analysis were extracted from the Yukendu clients' database and comprises of 171 clients, 87,7% (n=150) of which were women.
Tracked variables were gender, age, achieved weight loss (delta between weight at the beginning of the program and weight at the end of the program), plan duration, number of sent text messages (average per month), number of phone calls between coach and coachee (average per month).

3. Results

Only a minority of the sample (n=9, 5,3%) had a general life style change as objective for entering the program, while the majority (n=162, 94,73%) aimed to lose weight by purchasing the service. The most purchased option is the 1-month program (45%, n=77), followed by the 3-month program (36,3%, n=62), and the 2-month program (15,2%, n=26). Only a small part of the sample was into the 5 and 6 month programs (3,5%, n=6) and this group mainly consisted in clients who had already tried Yukendu and repurchased the service for a longer program.
Table 1 shows descriptive statistics for age, achieved weight loss and plan duration (days). Mean achieved weight loss is 2.6 Kg, with some clients losing no weight.

32,16% (n=55) of the sample attained its aim, and another 29,82% (n=51) partially reached its objective at the end of the program.

Table 1. Descriptive statistics for Age, Achieved Weight Loss, and plan duration.

Variable	N	Min	Max	Mean	Std. Deviation
Age	171	21	75	41.42	9.6
Achieved Weight Loss (Kg)	171	0	15	2.58	2.3
Weight Loss (Kg/month)	171	0	7	1.42	1.2
Plan duration (days)	171	3	175	41.16	33.7

Data regarding communication between coach and coachee are shown in Table 2. Clients call their coaches on average 2,5 times: the difference in number of calls between men and women is minimal (respectively m=2,10 and m=2,63). It is important to note that some clients purchased the service but did not contact their coach again after the first call to set up the program.

Table 2. Descriptive statistics for calls and text exchanged between coach and coachee

Variable	N	Min	Max	Mean	Std. Deviation
Calls (total)	171	1	7	2.55	1.42
Calls (average per month)	171	0	7	1.52	1.10
Cancelled calls	171	0	7	.68	.94
Texts (total)	171	1	216	49.75	42.08
Text – Coach (total)	171	0	95	26.56	19.31
Text – Coachee (total)	171	0	130	23.51	25.06
Texts (average per month)	171	0	143	28.03	23.89

A multiple regression using number of text messages (averaged per month), number of calls (averaged per month) and plan duration as predictor variables was used to identify which factor contributed more to the weight loss (Kg/month). The model explained 56,9 % of the data variance in weight loss (Table 3).

Table 3. Regression model: dependent variable: weight loss (Kg/month); predictors: text messages, number of calls and plan duration.

R	R Square	Adj. R Square	SE of Estimates
.754	.569	.563	.817

Standardized Beta coefficients (Table 4) show that calls and texts (averaged on plan duration for each participants) between coach and coachee are significant predictors and contribute almost equally to the regression model. Plan duration (days) also is a significant predictor, even though its contribution contributes slightly less to the regression model.

Table 4. Model parameters: text, calls, plan duration; dependent variable: weight loss (Kg/month)

	Unstandarized coefficients		**Std. Coefficients**		
	B	SE	Beta	**t**	**Sig.**
(Constant)	-,129	,123		-1,045	,298
Text	,016	,003	,314	5,128	,000
Calls	,433	,066	,388	6,512	,000
Plan duration	,011	,002	,291	5,411	,000

4.Conclusions

These results suggest that communication between coach and coachee is a focal point for goal attainment and must be strongly addressed in training eHealth coaches. Plan duration is set by the purchased option, and the longer one stays in the program, the easier it is to attain one's goal. Communication, both telephone and text based, may generate more self-reflection, clarity in setting reachable goals and therefore long lasting behavioral changes in clients.

As most Yukendu clients chose to get involved into short-term program, the validity of these considerations is limited to the very beginning of the relationship between coach and coachee and at the very start of a long-term of an important behavioral change. It would be interesting to revisit these results with a more consistent sample of participants undertaking a long-term program and with other possible predictors (i.e. log data from the app, use of fitness plan and mindfulness training). It would also be important to have an objective measure of other possible goals (i.e. general health, fitness) attainable via eHealth coaching services.

It must be noted that this contribution is mainly focus on the quantitative aspects of communication (i.e. number of calls, texts). It would be interesting to analyze the exchanges between coach and coach qualitatively and with a particular focus on participants who actually attained their goals and those who did not. This kind of qualitative exploration would allow to identify which communicative strategies are functional to support in life style changes and which strategies are an hindrance to it.

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SECTION V

CLINICAL OBSERVATIONS

Cybertherapy is a field that is growing rapidly due to today's technology and information boom.

Virtual reality and advanced technologies have been used successfully to in a variety of healthcare issues, including treatment of anxiety disorders and phobias, treatment of eating and body dysmorphic disorders, neuropsychological assessment and rehabilitation and distraction during painful or unpleasant medical procedures.

The novel applications of these technologies yield many advantages over traditional treatment modalities, and the disadvantages that accompanied the first trials of virtual reality are quickly being addressed and eliminated.

Virtual reality peripherals such as data gloves, physiological monitoring and Internet worlds are swiftly demonstrating their usefulness in cybertherapy applications.

Wiederhold & Wiederhold, 2004

Trait and State Craving as Indicators of Validity of VR-based Software for Binge Eating Treatment

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Abstract. The aim of this study was to establish whether virtual reality (VR) exposure to food cues is able to produce craving levels consistent with state-craving and trait-craving as assessed by the Spanish and Italian versions of the State and Trait Food Craving Questionnaires (FCQ-T/S). The results were compared in 40 patients with eating disorders (17 with binge eating disorder, 23 with bulimia nervosa) and 78 healthy control subjects without eating disorders. Controls and patients with higher levels of trait-craving and state-craving both showed a greater desire to eat during VR exposure. Results also showed that trait and state craving assessed by FCQ-T/S were able to predict the total mean craving experienced during exposure to the VR software in both clinical and control samples. These findings present preliminary evidence about the validity of a new virtual reality-based application for cue-exposure treatment in patients with eating disorders.

Keywords. Virtual reality, cue-exposure therapy, food craving, clinical sample, bulimia nervosa, binge eating, low-cost VR systems

Introduction

Previous studies have shown that people who usually binge or experience loss of control over eating are those with highest levels of craving, assessed as a stable and consistent feature – that is, as a trait [1], subjectively experienced as a strong desire to eat.

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Food cue-exposure therapy (CET) has been proposed as an effective treatment for binge eating, given that it eliminates the association between stimuli related to binge eating and the craving response.

Traditionally, studies of CET for the treatment of bulimia nervosa (BN) have applied in vivo exposure [2, 3], in which patients are exposed to the foods they usually consume while bingeing, but they cannot accomplish a binge (response prevention). The results of these studies show significant improvements in symptoms, eliminating or significantly reducing binging and purging behaviors and, therefore, improving the overall health of the patient. Despite its benefits, in vivo exposure has certain limitations that must be considered. For example, therapists must have food available in their clinical office to carry out the exposure with the patient. Further, this context does not allow generalization to the different environments where the patient usually binges, and so in vivo exposure requires the therapist to be present in these real environments. Virtual reality (VR) technologies have been proposed as a new and alternative tool that improves on in vivo exposure. VR allows the simulation of realistic situations in which participants can interact in real time, producing an immersive and vivid sensation. Exposure to virtual reality stimuli has been successfully used in the field of drug addictions, and has proven its ability to elicit craving in people exposed to situations related to their addiction. Given the similarities between the craving experienced by people suffering addictions and that experienced by patients with BN and binge eating disorder (BED) [4], the use of exposure to virtual reality stimuli may prove suitable for the treatment of these pathologies. Indeed, studies of VR are now beginning to be published [5, 6, 7, 8].

VR seems to be an effective technology for eliciting food craving, especially in the case of participants with high scores on the State and Trait Food Craving Questionnaires (FCQ-T and FCQ-S) [9, 10]. The present study aims to replicate the results found in our previous study [10] with the incorporation of a clinical sample of patients meeting DSM-5 criteria for BED and BN, with the ultimate aim of identifying possible differences between control and clinical groups.

Methods

Participants and procedure

The sample comprised a control group formed by 78 undergraduate students (9 male and 69 female) without eating disorders, and a clinical group of 40 patients (10 male and 30 female), 17 of whom met DSM-5 criteria for BED and 23 the criteria for BN according to the SCID-I. Mean age was 22.66 ± 2.75 (range 19 to 36) in the control group, and 33.45 ± 9.77 (range 18 to 63) in the clinical group. The mean body mass index (BMI) was 21.83 ± 3.07 in the control group, and 27.46 ± 5.37 in the clinical group. Patients were recruited from two hospitals in the areas around Barcelona (Spain) and Milan (Italy), while all controls were recruited among college students at the University of Barcelona. After signing the consent form, all participants completed the Spanish or the Italian version of the State and Trait Food Craving Questionnaires (FCQ-T and FCQ-S) [11]. The FCQ-S measures the intensity of the current desire to eat (food craving) using 15 items divided into five dimensions. The FCQ-T measures a

person's characteristic food craving intensity using 37 items divided into nine dimensions.

After completing the questionnaires, participants were exposed to VR-based software developed for CET in binge eating. The software creates an exposure hierarchy as a result of combining four VR scenarios (kitchen, dining room, bedroom, and bakery/café) and the 10 foods that each participant has assessed as the ones that produce the highest levels of craving from a list of 30 foods. In the first steps of the hierarchy, participants were exposed to the foods that elicit the lowest levels of craving in the four different situations. During the last steps of the hierarchy, participants were exposed to the foods that provoke the highest levels of craving. In each environment, participants were asked to indicate the level of food craving on a visual analog scale from 0 to 100.

The virtual environments were presented using stereoscopic laptops. The level of immersion that this system achieves is lower than that achieved using other systems such as Head Mounted Displays (HMD); however, it is a low cost hardware and it can be used with very few technical complications, and so it is especially well suited for use by non-technologically specialized clinicians.

Statistical analyses

Correlation analyses were conducted to assess the association between trait-craving and state-craving scores obtained on the FCQ-T and FCQ-S and the mean food craving experienced in each of the four VR contexts (kitchen, dining-room, bedroom, and bakery/café).

Multiple regression analyses were also conducted to determine the percentage of variance explained by the model, including FCQ-T and FCQ-S scores as predictor variables. This analysis also assessed which of the two variables (trait-craving and state-craving) contributed more to predicting the food craving experienced during VR exposure. Analyses were conducted separately in control and clinical samples in order to explore differences between the two groups.

Finally, an independent Student's *t* test was also applied to compare FCQ-T and FCQ-S total scores obtained by the control and clinical samples. Significance levels of $p<.05$ were considered.

Results

The results in Table 1 show significant, positive correlations between both FCQ-T and FCQ-S scores and the mean craving experienced in each of the four VR contexts in the control group. The strongest correlations were found between food cravings and the FCQ-S scale. The results also showed significant and positive correlations between cravings experienced and state-craving scores on the FCQ-S in patients. However, no significant correlations were found between food cravings and the FCQ-T scale in the clinical group.

Table 1. Correlations between trait-craving and state-craving scores on the FCQ-T and FCQ-S and the mean food craving experienced in each of the four VR contexts in controls and patients.

		Kitchen	Dining room	Bedroom	Cafeteria
FCQ-T	Controls	.234* (*p*=.039)	.230* (*p*=.043)	.289* (*p*=.010)	.266* (*p*=.018)
	Patients	.176 (*p*=.276)	.196 (*p*=.226)	.176 (*p*=.276)	.005 (*p*=.975)
FCQ-S	Controls	.570** (*p*=.000)	.551** (*p*=.000)	.508** (*p*=.000)	.513** (*p*=.000)
	Patients	.427** (*p*=.006)	.423** (*p*=.007)	.542** (*p*=.000)	.347* (*p*=.028)

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

The results of multiple regression analyses are shown in Table 2. The model, which includes the variables of trait-craving and state-craving, is able to predict food craving experienced during VR exposure in the different 3D environments in both control and clinical samples. The results also show that our model explains 30% of the variance in food craving for the control sample, and 24.1% of the variance in food craving for the clinical sample. In both control and clinical samples, state-craving assessed by the FCQ-S makes the largest (beta=0.531 and beta=0.589, respectively) single contribution to explaining the craving experienced during exposure to foods in the virtual environments. The contribution was also statistically significant (*p*=.000 and *p*=.002, respectively).

Table 2. Multiple regression analyses including FCQ-S and FCQ-T scores as predictors of mean food craving during VR exposure in the whole 3D environments.

	Model	Predictors	Beta	*t*	*p*	R^2	Adj. R^2	*F*	*p*
Controls	Food craving					.300	.281	16.05	.000
		FCQ-T	.037	.347	.729				
		FCQ-S	.531	4.984	.000				
Patients	Food craving					.241	.199	5.859	.006
		FCQ-T	-.221	-1.241	.223				
		FCQ-S	.589	3.303	.002				

Finally, the Student's *t* test revealed a statistically significant difference between clinical and control samples in FCQ-T and FCQ-S total scores. The clinical group presented higher scores on both FCQ-T (*M*control = 86.41 ± 24.95 vs. *M*clinical = 129.72 ± 27.33, *t*116 = -8.64, $p<.05$) and FCQ-S (*M*control = 26.41 ± 10.93 vs. *M*clinical = 43.40 ± 12.15, *t*116 = -7.69, $p<.05$).

Conclusions

In agreement with our previous studies [9, 10], people with higher levels of trait-craving and state-craving also showed a greater desire to eat during VR exposure to virtual foods in the different 3D environments. Our results also determined the extent to which trait-craving and state-craving may predict food craving elicited via VR in both clinical and control samples.

The results showed that trait and state craving assessed by FCQ-T/S were able to predict the total mean craving experienced during exposure to the VR software in both clinical and control samples. State-craving, assessed by the FCQ-S, made the largest contribution to explaining the craving experienced during VR exposure in the two groups. The contribution was also statistically significant.

Although previous studies have found that people with higher levels of trait-craving usually present more binges and a higher tendency to lose control over eating [1], our results showed that state-craving was the main variable associated with perceived craving during VR exposure. Therefore, in both controls and patients, the craving experienced may be determined by contextual variables more than by stable individual variables.

Our findings suggest that this VR-CET model using stereoscopic laptops may be helpful in improving the treatment of binge eating behaviors for bulimia and binge eating disorder, given that the food cravings experienced during the VR exposure were consistent with state/trait cravings assessed by means of FCQ-S/T.

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Robotic Companions for Older People: A Case Study in the Wild

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Abstract. Older people tend to have difficulties using unknown technical devices and are less willing to accept technical shortcomings. Therefore, a robot that is supposed to support older people in managing daily life has to adapt to the users' needs and capabilities that are very heterogeneous within the target group. The aim of the presented case study was to provide in-depth insights on individual usage patterns and acceptance of a mobile service robot in real live environments (i.e. in the users' homes). Results from three cases (users aged 67, 78 and 85 living in their own apartments) are reported. Findings on usability and user experience illustrate that the robot has considerable potential to be accepted to support daily living at home.

Keywords. healthy aging, humanoid companion-type robot, HRI, user acceptance

1. Introduction

Assistive service-robots offer enormous potential to meet occurring challenges in health care caused by severe demographic changes [7]. Robots assisting older people to manage everyday life need to perform a variety of tasks, interact flexibly, and adapt to a wide range of capabilities and health constraints in non-standard situations and environments [2]. Thus, the development of such a device, which is being designed to play a role in the lives of ordinary people, has to be user centered [3]. The design of the system has to adapt to the user's needs in a way that the user does not need to change his/her habits when working with it [8]. Although previous research has addressed senior acceptance of citizens of service robots, studies conducted "in the wild" (i.e. studies with robots autonomously operating in seniors' homes) are lacking [7].

