Annual Review of CyberTherapy and Telemedicine

Positive Technology and Health Engagement for Healthy Living and Active Ageing

Editors:

Brenda K. Wiederhold, Ph.D., MBA, BCIA

Giuseppe Riva, Ph.D., M.S., M.A.

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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. 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.

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 seven main sections:

1. **Editorial**: This introductory text expresses the position of the Editors – Brenda K. Wiederhold and Giuseppe Riva – about the focus of this year's issue;
2. **White Paper**: This introductory chapter states the position of the International Association of CyberPsychology, Training, and Rehabilitation (*iACToR – http://iactor.ning.com/*) about critical issues for the future of the field;
3. **Critical Reviews**: These chapters summarize and evaluate emerging cybertherapy topics, including technology-enhanced rehabilitation, Interreality, and Intersubjectivity;
4. **Evaluation Studies**: These chapters are generally undertaken to solve specific practical problems and yield decisions about the value of cybertherapy interventions;
5. **Original Research**: These chapters include research studies which address new cybertherapy methods or approaches;
6. **Clinical Observations**: These chapters include case studies or research protocols with long-term potential;
7. **Work in Progress**: These chapters include papers describing 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.

We are grateful to Chelsie Boyd from the Virtual Reality Medical Institute for her work in collecting and coordinating chapters for this volume. We sincerely hope that you will find this year's volume to be a fascinating and intellectually stimulating read. We continue to believe that together we can make an improvement to healthcare systems.

Brenda K. Wiederhold   *Giuseppe Riva*
Secretary General   President
iACToR   *iACToR*

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SECTION I

EDITORIAL

"Positive Technology" focuses on the use of technology for improving the quality of our personal experience, suggesting specific strategies to modify/improve each of the different dimensions involved, while generating motivation and engagement in the process.

The use of Positive Technology tools and strategies allows the expansion of healthcare beyond the traditional doctor's office and hospital to include advanced simulation technologies such as virtual reality or augmented reality, and spontaneous peer networks that encompass and utilize Web 2.0 properties (blogs, online communities, etc.) that are main fixtures of 21st-century living.

Wiederhold, Riva & Graffigna, 2013

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The Quest for Active and Healthy Ageing: What Cyberpsychology Can Offer

Brenda K. WIEDERHOLD[a-b] and Giuseppe RIVA [c-d]

[a] *Virtual Reality Medical Institute, Brussels, Belgium*
[b] *Virtual Reality Medical Center, San Diego, California*
[c] *Università Cattolica del Sacro Cuore, Milan, Italy*
[d] *Istituto Auxologico Italiano, Milan, Italy*

Abstract. The European Commission identified active and healthy ageing as a societal challenge common to all European countries, and an area which presents considerable potential for Europe to lead the world in providing innovative responses to this challenge (http://ec.europa.eu/active-healthy-ageing). To tackle the challenge of an ageing population, the European Commission launched the European Innovation Partnership (EIP) on Active and Healthy Ageing. What can cyberpsychology offer to this process? After presenting the main features of cyberpsychology, this paper identifies in patient engagement and positive technologies the key assets that will allow the technological innovations constantly being developed to