2.Related Work

Currently many service-robots are developed to assist elderly people with functional activities in their daily lives (e.g. medication management, monitoring, emergency help or feeding) [7]. Other developments focus on providing companionship, entertainment, and communication [6]. So far, robot-development is mostly technology-driven and available robots are predominantly prototypes [1]. Social and psychological research is mainly engaged in studying aspects such as embodiment/bodily presence, personality,

empathy, engagement, adoption (the ability of the robot to learn about its users' behaviors, needs and preferences and adjust to them) and transfer (the ability of the robot to change user behavior in the long-term) [7].
Robots supposed to assist the elderly are confronted with a wide range of capabilities and health restraints of the elderly, great variability regarding the environment of private homes as well as manifold tasks that might be solved during the course of the day. For successful purpose individual capabilities, needs and technological possibilities have to match [2]. So far, there is very little experience with such complex scenarios [7].
In this paper we present a case study serving to optimize a companion-type service-robot for health assistance for the elderly supporting everyday life, involving elderly people and testing in everyday scenarios in real-life situations. Therefore, an explorative multi-case study was conducted [9].

3. Case Study

The case study intends to answer the questions whether the target group accepts the developed robot as supposed. Therefore we tested whether the robot (technically) performs well, usability matched the requirements of the target group, and user experience was positive.

3.1 Case Selection

Three older people (aged 67, 78, and 85) with varying health conditions received a service robot and interacted with it within their homes. Case one is a male senior, aged 67, without any major health problems and an affinity to technology (e.g. using PC and smartphone daily). Case two is a single woman, aged 85, who suffers from severe health restraints (diabetes, cardiovascular diseases causing serious balance problems), not using technical devices on a regular basis (apart from TV and telephone). The third case is a 78 year old woman with severe health restraints (cardiovascular and respiratory disease). She is quite interested in using technology (especially frequenting her PC daily) though not experienced. She takes care for her husband (suffering from dementia, diabetes, and severe mobility problems) who lives with her in a two-room-apartment. All three respondents were already familiar with the robotic platform. They got exhaustive test instructions including a training how to use the robot.
All three apartments were mapped and tested before the case study was executed. The apartments provide a challenge for robot navigation because of narrow passages, difficult light conditions, and various immobile obstacles that are difficult to detect (e.g. low jutting edges or glass-topped tables).

3.2 The Assistive Service Robot

The participants were asked to interact freely with the mobile humanoid companion-type robot (see figure 1) offering various functions to facilitate everyday life like video telephony to support social interaction, monitoring vital signs (e.g. measuring pulse rate), or calendar functions for cognitive support including reminders for medication.

The robot could be navigated using a touch display, communicated verbally and nonverbally, and reacted with paraverbal feedback (purring) when stroked at its head [4].

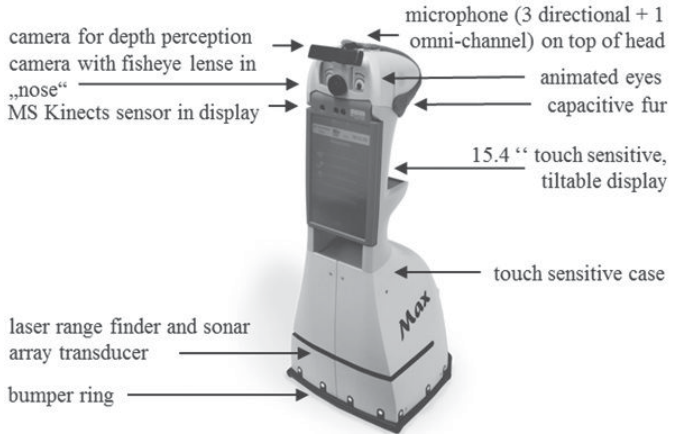

Figure 1. Robotic Platform MetraLabs SCITOS G3

3.3 Criteria Measuring User Experience

Referring to the theoretical framework of the ALMERE model [5], objective usability indicators (effectiveness, efficiency, learnability, and robustness) were measured. A particular focus of user experience is laid on how capable the robot actually is regarding human necessities like companionship. Therefore, safety, joy of use, co-experience, and intention to use [5] as well as satisfaction were measured.

3.4 Data Collection and Data Analysis

Respondents were visited in the morning or early afternoon. They were asked to use the robot’s applications for whatever and as long as they would like to. To assess comprehensive information, objective and subjective measurement methods were combined collecting qualitative and quantitative data.

Throughout the whole test a member of the research team was present observing the situation. The test was recorded on video and audio devices. In addition, field notes were taken. The robot’s activities were logged throughout the whole test (log files).

We used thinking aloud to audio record the subjective impressions of the users throughout the test session. After finishing the test session respondents were interviewed (semi-structured interview guide). In order to assess holistic information, content analysis of transcribed interviews and thinking aloud protocols for subjective data as well as field notes were triangulated with quantitative data from log file analysis (robot's actions and user's input were continually logged) for objective data for each case. Finally, the single cases were compared to find common or contrasting patterns.

4.Findings

4.1 Usability

Although each test session was about the same length (35-40 min), active interaction time with the robot varied (63%, 76%, 97% respectively). Regarding usability aspects, learnability was high although handling applications took some practice. Effectiveness and efficiency were low as robustness was still limited and issues concerning dialogue design arose at the given point in time.

4.2 User Experience

Despite the fact that all three users showed some concern regarding safety and usability, the overall user experience was positive: Respondents (see figure 2) were satisfied, joy of use was rated high.

Figure 2. Users interacting with the Robot.

Co-experience was rated high as well for several reasons: The users individually named the robot (‘Max’, ‘Robbi’, ‘Little One’), welcomed it heartily, and insisted to say farewell. In general co-experience was obvious concerning communication. Although the robot cannot recognize and react to speech, users asked back and commented in a way so that lively conversational sequences appeared. Likewise, the robots non- reactive, random twinkling was interpreted as a positive nonverbal reaction of the robot confirming activities or answering questions. Further, it could be observed, that users were talking to the robot as if it was a human being. They praised it (e.g. “See, if you try, you can do it!”), felt sorry for failures (e.g. “I know that’s difficult, I will teach you.”), ranted (“I told you before, don’t do it!”), cared about its condition (e.g. “Are you tired?”) or even asked for its opinion (e.g. “What would you like to do next?” or “Would you mind to be remote controlled?”). The most noticeable effects of co- experience could be observed when the robot reacted to stroking its head (capacitive fur). In case 1 the user triggered the reaction by accident. Right in the moment when the robot purred, he interrupted his current activity, turning to crawl the robots head for several seconds. The senior of case 2 insisted to stroke the robot at the end of the test session intending to reward its good work (Figure 3 above). The most impressing effect could be achieved in case 3. The users’ husband avoided interacting with the robot because he was afraid of it until he recognized it purred.

Each user acknowledged the intention to use the robot in the future. The user of case 1 could imagine exercising with the robot, especially looking forward to motivating companionship as well as professional feedback. Thus he would appreciate if the robot could motivate him for activities outside the apartment. The senior in case 2 was especially curious about security aspects provided by the robot (e.g. alerting before or assisting in case of emergency). The third senior would use the robot to support her while taking care for her husband (e.g. accompanying and appeasing him if she has to leave the house or to support him with exercising). She also would be delighted to use the robot as a partner for gaming.

5. Discussion

Apart from the necessity to improve usability (e.g. speech recognition should be implemented and navigation needs improvement), especially high ratings of co-experience indicate that the robot has high potential to be accepted as a companion and health supporter in everyday life of older people.

Testing an early prototype comes with limitations: There were technical issues making it difficult to reproduce exactly the same conditions for each test run. The differences that occurred were taken into consideration when interpreting the collected data. Additionally, recruiting adequate respondents from higher age and the intensive pretesting before the field tests are very time consuming. Still, preliminary findings of the case study turned out to be helpful for robot development.

Further research questions need clarification before robotic companions can be introduced to the elderly: 1) Does the robot work robustly over a long time in unknown environments? 2) Will there be effects of habituation in long-term-use – positive (e.g. increasing safety and trust) or negative (e.g. decreasing interest in interaction)? 3) At which times during the course of the day, respectively for which activities, will the robot be seen as supportive or distractive?

So far, the case study is restricted to findings of highly individual usage patterns in a short-term scenario in the wild. Thus, further research with larger samples and long-term scenarios integrating the robot in the seniors' everyday schedule is needed.

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Movement-Based VR Gameplay Therapy For A Child With Cerebral Palsy

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Abstract. This paper presents a single-subject feasibility study of a motion-based VR game designed to provide benefits similar to constraint-induced movement therapy for children with cerebral palsy, while providing a more enjoyable experience. The game was designed to encourage the child to perform the desired therapeutic movements by allowing him to interact with the game using only his more-affected arm. The study used an AB design: Performance across baseline and intervention phases was assessed to determine whether the intervention resulted in changes to repeated measures. Results of the study showed that compared with baseline measurements done prior to his game experience, the participant's post-intervention performance showed improvement in speed of reach, dissociated movement, and bilateral integration of upper extremities in functional tasks. The child's mother, as well as one of his therapists, reported better performance outside of the study environment as well.

Keywords. Movement-based therapy games, cyber rehabilitation, games for health.

1. Introduction

Children with cerebral palsy (CP) often present asymmetrical or unilateral impairments Due to failure in activities using the impaired upper extremity, the child may limit attempts to use the limb, resulting in a condition known as learned nonuse or developmental disregard. Children may be unable to perform daily functional tasks that require the coordinated use of both arms. Some form of constraint-induced movement therapy (CIMT) is frequently used as a treatment strategy. CIMT is designed to improve function in children with motor impairment by constraining the less-affected limb and having the child practice repetitive tasks with the more-affected limb only. The purpose is to increase spontaneous use of the affected limb and limit the effects of learned nonuse. CIMT has been shown to be useful in children with CP [1] [2], although it may not be especially child-friendly [3] for several reasons, top among them are the restraint of the less-affected limb and the repetitive nature of the therapy. In this paper we present a single subject study of a Virtual Reality (VR) game specifically designed to elicit the appropriate therapeutic movements of CIMT, while replacing the repetitive task performance with game play and eliminating the need to restrain the less

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affected arm by tracking only the more-affected limb, so that the child can only interact with the game by using this limb.

2. Previous and related work

Research on the effectiveness of VR therapy for children with motor impairments has been on-going for several years, with mixed results. Of particular relevance to this work are the studies that have addressed the use of VR therapy for upper extremity impairment. Here, we discuss some of the more recent research.

Green and Wilson [4] did a case study using the RE-ACTION system, a table-based augmented reality system requiring the participant to move physical objects over a projected virtual environment. Four children participated in the study. Trend analysis showed that two of the participants made progress with some translation to daily activities. Olivieri, et al, [5] used a non-immersive VR system in a study of six children with congenital hemiplegia. Results indicated that the children enjoyed the therapy and that their Melbourne Assessment of Unilateral Limb Movement showed a statistically significant increase. Other evaluative methods did not reflect this outcome. Yoo, et al, [6] combined a non-immersive VR game with EMG biofeedback to determine if VR could improve reciprocal inhibition (triceps/biceps) during a reaching task in children with spastic CP. Three children participated in the study. The VR game, "Aqua", was used to provide real time visual and EMG biofeedback during game play. Results showed an additive effect of VR integrated with EMG biofeedback in improving underactive triceps activation while reducing overactive biceps activation, as measured using the EMG data. Other researchers have studied the use of commercially available VR-like gaming systems as a therapeutic tool. Li, et al. [7] did a usability study of home-based VR intervention using the Sony PlayStation® 2 and the video camera-based EyeToy. Five children with hemiplegic CP participated in the study. Researchers determined that the VR system successfully elicited targeted hand/arm movements of the affected limb and that the intervention appears to have had a positive effect on participants' motor function. Levac, et al. [8] studied the use of the Nintendo® Wii to augment traditional therapy. These researchers reported little success and listed several possible reasons; among them were that the children were too involved in playing the games to want to make the desired movements and that the games were either too hard or too easy to be of therapeutic value. Still, the benefits of VR in therapy have yet to be fully explored. The purpose of this study is to further investigate whether improved measures of motor performance will be seen with the use of motion-based VR gameplay.

3. Procedures and Methods

3.1 Participant

The participant in this study was a ten-year-old boy with a clinical diagnosis of cerebral palsy. He had low postural tone and exhibited some ataxic (uncoordinated) movements when performing functional tasks with his arms and hands. The child was left-hand dominant and avoided using his more-affected right arm and hand. According to his

mother, he had difficulty accomplishing tasks that required using both of his arms, such as hand washing, or reaching with arms extended forward, sideways or up.

3.2 2 Experimental Setup

The video game developed for this study was a three-dimensional version of the "memory" game in which the player must find six matching pairs of animal images on the faces of square blocks arranged in a grid. The positions of the blocks were calibrated to the measured limits of the child's right arm reach. A 55-inch HD TV was used as the display and a Polhemus Liberty™ magnetic motion tracking system was used to track the child's right hand and to update the position of a red sphere representing his hand movement in the game. To make the game more fun, a second tracker driving the position of a blue sphere was also available to allow a researcher or parent to play in either cooperation or competition with the child. See Figure 1.

Figure 1. Participant playing the game.

3.3 Design and Procedures

A single-subject AB design was utilized to assess within-subject performance. Measures of performance across baseline and intervention phases were used to determine whether the intervention resulted in changes in (a) speed of reach with the affected upper extremity, calculated from motion tracker data; (b) enhanced upper extremity skills, measured using the dissociated movement subscale from the Quality of Upper Extremity Skills Test (QUEST) [9]; and (c) bilateral integration of the upper extremities in a functional task, measured using the Goal Attainment Scale (GAS) [10] which scores between -2 and +2. Hand-washing was the chosen task.

The procedure consisted of four phases: a) a pre-intervention assessment session using the measures listed above; b) five baseline sessions wherein reach data was collected using the trackers as the seated child reached for three dangling plastic fish suspended at the upper left, middle, and lower right extremes of his motion; c) nine intervention sessions using the motion-based VR game; and d) a post-intervention assessment session using the same measures. A weekly log was provided for the child's mother in order to supplement the quantitative data. The child's mother was asked to record any changes noted in the participant's overall functioning, upper extremity functioning, mood and demeanor through the duration of the study. Twice weekly sessions were scheduled over a period of 14 weeks, however, changes in scheduling occurred during this time due to scheduling conflicts, illness, and scheduled holidays.

During the initial baseline session, the researchers assessed upper extremity functioning using the QUEST and the GAS hand-washing task. The participant's functional reach was then quantified by using the motion-tracking device while he participated in the non-VR reaching task. This repeated measure was completed at each

of the five baseline sessions. At the start of the sixth session, the introduction to the VR intervention phase, the participant completed the dissociated movement portion of the QUEST, performed the hand-washing task for the GAS, and completed the reaching task. The participant was then introduced to the VR game, which he played for approximately seven minutes. At the end of the session, he completed the Satisfaction Rating Scale. During the nine sessions of the VR intervention phase, the participant completed the non-VR reaching task followed by playing the VR game for as long as he could tolerate. By the end of the intervention phase, the child was able to tolerate approximately twenty-five minutes of continued practice in the VR game. Sessions consisted of playing variations of the game wherein the child played alone, or in competition or cooperation with his mother or a researcher. During the ninth and final intervention session, the participant completed the QUEST, GAS, and reaching task, participated in the VR game, and completed the Satisfaction Rating Scale. During a post-intervention meeting that same day, the family weekly log was collected and a closing interview with the child's mother was held in order to gain any subjective data regarding her perceptions of his upper extremity functioning and the overall experience of the research project.

4. Results

4.1 1 Repeated Measures

QUEST dissociated movement scores were 81.25 at pre-baseline, 92.88 at post-baseline, and 100 at post-intervention, demonstrating a ceiling effect. At pre-baseline, limitations were noted in right shoulder abduction, elbow flexion and extension, and wrist extension. Limitations persisted in elbow flexion and extension, and wrist extension at post-baseline. These limitations, however, were resolved at post-intervention, when the child demonstrated full range of motion in all planes of movement. The child scored a -1 on the GAS for bilateral integration at the initial baseline assessment, completing 6 of 15 subtasks. At post-baseline, he scored a 0, completing 9 of 15 subtasks. At post-intervention he scored a +2, the highest possible score, and completed all 15 subtasks independently. Speed of reach to and from the targeted plastic fish was analyzed using the two standard deviation band method [11] which showed there was a statistically significant change in all directions between the pre-baseline and post-intervention assessments. On the Satisfaction Rating Scale, the child rated satisfaction with the game at five (highest score), participation in hand washing as a two, and upper extremity function as a four during the post-baseline session. At the termination of the study, the child rated each question as a five, indicating better satisfaction with his own performance.

4.2 Qualitative Data

Subjective information regarding the child's performance was also compiled from the weekly log. During the VR intervention phase, the child's mother reported seeing changes in performance of functional tasks such as hanging Christmas tree decorations, participating in volleyball, putting on and removing gloves, socks, orthoses, shoes/boots, making the bed, dressing, and reaching into cupboards. The child was reported to have been completing tasks more independently, providing self-appraisal,

seeking praise for newly acquired skills and continuing to strive for independence. The child's mother described greater success with the task of hand washing, with improvements in initiation of task and independence in completion. She also described an increased sense of accomplishment, confidence and sociability throughout his daily life. Finally, at the end of intervention, the occupational therapist working with the child reported improvements in bilateral integration during activities such as playing musical instruments with mallets using both hands at the same time.

5. Conclusion

Gains noted in motor skill acquisition and motor learning by the participant are not typically seen in children with cerebral palsy throughout school age [12]. These improvements in reaching performance and bilateral integration for a child at the age of ten years imply that goal-oriented task completion in a VR game may provide greater results when used in conjunction with typical therapy. The child's positive rating of his VR experience suggests that it is a more child-friendly method for delivering CIMT-like therapy than is the traditional method.

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Development Of A Virtual Environment Based On The Perceived Characteristics Of Pain In Patients With Fibromyalgia

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Abstract. Fibromyalgia (FM) is a disorder characterized by chronic physical pain. The perception of this pain has psychological effects on mood, anxiety, and the degree of perceived control. In turn, these factors may increase the experience of pain. This study aims to develop a new virtual environment for the treatment of FM in order to enhance the therapeutic effects of traditional interventions. The first phase included a sample of 19 patients in order to identify common characteristics of the representation of pain and absence of pain, through drawing. The results showed that patients used different colors and different physical states to depict pain (red, motionless) and the absence of pain (blue, in motion). These features were then included in a 3D representation of the human body. ANOVA analysis showed that the degree of anxiety and depression influenced the perceived characteristic of movement.

Keywords. Virtual reality, Fibromyalgia, characteristics of pain, clinical sample.

Introduction

Fibromyalgia (FM) is a disorder characterized by chronic widespread pain in different areas of the musculoskeletal system, including hyperalgesia and allodynia. FM patients may present other related symptoms such as intense fatigue, sleep disorders, paresthesias, stiffness, headaches, and a feeling of swelling in the hands. Due to the variety of the symptoms, patients commonly present hypervigilance toward pain perception, and frequently engage in testing behaviors by touching the parts that are painful (1).

In addition to these physical effects, various psychological states have also been shown to be directly involved with pain. Studies have shown that negative mood correlates positively with pain perception and a lower quality of life (2). The level of anxiety also presents a positive, statistically significant relationship with pain intensity (3). In addition, an increased perception of control encourages patients to believe that they are able to cope with the pain, and increases the use of active coping strategies (4) which reduce the physical and psychosocial impact of FM (5).

Cognitive Behavioral Therapy (CBT) has only a moderate effect on these psychological variables (6). Developing alternative treatments based on new

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technologies may enhance the therapeutic benefits. Virtual Reality, for example, achieves greater effectiveness than exposure in vivo in anxiety-related disorders (7). This new software aims to promote an active confrontation with pain rather than focus on the distraction of attention which characterizes other environments for the treatment of chronic pathologies.

In a preliminary study, Gutiérrez and colleagues (8) created a virtual environment to represent states of acute pain and no pain. This virtual environment was able to reduce pain intensity and increased participants' tolerance (9). These authors concluded that this environment also increased auto-efficacy, and reduced catastrophism (10).

Continuing this line of research, the aim of the present study was to develop a virtual representation of pain and no pain states for patients with FM. A second objective was to identify pain-related characteristics that may be conceptualized as continuous, to enable individuals to transform their own perception of pain. Finally, a third aim of study was to find relations between perceived characteristics of pain and anxiety and mood.

Based on previous research (8, 9, 10), this new virtual environment was developed from FM patients' experiences of pain of and was specifically designed for use with these patients to complement their standard treatment which consisted in CBT for FM. Pain experiences were recorded on a Visual Analog Scale (VAS) included in the software to quantify specific pain variables. Based on the procedure developed by Gutiérrez and colleagues (8), the VR environment also allowed patients to modulate these pain-related variables. In the light of previous results (9), we expected to find a pain reduction that would lead to an improvement in mood and a reduction in anxiety, finally raising patients' quality of life and enhancing their perceptions of efficacy (10).

1. Methods

Nineteen patients diagnosed with FM participated voluntarily in the study. First, they were asked to draw their representation of pain and to write down the most relevant characteristics of pain experienced. Then, they drew a representation of the absence of pain and again had to write down its most important characteristics. In order to quantify their experience of pain, participants also completed the McGill Pain Questionnaire (MPQ) (11), containing 21 items divided in four subscales: sensory, emotional, evaluative, and pain intensity. The degree of anxiety and depression was also quantified using the Hospital Anxiety and Depression Scale (HADS) (12), which has 14 items measuring anxiety and depression.

2. Results

Pain variables were categorized by color, image drawn, and the participant's depiction of the key feature of their pain. Over half the participants (57.9%) chose red as the color to represent pain. The most frequent image drawn was the human body (36.8%). The most prevalent description of pain was the feeling of stiffness (68.4%).

Blue was used by 31.6% of the participants in their representation of absence of pain, and green by 26.3%. As regards the shape, 42.1% of participants drew a human body,

and as the feature that best described the absence of pain, 52.6% of participants mentioned movement

The contingency tables revealed that 36.4% of those who chose red in the figure of pain also chose blue in the figure of absence of pain. Another 36.4% chose green to represent the absence of pain. Meanwhile, 85.7% of participants who drew a human body in their representation of pain also drew the human body when asked to represent the absence of pain. Finally, 61.5% of participants who described the key feature of their pain as a sensation of stiffness also defined the absence of pain by a description of movement.

According to these results, a 3D representation of the human body was created in order to maintain a continuum between the graphic representations of pain and the absence of pain

The MPQ-SV pain location scale was used to identify the most frequent pain locations. Areas in which more than 60% of the sample reported pain were considered significant enough to merit virtual representation. The human figure was divided into 27 parts: neck, right shoulder, left shoulder, lower back, front left and right forearm, forward left and right forearm, left and right front hand, left and right back hand, front left and right arm, back left and right arm, back left and right thigh, front left and right foot, back left and right foot, left and right chest and head.

Ambient sounds of creaking wood and the sea were also included to induce discomfort and relaxation respectively. The pain variables described above were also included to represent the continuum between pain states and the absence of pain: red-blue, stiffness-movement.

Analysis of variance was conducted to assess whether the degree of depression and anxiety influenced the characteristics of the figure. For this analysis, the sample was divided into two groups according to the cutoff scores on each subscale of the HADS (13)**:** $M_{\text{Low-Anxiety}}$=8.05±2.61, n=12 vs. $M_{\text{High- Anxiety}}$ =15.14±2.11, n=7, and $M_{\text{Low-Depression}}$=6.57±2.56, n=5 vs. $M_{\text{High-Depression}}$ =14±1.87, n= 5. The results showed that anxiety (p = 0.008) and depression (p = 0.004) affect only the movement of the figure, and presented an inverse relationship.

3. Conclusions

The results provide useful information for the creation of a virtual representation of perceived pain in people with FM, consisting of a 3D figure of a human body. As regards our second objective, we found two central continuous variables (color, and movement) which differed in the quantitative representation of pain and no pain. A third continuous variable was also included: background sound, which can be modulated to improve the immersive sensation. The incorporation of these features in in each part of the 3D human body allows participants to modulate perceived pain.

In this software, the subject selects the body part that presents the most pain, and the intensity of pain is assessed by means of a VAS that ranges from 0 (no pain) to 10 (extreme pain). According to this measure, the software assigns to each patient the corresponding value of intensity of pain represented in three pain variables in the selected body part: color, movement and sound. Each of these three variables are displayed in independent VAS. The patient can gradually transform the pain variables into a pleasant and less painful environment. After completing the task, pain intensity is assessed again by VAS. Returning to the selection area, users can select another area to represent pain and reduce it. They can choose between all areas in which the pain is

significant, until there are no painful areas to modify. Then, they can leave the software. Following on from the results obtained by Gutiérrez and colleagues (9) a significant reduction in pain levels is expected, with a decrease in the presence of catastrophic thoughts and an increase in self-esteem.

Despite the exploratory nature of the study, it presents several similarities to previous publications in the literature. First, the fact that patients who have higher levels of anxiety show less movement may be due to the fact that anxiety has a large avoidant component which diminishes the subject's degree of movement (15).

Second, with regard to depression, according to Seligman's theory about learned helplessness (15) when the patient considers that s/he lacks the skills needed to overcome the situation, s/he reduces the number of activities.

Third, identifying areas of the body as painful simulates the new diagnostic criteria for fibromyalgia (16). However, some areas were not significant: the buttocks, abdomen and jaw. The software is able to enter all areas that may be considered important in future research.

Finally, when patients observe the movement of a body part, mirror neurons are activated. As a result, they have the same brain activation as if they were moving the painful area, and a significant reduction in perceived pain is achieved (17).

Therefore, these results are concordant with previous literature, and suggest that this virtual representation has good construct validity. Future research should aim to determine whether this environment is useful as a component of the traditional CBT treatment for FM. It should also be determined whether this virtual environment is able to reduce pain perception by people with fibromyalgia, thus improving their psychiatric symptoms and facilitating active coping strategies for pain.

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A Pilot Study Using Mindfulness-Guided-Relaxation & Biofeedback To Alleviate Stress In A Group

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Abstract. The following study investigated the efficacy of a mindfulness intervention to reduce staff stress at a university in Melbourne that was undergoing a restructure and relocation. Using mindfulness guided-relaxation that incorporated positive emotions, controlled breathing and biofeedback monitors, 13 university staff recorded their sympathetic and parasympathetic activity over a four week period. They also supplied qualitative reflections of their experience. After one session of guided-relaxation and biofeedback there were significant increases in parasympathetic activity. For those people that continued practicing guided-relaxation by listening to a digital recording of the session, these gains continued to increase.

Keywords. Work Stress, Anxiety, Mindfulness, Positive emotions, biofeedback, Relaxation

1. Introduction

Anxiety disorders are the most common mental illness in the United States of America and this pattern can be found in most developed countries around the world [1]. Looking at effect sizes for psychological interventions for anxiety, they generally rival, or exceed, those of widely accepted pharmacological treatments [2]. Cognitive Behavioral Therapy (CBT) in particular, has been found to be more economical in the long run when compared to pharmacological interventions for anxiety [3] and CBT has received widespread empirical support for it leading to significant reductions in worry and anxiety by post-treatment [4]. CBT and Applied Relaxation (AR) are often similar in efficacy and research evidence strongly endorses the superiority of incorporating both interventions when compared to other treatments for anxiety [5].

There is also a growing recognition that psychological interventions can work equally well across a range of disorders [6]. For example, when robust treatments such as CBT and relaxation are effectively implemented, they can alleviate a number of common psychological symptoms irrespective of diagnosis. Additionally, there are a number of treatments that have incorporated a range of simultaneous inventions to reduce anxiety and stress to great advantage. For example, Thurber, Bodenhamer-Davis, Johnson,

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Chesky and Chandler [7], instructed their participants in emotional regulation and controlled breathing exercises. The researchers found a 75% decrease in anxiety and subjective improvement in performance after just five sessions of training. Reiner [8] also incorporated slow diaphragmatic breathing and CBT into his clinical outpatient treatment program over a three week period for people with anxiety disorders. He found significant reductions in anxiety when his participants were provided with the addition of portable biofeedback heart rate variability monitors. In Reiner's study, participants were taught to breathe in a relaxed and rhythmic way, in conjunction with focusing on positive cognitions. Using this method, relaxation techniques can help people become more aware of their own physiological responses and the differences between states of stress and calm. His participants were able to see dynamic representations in the change of stress levels (HRV) on a computer screen in front of them.

Recent studies that have incorporated computer-based heart rate variability biofeedback into large group programs have been found to be helpful. They reported a reduction in anxiety, especially when used in conjunction with CBT and relaxation strategies [9], or while focusing on positive emotions and controlled breathing [10]. Biofeedback heart rate variability (HRV) monitors are inexpensive and give practitioners and clients immediate feedback on the percentage of stress levels. Heart rhythm coherence (synchronizing positive emotions with HRV activity) and biofeedback has been developed to facilitate awareness of what is also known as psychophysiological harmony. McCraty [10] has found that increasing synchronization between physiological activity and positive emotions can enhance cognitive functioning, focus and attention. Furthermore, by training people to utilize biofeedback and emotion-focused techniques, he has shown that maladaptive patterns of physiological response to stress can be replaced with more positive responses such as emotional stability and mental acuity.

From another perspective, cognitive therapists theorize that by changing an individual's thought processes around stressful or anxiety provoking situations that this will help a client to gain more control over their emotional reactions to unpleasant stimuli and thus reduce stress [3]. However, neuroscientific data has shown that emotions can occur in the absence of cognitive activity and can influence subsequent cognitive processes [10]. In this regard, Bradley et al. [11] suggest that psychophysiological harmony building techniques can help to recalibrate a new set point for emotional responses which the brain can refer to in future anxiety provoking situations. This recalibration may include focusing on positive feelings or pleasant images, rather than specific thoughts.

The impetus for the present study developed out of necessity. The researcher was present at a University Campus in outer Melbourne that was targeted for closure, voluntary redundancies and moving the remaining staff to another faculty one hour away by car. Consequently, there was a lot of uncertainty about the future among staff. As with any major change in the workplace, stress levels usually increase and morale decreases, often with adverse physical and psychological consequences [12]. Therefore, it was very obvious to me as a staff member and practicing psychologist that people were stressed and anxious and that there was an urgent need for an intervention to reduce these adverse symptoms. Mindfulness guided-relaxation incorporating positive emotional images and feelings was selected to be administered in a group setting in conjunction with biofeedback. It was anticipated that sympathetic activity would be replaced with parasympathetic activity with the introduction of a mindfulness guided-

relaxation session and that parasympathetic activity would continue to increase with regular practice and thus indicate a more integrated reduction in stress and anxiety.

2. Method

2.1 Participants & Measures

The sample consisted of 13 university staff comprising 12 females with a median age of 52 years and one male aged 57 years. The parasympathetic and sympathetic systems were measured using an EmWave Biofeedback monitor during a mindfulness guided-relaxation session that incorporated eliciting positive emotions and controlled breathing. The monitor shows three bar graphs that change depending on the activation of the sympathetic or parasympathetic systems. The monitor displays heart rate and measures the variability of heart rhythms. When a person is stressed or anxious it displays a level of red color. When the person is relaxed it displays a green color (psychophysiological harmony). It also calculates the time a person is in a particular color zone reflecting their current state. Participants listened to the researcher give a mindfulness-relaxation session, which was recorded and made available for future sessions. Participants also provided qualitative reflections of their mindfulness experiences.

3. Results & Discussion

The purpose of this study was to investigate whether a mindfulness guided-relaxation that incorporated positive emotions and controlled breathing that was to a group, could help reduce staff stress and anxiety during a difficult restructure and transition. Although relaxation and CBT techniques are known to be beneficial for reducing stress and anxiety over time [5], introducing mindfulness guided-relaxation while focusing on positive emotions and viewing a biofeedback monitor, was found to reduce sympathetic activity (stress) in the group in just one session.

Negative high-energy emotions activate sympathetic activity and are related to anger, hostility, frustration and rage and negative low-energy emotions such as hopelessness, resignation, despair, depression, sadness and apathy. In these states cortisol, which is known as the "stress hormone", is released and if the secretions become chronic is associated with ill-health [10]. There was a dramatic increase in average parasympathetic activity with this cohort from the baseline measure and then immediately after the guided mindfulness-relaxation.

This study incorporated a repeated measure design using SPSS version 21 to assess changes from baseline measures of sympathetic and parasympathetic activity and then immediately after the intervention was completed. EmWave biofeedback monitors were concurrently running the whole time from baseline to the end of the mindfulness intervention. There was a significant difference from baseline which was 31.39% mean parasympathetic activity to 61.62% at the end of session one ($f12$) = 30.96, p<.000). Around half the cohort continued to listen to the guided-relaxation sessions in their own time for up to a four week period. In this group there was a consistent and significant increase in mean parasympathetic activity from Time 1 (baseline) 22.67%

activity; at Time 2 after the guided-relaxation to 64.33% and at Time 3 which was up to 4 weeks later to 72.83% (f[1.79, 8.93] = 16.33, p=.001).

The following are qualitative results are from participants after the first session. Each quote is from a different participant and their reflections have not been edited.

> "I never take the time to relax like this, so I really enjoyed it. I could feel myself becoming relaxed."
>
> "I am certainly more relaxed - I also have less body pains and I am walking better." "It's refreshing to find some time dedicated to relaxation. Provides a break to the constant stressful "head chatter".
>
> "Didn't make the time to use it enough."
>
> "Tried relaxation tapes before but helpful to see feedback and able to modify behavior if see that not achieving relaxation."
>
> "Yes helpful as it allowed me to gauge whether I am able to meditate. It provides some focus for meditation and you are not left wondering am I doing this properly. Much easier to meditate with direction / instruction!"
>
> "Made me aware that I was consistently stressed"

Most of the comments after this session reflected that staff had a positive experience from the mindfulness guided-relaxation. There was also a general sense of relief from the group having "permission" to rest and relax.

The ability to self-monitor progress as measured using the biofeedback monitor (or its lack), was also seen as helpful by many participants. The results also indicated that the interventions of this kind can have relatively immediate and powerful effects on physical and psychological processes.

Although this was a pilot study, there were a number of limitations that need to be acknowledged. Firstly, the small sample size and the lack of male participants. A larger sample size would bring about more statistical power and enable a more robust design. Additionally, although this was a repeated measure design, it would also have strengthened the results if there had been a control group who had also received a different intervention, but went through a similar monitoring using biofeedback.

Although this intervention was administered in a group setting to begin with and not in a counseling setting, there are great possibilities to use a similar process with clients on a one-to-one basis while connected to a biofeedback monitor. From using this method in private practice, I see many benefits, especially for clients who are suffering from anxiety. It is a concrete measure of change over time, and if there is not improvement, it can be noted by the practitioner and other interventions can be instigated. It also helps clients to connect their thinking with their bodily sensations and bring these mechanisms literally into sharp visual focus.

Future studies could build on present study by utilizing the recently released biofeedback monitor that can be used on the iPhone or iPad. On these mobile devices, reminders can be activated and digital recordings can be played whilst connected to the biofeedback monitor. Additionally, participants can email their daily result to the researcher or to their practitioner to review. This will enable a greater number of participants to access similar interventions and validate these initial but promising results.

4. Conclusion

In "modern" society we seem to be becoming more stressed rather than less and stress and anxiety can have serious health and negative psychological consequences. Building a body of research that informs people about how they can reduce stress and improve wellbeing using new technologies that are freely available, is an important way forward in health care and wellbeing. This pilot study demonstrated that stress can be reduced in a short period of time and with promising trends over the longer term utilizing ancient (mindfulness) and new (mobile biofeedback) technologies.

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Rehabilitation Tool: A Pilot Study On A New Neuropsychological Interactive Training System

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Abstract. Over the past 20 years, research has led to the development of new technologies to improve the quality of life of brain-damaged user. Introduction of new neuropsychological rehabilitation tools based both on the new knowledge on brain plasticity and on the latest developments in computer sciences is both necessary and scientifically challenging for health professionals, particularly neuropsychologists. Here we present a pilot study in which the use of a new Apple© iPad® software for neuropsychological rehabilitation, has demonstrated high level of appreciation and efficacy in cognitive rehabilitation.

Keywords. Neuropsychology, cognitive rehabilitation, iPad-based rehabilitation, vascular disease, serious-game

Introduction

Years of research have demonstrated the capacity of the Central Nervous System (CNS) to functionally and structurally adapt in response to experience. Despite the assumption that changes in brain network can occur only in specific and critical periods, now we adopt the idea of a permanently plastic brain [1,2]. Plasticity is not an occasional state of the nervous system; instead, it is the normal ongoing state of the nervous system throughout the life span [3].

The field of neuropsychological rehabilitation has begun to use this body of evidence to develop therapies that harness the key behavioral and neural signals that drive neural plasticity [4]. One way to achieve this kind of rehabilitation is through the use of technology. The increasingly rapid development of technology and the widespread use, as reported in the literature, of video games, serious games and computerized training for new psychological treatments have contributed during the past few years to move the efforts of researchers to all those characteristics that can increase the participation of the subject by inducing more motivation [5].

Computerized training programs could offer a more flexible, personalized approach to traditional cognitive training programs; they provide real-time performance feedback and can adjust to the user's ability level, keeping the activity engaging and

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fun. Computer and video games are designed to be fun and exciting and may provide motivation for the patients of all ages to adhere to the training program [6,7]. This is possible thanks to a gamification process that transforms the normal rehabilitation exercises in more exciting and fun tasks. As result people get more chances to maintain higher interest on rehabilitation over time, even if we deal with elderly [8,9]. Computerized rehabilitation is frequently used to facilitate improvement in patients with mild cognitive impairment or after brain injury [10,11].

More recently, the advent of tablet-based devices, such as the iPad, has proved to be promising for rehabilitation [12-15]. The interest for this technology derives in particular from two elements. First of all the use of touch screen: through easy, intuitive and natural gesture is possible to create a new generation of computerized training. The touch screen is easy to use even for elderly people that can see the tablet as an interesting and nonthreatening device and also for brain damaged people with movement disorders. Secondly today the tablets are very diffused; they are relatively cheap and allow the implementation of cognitive training also by remote in the patient's home. Des Roches [16] has recently tested the efficacy of an iPad-based software platform for individuals with language and cognitive deficit. She proved how experimental participants, who practiced the therapy also at home, showed more significant and positive changes due to therapy in their standardized tests than control participants.

Here we present a new neuropsychological rehabilitation iPad-based software and a pilot study that has shown significant improvements in cognitive functions in an Italian small size of patients.

The research

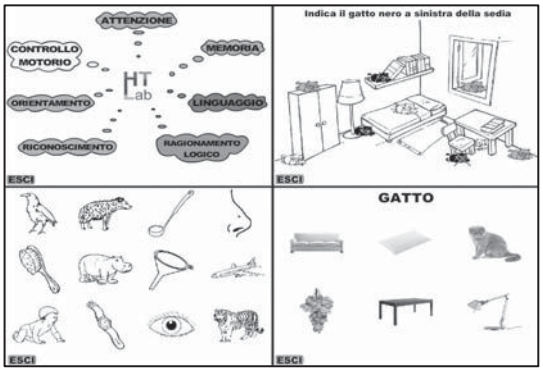

Figure 1. Screenshots of Padua Rehabilitation Tool

According with this background and starting from previous works [17,18] we designed and developed the "Padua Rehabilitation Tool (PRT)", a software that consists of 35 exercises of cognitive stimulation grouped into the various functions involved: attention, memory, language, logic reasoning, recognition, orientation and motor control (see Figure 1). The software run on Apple © iPad ® and it is still not in commerce but in a testing phase. The app is built using Adobe ® Flash Professional CC © with ActionScript 3.0 code (air for iOS).

The PRT was designed with a simple interface and the stimuli used are not complex in order to allow an easy interaction to all the users. Thanks to the different cognitive domains involved in the exercises is possible to develop specific treatment programs tailored to the cognitive impairments of each user. Thus the PRT is a valid tool for patients with different cognitive deficits and it can be administered to patients independently from the acquired pathology (brain vascular disease, traumatic brain injury, neurodegenerative deficits, etc.). All the tasks utilize the same method of response ("press button") after which a visual and auditory feedback is given to the participant both in case of correct or incorrect response. The exercises consist of levels of increasingly difficulty. In case of correct response the exercise automatically goes to the next level. In case of error the patients can retry the same level up to three times, after which the exercise runs out. In this way, starting with a very easy task, the patients can experience success, increasing the motivation and decreasing the sense of frustration derived from doing a task harder than what they are able to do.

One of the most innovative aspects is the use of Apple © iPad ® which allows the user to use natural and intuitive gesture to interact with the interface. Furthermore the use of a tablet allows you to move it wherever you need which is very useful in case of bedridden patients.

Following we will describe a pilot study to test the usability and efficacy of PRT on a small sample of Italian patients with acquired cognitive disorders.

Methods

Six patients (mean age: 65; SD age: 11; 2 male) were recruited in an Italian rehabilitation center, according to their Level of Cognitive Functioning (>6; LCF) and the use of at least one upper limb. Four of them used the PRT as tool for cognitive rehabilitation five times a week for a period of one month for a total of 20 individual sessions. Each session lasted about one hour. The exercises to be conducted with each patient have been chosen on the base of their cognitive profile as result of neuropsychological assessment. The other two patients during the same period performed the regular activities planned by the institution.

At the beginning and the end of the month, all patients were administered the Short Neuropsychological Examination 2 (SNE 2; 2011) [19]. It consists of 16 subtests, which assess the different cognitive functions. The software of SNE 2, comparing the test and retest score, shows the significance of change in cognitive functioning.

Results

Because of the small number of patients and the difference between each case we proceeded with a multiple single case comparison instead of a group comparison.

Table 1 shows the comparison between pre-test and post-test for each patients in each subtest of SNE 2. The results highlight a significant improvement of cognitive functions in patients who used the PRT respect to the other patients.

Table 1. Results at Short Neuropsychological Examination 2. Comparison between pre-test and post-test. (+ Improved; - Impaired; = Stable)
[1] Patients who did used PRT; [2] Patients who did not used PRT

	Experimental Group[1]				Control Group[2]	
	1	2	3	4	1	2
Digit Span	=	+	+	=	-	-
Immediate story recall test	+	=	=	=	-	=
Delayed story recall test	+	-	+	=	+	+
Interference memory (10 sec)	=	=	+	=	=	=
Interference memory (30 sec)	+	=	=	=	=	=
Trail Making Test - A	=	-	+	+	+	=
Trail Making Test - B	=	+	+	+	-	=
Token Test	+	=	=	=	=	=
Verbal fluency	+	+	+	+	=	=
Abstraction Test	=	=	=	=	=	=
Cognitive Estimation	=	=	=	=	+	=
Overlapping figure test	=	-	=	+	=	=
Copy Drawing	=	=	-	=	=	=
Spontaneous Drawing	=	=	=	=	=	=
Clock drawing test	=	=	=	+	-	=
Motor Control test	+	=	+	=	=	=

As example the patient n.3 reported a significant improvement in different cognitive function. In particular he has obtained most benefit from the use of PRT in memory function, as proved by the performance in "Digit Span", "Delayed Story Recall test" and "Interference Memory" and in attention as confirmed by "Trail Making Test – A" and "Trail Making Test – B". On the other side the patients who did not used PRT shown or a stable performance or some improvement associate with impairment in other subtests. They did not improve their clinical conditions.

Conclusion

Preliminary findings presented here suggest that the Padua Rehabilitation Tool can lead to excellent results in approaching neuropsychological rehabilitation. The variety of developed exercises and the different involved cognitive functions permit to tailor the intervention to the specific needs of the patients and adjust from time to time the treatment program.

The use of multi-touch screen allows to make the interaction with the technology easier using more intuitive and natural gestures respect to the use of a mouse and a computer. Within the last 5 years the tablet diffusion is significantly increased. These devices now are easily available on the market and they are relatively cheap and suitable for a domestic use. Indeed one benefit of the tablet is the possibility to implement the treatment even in home reducing the cost of therapy.

The desired effects using the PRT were the improvement of cognitive skills directly trained with the exercises chose during the PRT sessions as well as a general increase in the cognitive functioning of patients. Even skills, that are not directly trained, showed a significant improvement: an effect attributable to learning of strategies not directly related to the cognitive function involved in each single PRT's exercise.

The patients have shown interest and curiosity about the proposed treatment with PRT. They found it easy to use and engaging, furthermore they asked to use this tool again in the future if needed.

There are several limitations to this study. The first is the small number of patients, which cannot let us generalize the obtained results. Moreover this is not a randomized blind study because participants were aware of the kind of treatment and participants were allowed to express their willingness to participate or not.

In the next future we aim to consolidate these results adding more participants to the clinical trial and using other instrument to evaluate the effects of PRT in the autonomy and in other aspect of daily life of the patients.

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SECTION VI

WORK IN PROGRESS

It is important to emphasize the importance of developing technological strategies (such as artificial intelligence or augmented reality) that can provide either new enhanced experiences or technological systems also nurtured by artificial intelligence techniques developed by humans.

These new mixed ICT tools might evolve into experts in "helping others," with the objective of making our net-shared experience increasingly more competitive, creative, and capable in the task of helping others. Of course, this has significant ethical implications, which will also need to be explored at greater depth.

Botella, Riva, Gaggioli, Wiederhold, Alcaniz, and Banos, 2012

Virtual Reality for Artificial Intelligence: human-centered simulation for social science

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Abstract. There is a long last tradition in Artificial Intelligence as use of Robots endowing human peculiarities, from a cognitive and emotional point of view, and not only in shape. Today Artificial Intelligence is more oriented to several form of collective intelligence, also building robot simulators (hardware or software) to deeply understand collective behaviors in human beings and society as a whole. Modeling has also been crucial in the social sciences, to understand how complex systems can arise from simple rules. However, while engineers' simulations can be performed in the physical world using robots, for social scientist this is impossible. For decades, researchers tried to improve simulations by endowing artificial agents with simple and complex rules that emulated human behavior also by using artificial intelligence (AI). To include human beings and their real intelligence within artificial societies is now the big challenge. We present an hybrid (human-artificial) platform where experiments can be performed by simulated artificial worlds in the following manner: 1) agents' behaviors are regulated by the behaviors shown in Virtual Reality involving real human beings exposed to specific situations to simulate, and 2) technology transfers these rules into the artificial world. These form a closed-loop of real behaviors inserted into artificial agents, which can be used to study real society.

Keywords. Computational Intelligence, Computational Models, ALife, Virtual Reality, Computational Psychometrics, Social Simulation, Artificial Societies.

Introduction

Several experiments have been done in virtual environments in the last ten years but an integrated simulation based on real behaviors had never been done before. Our proposed solution proposed a simple way to integrate real behaviors in artificial simulations by the means of virtual environments. Potential applications of this approach are unlimited, spacing from decision making to cognitive science and including clinical and educational purposes. Data collected following this method are satisfy top-down (model-based) needs and bottom-up (empirical-based and simulation-based) needs, under the umbrella of complexity science.

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Virtual Reality Platform for Artificial Life

The platform used for Artificial Life was Java communicating with the platform for Virtual Reality NeuroVr 2.0 (http://www.neurovr.org/neurovr2/) [1], which allowed us to test in experimental and clinical settings the potentiality of VR and enable us to integrate real behavior in artificial simulation.

Although the neuroscience literature contains many examples of the use of computational models to describe neuro-processes and biological patterns, there are fewer reports of their use in modeling behavior, primarily due to difficulties in simplifying such complex phenomena. In fact human behavior is much too complex, nonlinear, and unpredictable due to the irrationality of even healthy humans. Even with very efficient models it is impossible to predict the influence of irrationality on human behavior [2-4].

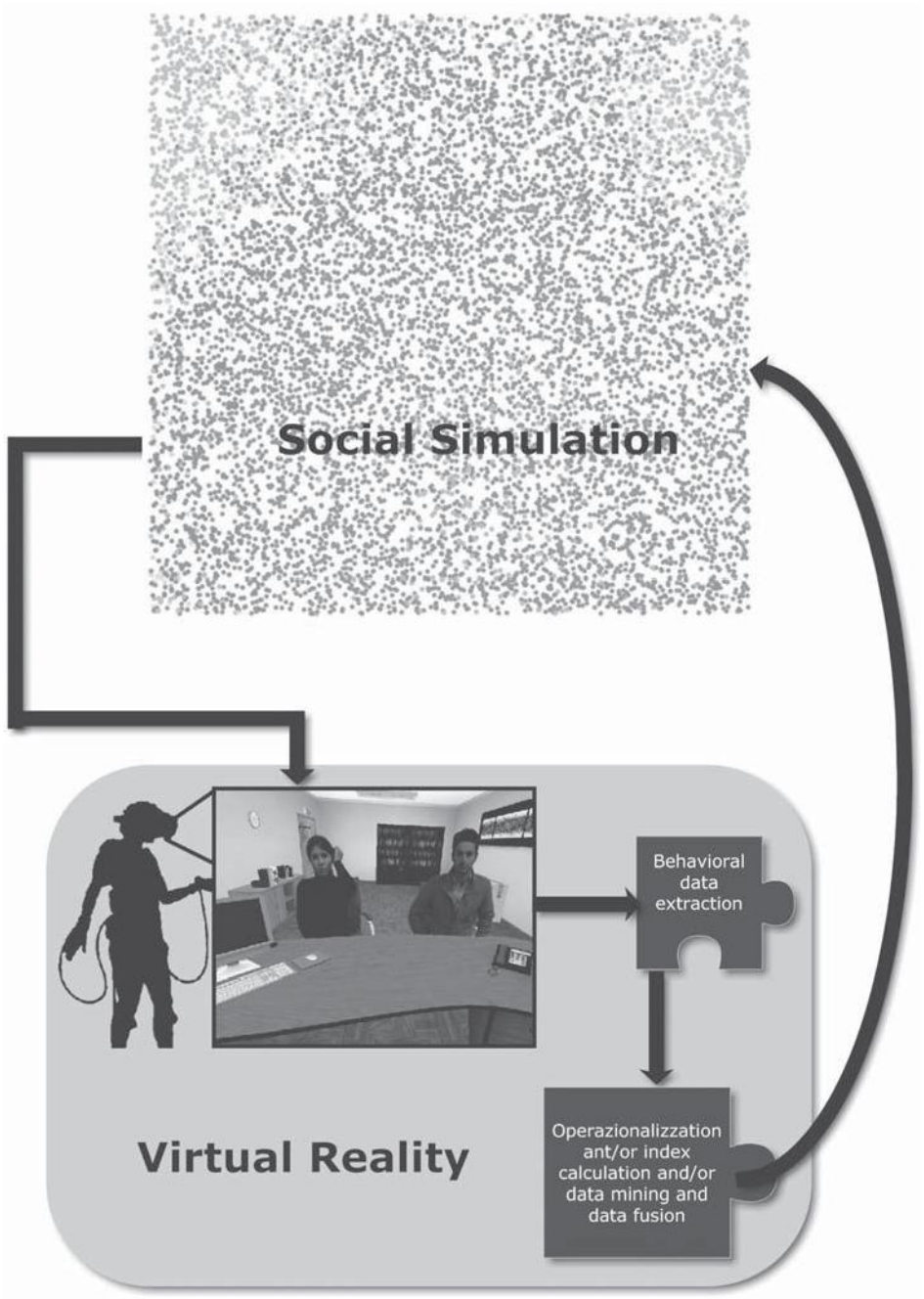
If human behavior cannot be predicted, how can social simulation be useful in predicting society as a whole? Complexity science provides a paradigm to help answer this difficult question. In fact one focus of social simulation has been studying emergent properties and the simple rules that can be useful to policy-makers in understanding a social change due to a simple change at a lower level [5-7]. Computational sociology and computational economics received much attention in the last decade, and the improved computational capability of commercial computers has extended its use in many fields, from industry to the arts and many other applications [8-12].

In the meantime, behavior, which is not predictable, has been considered only within limited application and simplified to what is simply recorded, such us gesture, voice, gait, and so on. This is not wrong but surely is incomplete. In fact human behaviors are a complex of human actions that are not limited to single steps like a gesture, but comprehend intentions, consciousness, willing, and many other wonderful concepts that unfortunately make human behavior unpredictable and difficult to model [13-16].

Therefore, researchers have had to resign themselves to the fact that there is no way to integrate real behavior in social simulation. If this is true it is unthinkable to use computational simulation at an individual level, and simulation is limited in its use either for social emergence or in low-level processes of cognition (such as specific neural mechanisms). At higher cognitive levels there are too many variables to make the processes predictable for specific purposes (such as decision-making), so simulation will be useful to psychology and social science only at low cognitive-levels in the understanding of specific mechanisms. To predict a patient's behaviors will never be done with simulations.

However, there is a radical change in this idea that would allow researchers to integrate computational intelligence (and in particular computational simulations) into psychology and social simulation.

Since there is no way to predict human behavior, the only possible solution to have a realistic simulation for psychology and social science is to integrate real humans into artificial simulation. In particular our aim was to integrate real human behavior into computational models, which means bringing real experiments with human-beings into simulated worlds.



However, it is not enough to connect human beings and artificial simulation, we need to include human behavior and this means to immerse humans in prototypical situations within which human behaviors make clinical or experimental sense.

Since it would be very expensive, and sometimes impossible, to create a real scenario that would involve actors and artificial scenes, an alternative would be to use Virtual Reality (VR) to create a virtual scenario [17-21]. Virtual reality has already been used in clinical and experimental settings and is a validated method to elicit human behaviors within specific situations.
Our aim was to use virtual worlds with tasks that already have been used in psychology and behavioural science, linking this environment with a computational simulation including artificial agents (agent-based approach) and real users (VR-based approach). The emerging properties of such a simulation include, for the first time in the world, the realistic modeling of behavior.
Even though behavior is not predictable we found a solution to have predictable responses with our computational models.

Conclusion

Psychometrics has traditionally used paper-and-pencil tests. However an emerging part of psychometrics is now using more advanced technologies which can provide useful tools for the field. Computational psychometrics regards the use of computer and computational intelligence for measuring behavioral, cognitive, emotional and other psychological processes. In this sense all the measurements in psychology using these advanced methods and tools falls in computational psychometrics comprising computer-based tests, virtual reality, psychophysiological recordings, computerized behavioral analysis, social network analysis, simulation-based methods, and other modeling science.
However we were interested in the understanding of the underlying levels which make possible the use of emerging technologies. At this purpose we extended the current knowledge of computational model of behavior, complex systems, and agent-based simulations integrating virtual environments and consequently real behavior.
For years, scientists wondered how AI could be useful for mankind. Now is the time to wonder how human beings can be useful for AI for the beginning of a bottom-up artificial life (ALife) based on the top-down human mind.

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Importance of Virtual Reality to Virtual Reality Exposure Therapy, Study Design of a Randomized Trial

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Abstract: Post Traumatic Stress Disorder (PTSD) can be a debilitating problem in service members who have served in Iraq or Afghanistan. Virtual Reality Exposure Therapy (VRET) is one of the few interventions demonstrated in randomized controlled trials to be effective for PTSD in this population. There are theoretical reasons to expect that Virtual Reality (VR) adds to the effectiveness of exposure therapy, but there is also added expense and difficulty in using VR. Described is a trial comparing outcomes from VRET and a control exposure therapy (CET) protocol in service members with PTSD.

Keywords. Post Traumatic Stress Disorder, Virtual Reality, Exposure Therapy, Depression, Anxiety, Combat, Military

Introduction

Virtual Reality Exposure Therapy (VRET) has been reported as promising treatment for Post-Traumatic Stress Disorder (PTSD). Exposure Therapy (ET) is itself the most widely accepted treatment for PTSD [1]. VRET attempts to improve on the limitations of traditional therapy. In theory, the addition of Virtual Reality (VR) minimizes the avoidance that otherwise perpetuates symptoms, allows the therapist and patient greater control over what will be confronted in therapy, offers an environment in which physical safety is guaranteed, and engages patients via the allure of the technology [2]. There is a growing literature that VRET can be a successful option for PTSD, especially in military populations where the problem is large [3], and there is a dearth of evidence for other interventions. VRET is one of the few options in which there are successful randomized controlled trials in active duty military populations [4]. Published VRET outcomes are better than are typically expected with combat PTSD [5], and there are case reports of patients who did not respond to traditional exposure therapy responding to VRET [2].

Missing in these studies is evidence that VRET offers better outcomes that the same treatment offered without the use of the virtual reality simulator. Although the efficacy (essential effect) of VR is an interesting academic question, the effectiveness (tendency to improve real-world outcomes) is perhaps more pressing. An estimated 2.6 million

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service members deployed to Iraq and Afghanistan. If there is even a moderate advantage in outcomes, VRET could be both cost effective and greatly reduce the volume of suffering.

1.1 Hypotheses

1) In service members with PTSD related to deployment to Iraq and Afghanistan, PTSD symptoms will be reduced by a greater degree after VRET than by a Control Exposure Therapy (CET) condition that omits the VR simulator.
2) Longer term outcomes for PTSD symptoms will remain better three months after completing treatment in individuals who received VRET than those who received CET.
3) Individuals with PTSD who do not respond to initial treatment will be more likely to respond when VR is added to treatment than when it is removed.
4) Gains in related symptoms, such as depression, anxiety, cognitive function, behavioral reactivity, and overall disability will parallel those seen in PTSD.
5) Baseline characteristics such as age, symptom pattern, and improvement before treatment begins will be significant predictors of who does and does not respond to particular forms of exposure therapy.

1.2 Overall study design

Service Members with deployment-related PTSD are recruited from military facilities in Southern California. Participants are assessed using validated measures of PTSD, Major Depressive Disorder, anxiety, cognitive function, and behavioral/physiological reactivity. Participants who meet inclusion criteria are randomly divided to receive either VRET or the CET, comparison condition. Therapists use the same, manualized techniques for VRET treatment that have previously been successfully employed to treat PTSD at these institutions [5]. The difference between the treatment groups is if the VR headset and controller computer is used, allowing the role of the VR itself to be tested. At the end of treatment, participants again receive an independent assessment of symptom severity. If symptoms persist they are offered the option to cross over to the opposite form of therapy. Three months after completing treatment, symptoms are again assessed to determine long-term effectiveness. Data are analyzed to test the hypotheses listed above.

1.3 Study Sites

The study is conducted at seven clinics under the auspices of Naval Medical Center San Diego (NMCSD) and Marine Corps Base Camp Pendleton (MCBCP). These are both large military bases in Southern California that are open to members of all branches of the military, but which primarily serve members of the Navy and Marine Corps. One of the clinics in the study is a residential PTSD treatment center, the remainder are military outpatient clinics.

1.4 Participants

Participants must be eligible to receive care at NMCSD or MCBCP, willing and able to give informed consent, aged 18 to 60, have a PTSD diagnosis based on Diagnostic and

Statistical Manual (DSM)–IV Text Revision criteria and Clinician Administered PTSD Scale (CAPS) [6] score greater than 40, have an index trauma that occurred in Iraq or Afghanistan, be medically able to tolerate exposure treatment and physically able to don equipment, be willing and able to give up alcohol and/or other intoxicating substances within 12 hours of a treatment session, and be able to see, hear, and smell. Participants are excluded if they exhibit psychosis, mania, epilepsy, have current suicidal intent, are less than 30 days from a psychiatric hospitalization or suicide attempt, meet criteria for current, active substance dependence, use an intoxicating substance within 12 hours of a treatment session, or have another condition or event that the treating provider or medical monitor consider to be a safety hazard within the study.

1.5 Assessment Blinding and Randomization

Assessments are conducted by independent technicians, who are blinded as to the study condition. For reasons of clinical safety, assessments are supervised by a clinician, but the clinician may not alter the research data gathered. It is not possible to blind participants, but to minimize treatment-expectation effects and the sense that controls receive a "low tech" intervention, computers are used in both conditions. In discussing the two conditions the active condition is referred to as "dynamic virtual reality," and the control condition as "static virtual reality."

Demographic and diagnostic information information is gathered from participants and from the military medical record using the Naval Center for Combat and Operational Stress Control (NCCOSC) psychological intake questionnaire. DSM diagnoses, including for PTSD, are confirmed using the Mini International Neuropsychiatric Interview (MINI) [7]. Primary outcome for PTSD symptoms is tracked using the CAPS, with measurement period of the previous week. This timeframe is chosen because it is the shortest interval over which symptoms can be reasonably assessed, and prevents overlap with other assessment periods.

Secondary assessment measures include: the Combat Exposure Scale[8], PTSD Checklist, Military Version (PCL-M)[9], The Patient Health Questionnaire 9 for depression[10], Beck Anxiety Inventory[11], Behavioral Reactivity Test[12], Automated Neuropsychological Assessment Metric[13], Sheehan Disability Scale[14], and the Acceptance and Action Questionnaire II[15].

Assessments are conducted before treatment starts, and one week and three months after treatment is completed. In the event a participant does not start treatment as scheduled, CAPS must be repeated. In the even participants cannot come to an assessment session, CAPS assessments may be conducted over the phone.

Block randomization is conducted in which therapists draw randomly selected lots of 2, 4, or 6 paired selections for VRET and CET. This ensures each therapist treats roughly the same number of participants in each condition but is unaware of which condition their next participant would receive.

1.6 Therapists and Treatment

Eleven therapists provide treatment. This includes two psychiatrists (M.D.s), eight psychologists (Ph.D.s), and one clinical social worker (M.A.). All therapists complete a course in prolonged exposure therapy, a training workshop in VRET, and at least one supervised case of VRET before participation.

The VRET protocol is the same as was used in an earlier treatment-development study [5], which in turn is based on principals laid out in prolonged exposure therapy [1], and earlier work in VRET [16]. Briefly, participants meet in 90-minute sessions up to twice a week for 9 weeks, with a goal of achieving 8-12 sessions during this time period. In theory, participants can drop out with as few as three sessions and still have data included, or, if failing to progress, get as many as 18 sessions before time runs out. Self-report scales of PTSD, depression, and anxiety are gathered at each session, and standard clinical questions concerning problems or safety issues reviewed as clinically appropriate.

In the CET condition, no virtual reality headset, or any other aspects of the immersive technology is used. Rather, participants view images from the simulator on a standard computer screen. Participants have the option of choosing a still shot (screen capture) from the simulator or using another still computer image on which they would focus during the remainder of treatment.

To maintain protocol adherence, therapists meet with each other and the PI in a review session once a week. Together, therapists review the course and methods of treatment, and view videotapes of each other's ongoing treatment. Initial tapes are also sent to an outside reviewer to verify that there is adherence to the protocol.

Participants are allowed to seek other treatment, including medication changes, group therapy, or supportive treatment during the experimental protocol. No other, individual therapy is allowed during VRET/CET. Participants still meeting entry criteria after their first round of treatment are eligible to cross over and receive treatment in the converse condition. To prevent skewing the sample size of either group, crossovers to a particular treatment are not allowed when the sample size for a receiving group is more than two greater than in the opposite condition.

Two virtual reality systems are available and used interchangeably. The first system uses the Virtual Iraq and Virtual Afghanistan system designed by the University of Southern California Institute for Creative Technology, and run on computer systems by the Virtually Better Corporation [5]. The second system uses software and hardware by Virtual Reality Medical Center [17].

1.7 Power and Data Analysis

The primary outcome is CAPS one week after treatment. Preliminary data that showed that VRET treatment results in about a 20-point improvement on the PCL-M, with standard deviation for the first fourteen patients of 14.46. Using this information it was calculated that to have a "medium" effect size (Cohen's $d = 0.549$) between two treatments, VRET would have to outperform CET by at least 8 points. To have an 80% probability of detecting a difference of such magnitude at the $P < 0.05$ level requires an n of 40 per group.

Primary outcome is assessed by repeated measures ANOVA. We will use intent-to-treat methods in this analysis, and therefore any participant who is randomized and who completes a post-treatment assessment is included in the calculation regardless of how many therapy sessions they attend.

Separate ANOVAs are used, for primary and secondary measures, to examine changes from pre-treatment to post-treatment, and to three-month follow up. These are run as a separately because missing data and dropout may otherwise substantially reduce the study power.

1.8 Conclusions

This randomized, controlled trial will allow us to determine if Virtual Reality itself substantially improves outcomes when used as a component of exposure therapy for military PTSD. It will also provide secondary data concerning use of VRET in individuals who fail traditional exposure treatment, on predicting the best candidates for VRET, and on how different symptoms vary along with PTSD over the course of therapy.

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Modeling Aggression and Bullying: A Complex Systems Approach

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Abstract. Almost daily, we read about the devastation and lasting consequences of bullying, and feel a greater impact when we hear of another child taking their life or the lives of others. What makes bullying behaviors so insidious is they cut across people, age, cultures and nations. These behaviors remain difficult to study and direct experimentation remains ethically and morally prohibitive. Therefore, we turn to computational models and simulate the natural complex social systems using the human element. If approached well, these models may yield emergent behaviors providing insight into the interactions around bullying. This paper discusses our complex systems model, and evaluates the viability of modeling bullying. Results of our implementation are described and future opportunities are identified.

Keywords. NetLogo, simulation, complex system, bullying, aggression, emergence, collaboration, modeling

Introduction

Bullying is defined as a specific form of unwanted, intentional, and repeated aggression, that involves a disparity of power between the victim and perpetrator(s) [1], it occurs across all cultures, age groups, environments and peer groups. Anywhere we find people, we find bullying and the lasting personal and social consequences of this undesired behavior. Bullying is a difficult area to study due to the complex organic nature of the social systems involved. As in most social sciences, conducting potentially damaging experiments directly on people is impossible or undesirable, and achieving isolation generally impossible. More importantly, treating subjects while not treating the control is often ethically undesirable [2]. Complex Systems Modeling (CSM) provides a means to study the core of these behaviors within environments created and controlled by the experimenter [3]. A CSM facilitates research of core theories by supporting the creation of a virtual environment in which we can normalize the participants and environmental factors. This yields to higher repeatability, emergent behavioral effects, and the ability to apply various experiential criteria.

Examples of complex systems can be found in computer science, sociology, psychology, economics, game theory, physics, biology, and many other fields. These various fields have created their own names, definitions, and characteristics for complex systems within their domains. For our purposes, when we speak of Complex Systems, we are referring to the general views espoused by Melanie Mitchell [8] and Nigel Gilbert [9].

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In this paper, we use Agent-Based Modeling (ABMs) to explore the dynamics of bullying. Agent-based modeling (ABM) is a form of computational social simulation particularly suited to tasks where understanding processes and their consequences is important and concrete experimentation may not be a viable option [4]. ABMs do not take a purely reductionist approach to decomposition of a given model/problem into its primitive constituent parts but rather work towards definitions of simple behavioral rules executed by autonomous entities, allowing behaviors to emerge through interactions between these entities [5]. As the agents go about their "lives" within the simulation, the execution of these base-behaviors can yield a dynamic and emergent pattern of interactions; with these emergent patterns providing great insight into the real-world systems in question and allowing ABM based simulation to operate as a principle investigative tool [6].

1. Complex Systems Modeling

Mitchell provides a succinct complex system definition as "a system that exhibits nontrivial emergent and self-organizing behaviors" [8] with the following three commonly exhibited properties [7]: Complex collective behavior, in which simple rules give rise to complex changing patterns of behavior; Signaling & information processing in which agents consume internal and external environmental information and Adaptation, in which changing behavior improves the chances of survival/success.
Nigel Gilbert provides the following view of ABM requirements [9]: Ontological correspondence in which a direct correspondence between the computation agents in the model and real-world actors exists; heterogeneous agents, an environment, agent interaction, bounded rationality to limit the cognitive abilities of the agents and learning.
Epstein and Axtell [10] describe their agents as heterogeneous with an emphasis on micro-level behaviors, supporting bottom-up modeling. The heterogeneous model provides a natural fit to social modeling as societies contain various actors (agents) such as people, processes, organizations, businesses, countries, animals, etc., encompassing the various attributes as describe earlier by [8,9], and refine agents to be autonomous in pursuit of their own goals. Joshua M. Epstein [11] presents two models regarding civil violence: (1) A central authority seeks to suppress decentralized rebellion, and (2) A central authority seeks to suppress communal violence between two warring ethnic groups. These models explore the impact of various exogenous factors on agent violence behavior given the presence of coercive agents. Each scenario focuses on a different aspect of agent-agent interaction where the agents are both the "population" agents and the "police" agents. In the first model, agents exhibited deception as an emergent behavior from the basic rules. In the second model, an emergent phenomenon, very similar to "competitive exclusion", and as found in population Biology, occurs. The results illustrate the viability of CSM as a means to create an artificial society in which agents act out local behaviors, and emergent macro- level behaviors emerge with strong correlation to the "real world".

2. Model Details

Our model supported three primary actors: a person, a coercive agent and a passive 'food' agent, with the person agent possessing the greatest breadth of attributes and behaviors. The actor attributes that the person possessed included both a 360 degree field and varying range of vision, with each respective agent as the center point. A current energy balance that would be lowered do to a metabolic burn rate. This energy reduction increased hunger leading to an impact on the person's other attributes of aggression, strength, tolerance and defense. Each person also possessed an appetite indicating the amount of energy taken from the target. For differentiation, we used the Hamming Distance. Typically, the Hamming Distance acts as a comparative mechanism in which a bit-wise comparison of each element of a trait array is compared, and a running total of the differences is calculated [13]. This integer value then provides one basis for comparative differentiation. Our population differentiated individuals with a variation of the "Hamming Distance" concept. We forgo the trait array and simply create a random integer value for each person within the population to represent a series of arbitrary traits. The difference between any two agents based on this value, represents a Hamming Distance. We further incorporate the use of the tolerance value to create a tolerance range over which similarity, which is "close enough", and would be considered acceptable. Each person possessed four categories of behavioral algorithms: perception algorithms to observe their world; aggression algorithms for selecting prey; defensive algorithms to protect themselves from attack and movement algorithms in response to seeking prey or fleeing attack.

3. Model Implementation

We made various design decisions regarding how to approach the implementation and goals for our model. Based on prior modeling experience regarding the mapping of arbitrary model time units to real world time units, we chose to not map model time units to any real world time units [14]. Additionally, as the desire for complex systems modeling is to create base behavioral rules and evaluate their impact on emergent behavior, we chose to use hunger as the primary influencing value with all other secondary values (aggression, movement, self defense) deriving from hunger. We also choose to keep visual distance a constant with each person and not vary, like hunger, during simulation. While we chose a passive role for coercive and food passive agents, we did provide coercers with an "authority" attribute to reflect their willingness / ability to enforce good behavior.

4. Simulations

We conducted eight simulations, keeping the population and personal visual distance the same throughout. We also varied the inclusion of food agents, and one simulation, with coercive agents, include four sub models for testing varying levels of coercer authority. The first simulation, that displayed easily identifiable aggression, was with the inclusion of food agents. We observed bullies forming noticeable flocks centered on the food. The third simulation introduced coercive agents. We performed four sub-simulations with coercer authority values of: 0%, 30%, 60% and 100%. Interesting

emergent behavior occurs as we increase the authority of the coercive agents. As authority increases, the aggressive clusters form further away from the coercers. This effectively creates "safe zones" around the coercers. The closer to a coercive agent, the safer the person is. Those on the edge are still subject to bullying. The fourth simulation supported some food and coercive agents with use of Hamming discrimination. "Stalking" was observed along with repeated preying. With a 20% authority setting, presence of "safe zones" was not as pronounced as when authority was 60+%.

For our fifth simulation, we kept the same parameters as our fourth simulation but added a "defensive buff" empowerment model. This model increased the defensive value of a bullied person by 1 after each incident. Very interesting emergent behavior occurred with this simulation as early as 50 cycles into the run. The population collapsed down in many localized, non-interactive eco-systems with bullies and victims in close proximity. As the simulation continued, we saw these localized pockets break down and their populations merge back into the larger population. Continued execution of the simulation led to additional interesting behavior, as between the two food agents, a distinct band of population had emerged, while a weaker secondary band had formed to the right of the rightmost food agent.

5. Discussion of Emergent Behavior

From the population attribute statistics, it is apparent that a consistency exists across all simulations regarding the progression and relationships of hunger, strength, energy and aggression. This is important for our models as it establishes that the environmental choices and behavioral actions of the people do not affect their core attributes in any significant way. Therefore we are able to focus on behavioral results. All simulations demonstrated bullying and so the number of bullied people, as a whole, does not present any surprise.

In our simulations, simulation 5 introduced two key elements: defensive training for victims and the use of hamming distances for prey determination. We see the initial rate of bullied people drop noticeably and then climb back up, only to plateau and then grow at a very slowed rate as time progresses. Our analysis of the data from simulation 5 is that the initial population of non-similar people become prey. Because of the empowerment model employed, this population quickly learn "defensive skills" for dealing with the bullies. The result is a noticeable drop in bullying rates. This leads to a population of bullies that become hungrier with a decrease in their prey tolerance, i.e. they are less tolerant of variation and therefore more willing to bully similar people. As a result, their potential prey population increases to now include individuals that do not have defensive training. Therefore, we begin to see an increase in the bullied rate over time though not as steep. This indicated a possible "herd immunity" to bullying in which the population as a whole was becoming better able to resist.

The other interesting data from our simulations reinforces that regardless of simulation parameters, every simulation had a significant portion of its population wanting to bully. Of course, with the base aggressive behavior being derived from hunger, these results are not surprising, but they do provide an indicator that a "desire or need" exists and is greater than the actual success rate for bullies within the population. What was quite exciting from the emergence perspective was that several examples of "stalking" behavior emerged, where a bully would follow a person and continue to prey upon

them. Evidence existed as well that bullies would avoid the areas where coercers existed and exerted influence. It was also noticed that bullies sometimes would overshoot prey only to "rubber-band" back and victimize the person. Additionally, several simulations exhibited behavior similar to "flocking" where lots of bullies would converge into a local space and begin preying on one another.

Conclusions

Applying the more specific definition provided by StopBullying.gov, which defines bullying as unwanted, aggressive behavior among individuals that involves a real or perceived disparity in power, occurring more than once, or has the potential to happen more than once [15], we proposed the question if an environment could be created in which digital people could demonstrate these behaviors emergently.
Our analysis and visual inspection of the simulations as they progressed, demonstrate emergent aggressive behaviors which were not specifically coded for. These behaviors included returning to prey after passing it, stalking prey, and group aggression in which many bullies co-located and behaved aggressively. We further saw the emergence of "no bully zones" around coercive agents that allowed for people to remain fairly unmolested. We feel that the current model has yielded encouraging results on the topic of using ABMs to model bullying and aggression and can provide a starting platform for further development and complimentary work.

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Confronting Auditory Hallucinations Using Virtual Reality: The Avatar Therapy

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Abstract. The AVATAR therapy is a computer-based intervention which aims to reduce the frequency and severity of voices. The approach is based on computer technology which enables each patient to create an avatar of the entity (human or non-human) that they believe is talking to them. The therapist promotes a dialogue between the patient and the avatar in which the avatar progressively comes under the patient's control. Using real-time voice conversion delivery software, the therapist can modify the relationship between the patient and his/her voice. The innovation of this new intervention is discussed in the present paper as well as the advantages of using a computer based system. The subjective view of the technology from a participant's point of view is also presented.

Keywords. Auditory hallucinations, voices, psychosis, virtual reality, avatar.

Introduction

Auditory Hallucinations (AH), typically defined as experiences of hearing voices in the absence of the appropriate external stimulus [1], are one of the most distressing and medication-resistant symptoms of psychosis [2].

The cognitive model of voices [3, 4] proposes that beliefs about voices (specifically regarding identity, power, intention and control) are key to understanding distress and maladaptive responding. Birchwood and colleagues also stated that it is not only the frequency of voices, or the content, that drives the individual's affect or behaviour, but also the nature of their relationship with the personified voice. They applied social rank theory [5, 6] to voice-hearing and found that individuals who experienced powerlessness and inferiority in social relationships were more likely to report similar experiences during the voice interaction [7, 8]. Recent intervention approaches have continued with this line, by focusing on the perceived power of voices and subjective control [9] or adopting an explicitly relational approach [10, 11].

AVATAR therapy has been developed as a relational approach that builds on the previous theoretical and clinical developments, using a computer based system to facilitate the confrontation and dialogue with the voice.

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What is AVATAR therapy?

The AVATAR therapy is a computer-based intervention which aims to reduce the frequency and severity of voices. Although it is not a complex immersive environment, it uses a Virtual Reality (VR) platform to create and display a human/non-human identity to the patient in order to facilitate a real-time voice "trialogue" between the participant, a computerised representation of their voice and the therapist.
In the first session of AVATAR therapy, participants create a computerised representation of the person or entity that they feel represents the source of their voices. The system is set up in two rooms in the same building with two linked computers. Participants sit in one room facing the monitor on which the avatar appears. The therapist sits in a second room facing the monitor with a control panel that allows him/her to talk to the participant in his/her own voice or in the morphed avatar voice. He can see and hear everything that is appearing on the participant's monitor as well as the participant's responses, adjusting his therapeutic interventions (in his own voice) according to the unfolding dialogue between patient and his/her avatar or virtual agent. After this ssessment session and the creation of the avatar (enrolment), the therapy focuses on aspects such as assertiveness, standing up to the voice or taking back power and control by the participant. Using real-time voice conversion delivery software the therapist voices the avatar, engaging in a direct dialogue with the person with the ultimate aim of modifying the relationship between the patient and his voice.

Figure 1. Examples of avatars.

In an initial pilot study of the AVATAR therapy, a maximum of 7 sessions lasting 30 minutes resulted in highly significant reductions in the patients' hallucinations and the associated distress, along with reported improvements in quality of their life [12].

Embodying the voice

Research has shown that patients often identify their voices as being those of known people or famous people. McCarthy et al. found that around 70% of voice-hearers

reported that the voices they heard were like those of people who had spoken to them in the past [13]. This implies that often the voice is clearly personified and, understood as a representation of an abstraction in the form of a person or entity. The approach used in AVATAR therapy allows the patient to access and visualize this abstract non-physical information, in this specific case, of the AH. One could define it as a *virtual embodiment* of the experience: to give a physical representation to the personified but disembodied voice. This visualization of the voice may facilitate two essential processes in the AVATAR therapy: a) the validation of the experience and b) the flow of dialogue with the voice through the sessions while modifying the type of relationship between the voice and the participant.

This *virtual embodiment* of the experience is fully achieved by matching the voice of the avatar to the current AH. This adds even more realism to the experience and seems to be a key aspect of the therapy. In their meta-analysis on the impact of the inclusion and realism of human-like faces on user experiences in interfaces, Yee et al. [14] concluded that human-like representations with higher realism produced more active social interactions than did representations with lower realism.

Although the system is not immersive, we have incorporated an adapted version of the Sense of Presence Questionnaire [15] in order to evaluate the degree of verisimilitude of the experience, the participant's sense of "hearing the voice" and the participant's perception of the avatar as a "voice talking to me". It is hypothesised that strategies developed in therapy may be more likely to generalise to voices in daily life when the created avatar is high in ecological validity.

Confronting the voice

AVATAR therapy offers a unique way for clinicians to directly observe patients interacting with a representation of their voices and for working and modulating many aspects of the patients' relationships with these "voices" [16]. The efficacy of this intervention seems to lie partially on a) the validation of the patient's experience, by creating and facing the entity the subject believes is talking to him using virtual reality, and b) the increase of sense of power and control over the voice, by working on the assertiveness component. The creation of the avatar as well as the continuous exposure to the specific content of the voice has the potential to be very threatening and distressing. However, we are offering the participant the opportunity to face this experience within a controlled and safe space, always under the supervision of the clinician.

Therefore, the AVATAR therapy could be also seen as an exposure intervention to the fear stimuli (the voice). Interestingly, Morrison et al. showed that approximately 75% of psychotic patients could identify images that occurred spontaneously in relation to their voices (e.g. having an image of the perceived source of a voice when hearing it)[17]. They also reported that some of the patients used their images as evidence to support their beliefs about voices (e.g. believing that a voice is omnipotent, powerful, and omniscient because they have a concurrent image of God or the Devil). They concluded that working with these images, for example altering the content or meaning of the image, could result in a reduction of the distress associated to them or even increasing the control over the image [18]. The continuous exposure to the experience of seeing and hearing the voice over therapy sessions, along with the modification of

the relationship with the voice, may be contributing to the reduction of voice's associated distress and to the disconfirmation of maladaptive beliefs about the voice.
One may argue that the same technique could be applied by using the patient's imaginative capacity (without any technological support). Other authors have used a relational approach using other techniques, such as role-playing and "empty chair", techniques [19, 20] with positive results. However, by providing visual and audio stimuli to the participant we are preventing any cognitive avoidance of fear-relevant information (i.e. the voice and its content) [21]. Consequently, the therapist can focus on other key aspects of the intervention, such as dysfunctional beliefs about the voice, empowerment or increased self-esteem, while the participant is confronting the voice.

Participant experience

M is a 47 years old British woman. M was a victim of sexual abuse when she was 8. She experiences two voices, a male and a female, which are present every day, almost continuously. Voices were always unpleasant and they disrupted her life to the extent that she often found it difficult to look after herself and ended up spending hours in bed doing nothing. She decided to work with the male voice, which issued verbal abuse (e.g. "you are worthless") and commands such as "you should go and kill yourself". At post treatment, in addition to the clinical measures (these measures are not reported here due to the ongoing status of the trial). In addition to reporting the clinical outcome measures, M answered some questions about her subjective experience. She said that she "found the opportunity of talking to the voice very good. The fact of having the image was very useful… I couldn't look at the avatar for the first couple of sessions, but once I could look at his face then I seemed to move on into it. Now I talk back to him, and I didn't know I could do it before. Now I automatically reply to my voice. I am more able to talk back. And the impact is huge, I have more fight".

Conclusions

VR is becoming a well-established and effective adjunct technique for treating schizophrenia spectrum disorders [22]. Although it has been mainly used as a way to immerse patients into virtual social situations in order to evaluate positive symptoms or ameliorate social anxiety, it has been recently used as a paradigm to study how people relate to themselves [23] and others [24]. In AVATAR therapy, the creation of the avatar may have a significant impact on the therapy outcome not only because it facilitates the dialogue through a credible platform, but also because it offers to the voice hearer the opportunity to confront the experience and gradually modulate the meaning of that image and related affective responses (i.e. anxiety and distress).
AVATAR therapy is currently being tested in a single blind randomised controlled trial. Patients who meet inclusion criteria will be independently randomised to receive either 7 sessions of AVATAR therapy or supportive counselling (SC).

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NO-FEAR Airlines: A Computer-aided Self-help Treatment for Flying Phobia

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Abstract. *In vivo exposure* is the treatment of choice for specific phobias. However, this treatment is linked to a number of limitations in its implementation. Therefore, it is important to develop strategies for improving treatment adherence, acceptance, and dissemination of evidence-based treatments. Information and Communication Technologies, specifically, computerized programs boast advantages in treating flying phobia. *NO-FEAR Airlines* is a Computer-aided Self-help Treatment for this problem, which can be self-applied via Internet. *NO-FEAR Airlines* treatment protocol comprises three therapeutic components: psychoeducation, exposure and overlearning. Exposure is carried out through 6 scenarios that are composed by images and real sounds related to a flight in process. The aim of the present work is to describe *NO-FEAR Airlines* program.

Keywords. Specific phobia, Flying Phobia, Computer-aided treatments, Self-help, Computer-Assisted Exposure, Internet based therapy.

1. Introduction

One of the most prevalent phobias in our society is Flying Phobia (FP), showing a prevalence rate around 2.5% in the adult population [1]. This problem can, therefore, have a profound impact on professional, social and family life, and can substantially affect marital or relationship satisfaction [2]. *In vivo exposure* is the treatment of choice for specific phobias [3]. Despite that, this treatment is linked to a number of limitations in its implementation such as low acceptance on the part of therapists and patients, high dropout rates, limited access to treatment and difficulties in its application in the clinical context [4, 5]. Particularly relevant is the problem of dissemination (evidence based treatments do not reach all people that need them). It is important to develop new strategies to apply exposure. Information and Communication Technologies (ICTs) can improve treatment adherence and acceptance, and also help to reach a higher number of patients than traditional face to face therapy [6]. Specifically, computerized programs boast remarkable advantages in treating FP: a reduction in direct therapeutic contact time, the possibility of standardizing treatment to the maximum, the low cost- which allows a greater extension- and, perhaps most importantly, the access to patients who would not be very willing to go through live exposure (a real flight) with a steep

exposure gradient [7]. Furthermore, Internet is a useful tool for disseminate and providing effective psychological treatments [8]. The Computer Assisted Fear of Flight Treatment (CAFFT) program developed by LabCSD research group has proven to be effective for FP in several studies [9, 10]. Authors concluded that the application of exposure through interactive computer programs is especially recommended for FP [11]. However, as far as we know, no controlled study for FP has been published so far to test the efficacy of a computerized program completely self-applied via Internet. A new version of CAFFT has been developed by LabPsiTec (Laboratory of psychology and technology, Universitat Jaume I) in collaboration with LabHuman (Polytechnic University of Valencia) and LabCDS (Universitat de les Illes Balears), which can be totally self-applied through the Internet: *NO-FEAR Airlines*. The aim of the present work is to describe *NO-FEAR Airlines* program.

2. Method

NO-FEAR Airlines is a computerized-aided program for FP that can be self-administered via Internet. This program allows people with FP to be exposed to images and sounds related to their phobic fears on a standard personal computer. Figure 1 shows the *Home page* of the program. Here information related to FP, the treatment, NO-FEAR *Airlines* program, as well as information about the research groups that have developed it is provided.

Figure 1. *NO-FEAR* Airlines: *Home page.*

NO-FEAR Airlines includes an assessment protocol and an exposure-based cognitive-behavioral treatment (CBT) protocol.

The *assessment protocol* includes a short screening with 19 questions about FP, related problems (i.e., claustrophobia, panic disorder, agoraphobia and acrophobia) and exclusion criteria. After that, the program carries out a pre-treatment evaluation including primary and secondary outcomes measures, as well as expectations and disposition toward the system. During treatment, *NO-FEAR Airlines* records: initial fear level regarding to each exposure scenario, the highest level of anxiety experienced

during the exposure to the scenarios, number of cycles performed in each exposure scenario and the sense of presence and reality judgment after the exposure to "the flight" scenario. At the end of the treatment, the system applies the same assessment instruments (post-treatment evaluation) and at 3 and 12-month follow-ups.

The *treatment protocol* comprises 3 therapeutic components: psychoeducation, exposure and overlearning. These three key aspects are based on techniques that have proven efficacy and meet the recommendations of the guidelines on good clinical practice state by international associations of psychology such as the American Psychological Association (www.apa.org) and the National Institute for Health and Clinical Excellence (www.nice.org.uk).

a) *Psychoeducation* component provides information about what the program will consist of as well as specific information related to FP. Specifically, the program teaches about how many people are affected by the problem; what kinds of people are affected; the physiological, cognitive and behavioral (or avoidance) components of FP; how it begins, how it is maintained and how to cope with the problem. This section contains text, vignettes and illustrations in order to make the therapeutic content more attractive for the patients (Figure 2).

Figure 2. *Screenshot* of *Psychoeducation* section.

b) *Exposure* is conducted through 6 scenarios that are composed by images and real sounds related to the flight process: (1) flight preparation, (2) a series of activities immediately prior to flying on the day of the flight, (3) boarding and taking off, (4) the central part of the flight (see Figure 3), (5) the descent of the aircraft, approach to the runway and landing, (6) sequence with images and auditory stimuli related to plane crashes. Exposure scenarios are presented following an exposure hierarchy automatically constructed in the pre-treatment evaluation. During exposure scenarios, the system asks (every 3 minutes) the maximum anxiety level experienced on a scale ranging from 0 "no anxiety" to 10 "high anxiety". Exposure to each stage ends when the participant indicates an anxiety level lower than 3, in order to achieve the habituation process.

Figure 3. "Screenshot" of *flight* exposure scenario.

c) *Overlearning* component is offered as an additional exposure in all scenarios. Patient can choose to practice *overlearning* at will, according to their needs. This component aims to review some of the exposed situations and strengthen the achievements. Patient may be exposed to the above scenarios but with a higher degree of difficulty during which storm conditions and turbulence are simulated.

The duration of treatment depends on the rate of each patient. All they will be advised to do around two exposure sessions per week, taking a few days off between sessions. Therefore, it is estimated that in three or four weeks the treatment can be completed, with a maximum period of six weeks. However, each participant will be free to keep rate he/she needs. Furthermore, after the program, all patients will be encouraged to take a real flight. *NO-FEAR Airlines* provides guidelines to meet this test flight through downloadable material.

3. Results

A RCT to determine the efficacy of this program, compared to a waiting list control group, is being currently in progress. The role of support (with minimal contact versus with no contact) in the treatment via Internet for FP will also be examined.

4. Conclusions

NO-FEAR Airlines tries to provide an effective and useful tool to help people who may need it. This Internet based program has been designed to facilitate the acceptance and the access to treatment for FP. Furthermore, the comparison between the self-applied treatment groups will provide relevant data to the debate about the role of the therapist in the psychological treatments administered via Internet, specifically regarding FP treatment.

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Human Instruments: Accessible Musical Instruments for People with Varied Physical Ability

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Abstract. There are few ways in which persons, who do not have the use of their hands or arms, are able make music or control complex computer systems. Music as an expressive output is key to the full development of the human mind. Human Instruments is dedicated to the development and production of accessible musical instruments playable at a professional level, as well as computer control interfaces. We are currently user-testing three new, uniquely accessible devices, for their effectiveness in expressive music creation. Preliminary results are compelling.

Keywords. Music, accessibility, instruments, disability, disabilities, paraplegia, quadriplegia, MIDI, devices, music technology, sound, Sound Space, Human Instruments, expression.

Introduction.

Everyone deserves music, and the chance to make it. If you have fingers, toes, arms, legs, muscles and health, then it is yours. But "the disabled encounter many obstacles in their quest for self-expression through music. Most musical instruments are difficult to use. They are the result of hundreds of years of an evolutionary process that has favoured able-bodied skilled performers."[1]
This paper draws together research and development by Human Instruments, a company devoted to the development of instruments playable by people with severe physical disabilities.

"Music is often regarded as entirely a decorative art, whereas instead it is the expression of man's deepest self."[2] Current scientific studies supporting this claim that was made some sixty years ago.

Music training at an early age is greatly beneficial, both in the moment, through enjoyment and development, but also later in life. Training in music augments connections in the Corpus Callosum between the left and right brains as well as the parts of the brain relating to hearing and self-awareness.

[1] Technologies of Inclusive Well-Being, Studies in Computational Intelligence, Anthony Lewis Brooks, Sheryl Brahnam, Lakhmi C. Jain, Springer 2014
[2] Deryck Cooke, The Language of Music, Oxford Uni. Press, 1959

Music and the Brain.

A person's ability to follow rhythm in tapping and listening tests under brain observation, is being linked to the augmented ability of language comprehension. Krauss has noted that "Musicians have highly consistent auditory-neural responses... It may be that musical training – with its emphasis on rhythmic skills can exercise the auditory system, leading to less neural jitter and stronger sound-to-meaning associations that are so essential to learning to read... ...and a crucial cue to understanding."

This begins to solidify "why music must exist in the schools at the heart of the curriculum – not as entertainment or relaxation, but as a unique way of knowing and as the foundation of feelingful intelligence."

If brain connections of multiple types are created and heightened through early stage music training, and these connections are not specific to music but directly transferrable to other communication forms, thought and memory organization, then access to music from an early age must be made available to everyone. The joy of playing music and exploring instruments, is incomparable to any other experience, but some do not have the ability to operate a traditional instrument. For persons locked in their own bodies, e.g. crash survivors, music can be a freeing outlet of expression and escape, as "musical activity provides a mechanism for creating events that place the activity in a 'realm' different from the everyday"[3] The studies referenced in this paper show that this expressive musical output is not a luxury or a 'decoration' but necessary to development of self and augmented social communication.

There are 7k-11k new cases per year of quadriplegia and paraplegia in the USA, with a current affected population of ~250k-400k. In 2010, 18.08m people were playing an instrument[4]; with a current population estimated at 318.9m[5], this tranche is 17.6%. If only 5% of quadriplegics and paraplegics wished to be musicians, that makes 450 new musicians every year, or ~17k people in the USA alone. Due to lack of R&D funding in this area, these people are denied the opportunity to develop their mind to its full potential.

Sound = Space: Interactive Music Workshops.

Co-founder, Rolf Gehlhaar, has worked in the fields of interactive music installations since 1972. He worked with Stockhausen and in 1985 created SOUND = SPACE in which people create music directly from their movements in physical space[6]. The space is surveyed by an ultrasonic echo-location system, similar to dolphins, which measures the positions of 1 to 20 persons within it. The measurements are used to create and distribute musical topologies throughout the space.

The results of the University of New England workshops dedicated to autistic children were very interesting. Predominantly, the children actively took part, seeming to enjoy

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[3] Ellen Dissanayake, What Is Art For? Seattle: University of Washington Press, 1988

[4] http://www.statista.com/statistics/192834/people-playing-a-musical-instrument-in-the-us/ 2015

[5] https://www.google.co.uk/publicdata/explore?ds=kf7tgg1uo9ude_&met_y=population&idim=country:US&hl=en&dl=en 2015

[6] Rolf Gehlhaar, SOUND=SPACE Contemporary Music Review, Harwood Academic Publishers, Vol.6,1992

the experience greatly. Many of them became intensely involved hardly stopping to take a break, in many instances their behaviour was elevated, socially augmented or unusual, as noted by carers or mothers with some experience in the field of music therapy.

"After initial reluctance to participate, my son, who is normally quite aloof from other children, tried to initiate contact with an unknown peer, stating he wanted to be friends. He was able to use the child's name without having been told it, i.e. picking it up from incidental conversation.

"He also actively sought out his sister to play, using full sentences. He also was able to respond to a request to dance like a butterfly and horse. His communication continued for some hours after, to be greater in quantity and clarity. In all, a remarkable experience.

"To have access to such an avenue is wonderful. The experience was enriching. It confirmed much of the research I had done into music therapy. Best of all, it helped to open another window of opportunity for my son to experience the world."[7]

HeadSpace: a Hands-free Music Controller for Quadriplegic Humans.

Experiences with SOUND = SPACE led in 2000 to HeadSpace, a musical instrument for an ex-trumpeter Clarence Adoo rendered quadriplegic by a car accident. HeadSpace is a computer aided instrument controlled by a commercially available head-mounted mouse device registering head position and breath pressure. The computer displays a Graphical User Interface (GUI) that is in essence two musical instruments. This GUI gives the player expressive control over the sounds chosen and triggered. It is by no means a traditional instrument replacement, but an instrument controller with an extensive palette.

Adoo has performed with HeadSpace many times since 2001, in an eponymous ensemble and since 2012 in the British Paraorchestra stating "this is the first time I feel like a musician, not a disabled musician."

Viagem: Instruments for Eveyrone, Controller vs Instrument.

HeadSpace is noted by leaders in music therapy and accessible instruments. In 2009 Gehlhaar was commissioned by Casa da Musica, Porto, to compose a music / dance / multimedia performance. VIAGEM, produced by Artshare, was performed entirely by people with a vast array of physical and mental conditions in the Sala Suggia in Portugal. "The purpose of this 2-year project – Instruments for Everyone – was the development of tools that facilitate the musical expression of a well defined group of physically and mentally challenged people."[8]

[7] Rolf Gehlhaar, SOUND=SPACE workshops for disabled children, Research Report, Music Department of the University of New England, NSW, 1998.

[8] Technologies of Inclusive Well-Being, Studies in Computational Intelligence Volume 536, Springer 2014

The challenges of the performance are: the array and distribution of physical and mental conditions of the performers is vast / it is logistically impossible to facilitate full rehearsals in the preceding months / the ten groups and schools involved are geographically remote / the players do not all have the physical ability or attention span to follow one conductor or score / the players do not play traditional instruments.

In contrast to 'normal' workshop situations where concentration and stamina was an issue, the players reacted to the intensive nature of the rehearsal with uncharacteristic and increasing fortitude. Plausibly, for many the looming performance in this significant venue was the influence.

"Upon the basis of... interviews [of participants], the authors designed and built five prototype instruments. ...they were manufactured and handed over... at a day-long workshop to[9] which other music educators and teachers for the disabled were invited to participate."

Some instruments allowed physical control and manipulation of sound, some were game based and others controlled robotic percussion and were played via no-touch beam sensors. The chain of command and responsibility was distributed. Each school unit represented a section of the orchestra and was assigned musical instrument devices that suited their players. They were given parts of the score to rehearse with their respective facilitators. In performance, with a series of pre-determined hand signals, Gehlhaar conducted the respective sub-conductors who could thus conduct their units employing their own cues. Some 85 performers took part in the performance, including a 60 strong choir and dance group. An audience of over a thousand included dignitaries who responded with prolonged standing ovations.

What comprises an instrument? What comprises a controller? What are the differences? What can be used to gauge the success of a musical device? HeadSpace is a big leap, but remains an interface rather than a true instrument. It demands the user operate a computer with precise visual orientation of the pointer on a display, thus obstructing total sonic immersion in a solo situation or sonic alertness in an ensemble situation or visual communication with other players or conductors. Work with Adoo, Artshare and the British Paraorchestra leads us to consider other design strategies of digital musical instruments for the disabled, mainly quadriplegics, and to form the company, Human Instruments.

Human Instruments: the Devices.

A more instinctive interface could be imagined that would link movement and expression more directly to note control, timing, sound colour (timbre), sound quality and communication with other players. Musical instruments have multi-physical feedbacks. Pressure from a mouthpiece, resistance from a key or flex of a string, even before a note is played. Then, a plethora of others during the sounding of an instrument. This is key to deliberate and precise control of notes, the essence of an instrument, versus a controller. The players and "their personal characteristics, capabilities, tastes,

[9] Ibid

ambitions"[10] is their 'style' in music and is unique. A player's uniqueness should be discernible through the playing of *any* instrument.

Initially we are focusing on two devices: Typhoon, a hands-free universal controller to be held in the mouth, that controls common synthesizer devices as well as automated or robotically enabled mechanical instruments; Doosafon, a percussion instrument played with a breath sensor and a mallet held in the mouth. Doosafon follows on previous work by Atkin and Jewell, on the Lynstrument – trigger pads built for someone suffering from cerebral palsy.[11]

Typhoon: Hands-free Expressive Instrument.

Typhoon consists of mouthpiece that physically registers X and Y head position and digitally outputs data to a computer. The boundary of the key positions is relayed to the player with small haptic vibrations – similar to a smartphone key press. A breath puff sends note-on command to the computer and thus notes are deliberately felt and played on command. Initial tests with Adoo were positive and in 20 mins he played 'The British National Anthem'. New sensors have been added and reliability and resolution developments made. Version 3 of the software is currently under development with rigorous testing to be made throughout 2015.

Doosafon: mouth operated digital xylophone.

Typhoon is not based on any existing instrument i.e. it does not have the note navigation of the keyboard or wind instrument, thus requires a totally new set of skills. Doosafon is a mouth and head operated device similar in kind to a Xylophone but with a digital output.

Rapid prototyping allows swift printing of precise 3d models, with minute changes, that make a signifiant difference for those with a particular range of motion. We have partnered with Bare Conductive[12], who produce touch sensitive electric paint. Unlike traditional buttons and commercially available key types, we can freely customize their shape and arrangement on any material to suit a range of players. This approach costs pennies per print as opposed to hundreds of dollars for touch screens. Advancements include variable touch sensitivity for further expressivity.

Doosafon has a semi traditional keyboard layout with a playable area above and below. Moving the head up accesses the black keys (sharps and flats) and down the white keys (naturals). A lightweight baton is held in the mouth and is linked to a breath sensor. When baton, keypad and the player puff coincide, the chosen note sounds with the intensity of the puff. Adoo played cinematic sub frequency bass on Doosafon in Qatar on stage with the British Paraorchestra in 2014.

[10] Technologies of Inclusive Well-Being, Studies in Computational Intelligence Volume 536, Springer 2014

[11] Enabling Technology: Creating an Inclusive Approach to Digital Technology. https://liorsmith.wordpress.com/tag/lynstrument/ 2015

[12] Www.bareconductive.com

Accompanying players cannot always tell when Adoo is playing HeadSpace. The physical movement of triggering a note from Doosaphon is noticeable and so he can become a signal for time keeping. As any band member will tell you the bassist keeps time in an ensemble as much as the drummer.

As accessibility is the fundamental criteria of the objects we create and activities we foster, so must access be. With this, Doosafon is open source and free to copy under Creative Commons. All files and a build tutorial will be available for free download. The Doosafon uses inexpensive and readily available parts, including Touch Board, microcontroller package by Bare Conductive.

So far all the devices have been monophonic, allowing the player to play one note at a time. The third device (working title: Puffin) is made in collaboration with Bare Conductive, using Bare Paint and the Touch Board, is polyphonic. Work with Paraorchestra identified players with finger dexterity but less upper body strength or arm control. These players can be found to play touch screen tablets controlling music software. The downfalls are lack of capacity for expression, technically complex setup, necessity to look at the screen causing neck ache and distraction.

Puffin is breath controlled and is a one or two hand device with a 1-octave touch sensitive keyboard layout on one side, and a range of modifier keys and strips on the other. When a note key is touched and the mouthpiece puffed, the note sounds. When pressed, the modifier keys on the other side add the respective accompanying chord notes to the original root note. Chords available are major, minor, seven, major seven, minor seven, augmented, diminished, and diminished seven. On sip (breath in) the octave above is played. Rolling the finger across control strips arpeggiates the chord up the octave allowing access to 3 octaves (only one octave less than a guitar). Breath control can be used to control any expression type available from the synthesizer, from delicate nuanced tone changes to vastly abstract and powerful total destruction and reconstruction of whole soundscapes. Further modifier keys can be programmed to perform any function available. At time of publication this device is new. Initial testing with musicians shows promise.

Conclusion.

"We believe that working under constraints and requirements such as the ones that are imposed by disability will lead to new paradigms. The history of inventions has shown several times that ideas developed for disabled people became essential tools in the everyday life of the able bodied. In the 21st Century we are witnessing significant progress in the development of new interfaces for musical expression. Perhaps working with people with disabilities can catalyze the emergence of new ideas for musicians and artists in general."[13]

[13] Ibid. Technologies of Inclusive Well-Being, Studies in Computational Intelligence, 169

Presence at a distance

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Abstract. Nowadays in the context of the cyberculture, computer-mediated inter-subjective relationships are part of our everyday lives, in both the professional and personal spheres, and for all age groups. In the clinical field, many applications have been developed to facilitate the exchange of informations and mediate the relationship between patient and therapist. In psychology, more or less immersive technologies are used, to encourage the feeling of presence among the users, and to trigger certain psychological processes. In our research, we have explored the remote clinical interview through videoconferencing, with the development and utilisation of the iPSY platform, totally focused on this objective. In this context, we have considered the notion of intersubjectivity, despite the physical absence. This research is leading us today to envision the notions of distance and presence, and possibly to redefine them. Thus, can we still oppose physical distance to psychological distance? Can we still affirm that the physical absence does not permit a psychological co-presence in certain interactions, like this observed in video interviews? The results show that the psychological processes, activated in this context, are similar to those observed in "traditional" clinical consults between the patient and the therapist. However, certain specifics have led us to consider the concept of distance, here influenced by the framework, and to observe its effects. This distance could possibly constitute a therapeutic lever for some patients, notably for those who have difficulties establishing the right psychological distance in their relationships with others. According to these results, can “distance” still be opposed to “presence”, or could it be re-defined? This also opens up questions on the more general concept of digital relationships, and the definition of their specificities.

Keywords. Distance, Presence, Intersubjectivity, Video interview, Digital Relationship.

Introduction

Computer-mediated intersubjective relationships are now part of our everyday lives and are often referred to as "remote relationships". These relationships are established in different contexts, involving the participants in different manners from a psychological perspective. In the more global context of cyberculture [1], these relationships are now emerging from childhood, and at all steps of life.

In the context of video interview [2], [3], it is the clinical interview between the psychotherapist and the patient that takes place "remotely". Thus, the framework for the clinical interview [4] has been adapted for certain rules, notably to respect the matters of confidentiality of the exchange, of time and of money. The choice of

videoconferencing as a preferred exchange method has enabled the integration of the body image in the relational modalities that are specific to this framework. Thus, the sensorial factor has been an important consideration [5], to foster the development of a relationship similar to this established in a traditional clinical interview. In cyberpsychology, more or less immersive technologies are used, to encourage the feeling of presence among the users, and to trigger certain psychological processes [6]. Other current research projects show the importance of the sensorial factor in this type of context, even when the exchange takes place between a human and a software-programmed avatar [7].

However, can we state that the physical distance induces a psychological distance, which could be an obstacle to the specific process of psychotherapy? Several research works highlight the phenomena linked to intersubjectivity in this type of relationships, and the feeling of presence, despite the remoteness [8], [9], [10].

According to some other research works [11], [12], no significant difference has been reported by patients, in regards to the therapeutic alliance between face to face and videoconference sessions, using a quantitative assessment method for patients suffering of panic disorder with agoraphobia, or of post-traumatic stress disorder. These findings need to be validated for other mental disorders.

Thus, we can envisage that the notion of intersubjectivity is possible between two persons communicating remotely, distinguishing between physical distance and psychological distance. In the context of a psychodynamics-influenced clinical interview via video session, the co-presence of two humans can correspond in terms of acquaintance, then in terms of relationship, to the normal relation usually observed. The specificities that can be observed shed a light on the nature of this "digital relationship".

Problem

Can we consider there is a feeling of presence in video interview despite the physical distance?

What are the potential specificities of this "remote" relationship, and how does the physical distance lead to the emergence of subjectivity and to the development of intersubjectivity?

We assume that the specificites of the “digital relationship” can be explored through the use of video interviews on the iPSY platform. This kind of relationship, constructed through a psychotherapeutic framework, can bring elements of understanding about the emotional and fantasied sides of the online interactions.

Method/Tools

We have used the iPSY[1] video interview platform that we had designed as a prototype for our PHd research work, and subsequently developed as a software programme available for many users, professional therapists and patients.

[1] http://www.ipsy.fr and http://www.ipsy.eu

This software includes several options that aim at restoring the classical framework for such an exchange, such as confidentiality, deontological principles, time management during the interviews, etc. Other options are specific to this framework, such as the use of the mirror option, of the image frame and of the camera, which we have also integrated in our analysis.
We have compared the relationship established between the therapist and two patients groups: one previously handled in a traditional framework, and the other solely met through the platform. We have observed the development of the intersubjective relationship in the video interview framework, in which bodies are "remote" but the senses are mobilized through the image of the body and the discursive exchange between the participants [5], [10].
We have also observed that this kind of relationship, notably in their emotional and affective aspects, that are generally triggered in a clinical interview between a patient and a psychologist.
We have used a qualitative method through a theme-based grid comprising 12 items for the analysis of 139 interviews captured on video.
We have also used a quantitative tool to try and evaluate the level of social phobia of the participants.

Results

The results show a similarity between relationships established "remotely" between the therapist and the patient, and these established when the persons are physically present. However, we can still discuss the notion of physical presence, as opposed to this of psychological presence. Thus, the physical distance does not emerge as counter productive to the psychological presence (or co-presence) in a video session context.
These results might be aroused by the emotional dimension of the relationship in a clinical interview, as suggested by other results obtained in telepsychotherapy [13], showing that the emotional value of the verbal exchanges between two people who meet in videoconference has a direct impact on the subjective feeling of presence. These results reinforce the idea that the feeling of presence is facilitated by the quality of the exchanges during clinical interviews, where the emotional dimension is essential, because the subjects talk about their personal history and their psychological life, including a fantasied side.
We have also noted that the physical distance that is specific to such interviews can in certain instances be a therapeutic trigger with dependent personalities or these with narcissistic traits. These types of personalities are potentially these that suffer difficulties in establishing the "right distance" in their relationships to others. The distance that comes with the video session framework could thus contribute to their therapy.
These results should be verified in the future, with a larger group of patients and many psychotherapists working on the iPSY platform.

Conclusion

The results observed during this research underline the fact that the physical distance is not a counter-indication to the development of a psychotherapeutic relationship, if the

framework of this relationship has been previously clearly defined by and in the tool that is used. The fact that iPSY has been developed by psychotherapists is thus an essential factor in this project, enabling the observation of the development of an online psychotherapeutic-type relationship.

Thus, the opposition between the notions of "virtual" and "real" does not quite fit the observations made, since the participants' psychological reality remains the same.

We are continuously exploring the specificities of the relationship established in this context, to better know and understand what we can label a "digital relationship", both in the context of clinical interviews and for exchanges established through other online media.

A think-tank comprising several therapists using the platform with different patients has been set up to continuously analyse the data collected through the platform, and define the specificities of this type of online relationship.

We are also working on the platform development in other countries, to increase the availability of psychotherapists in some geographies where there are not many professionals, and also to possibly enable cross-cultural studies in the future.

Finally, it seems that the concepts of "distance" and "presence" need to be redefined today, taking into consideration the variations linked to the use of information and communication technologies.

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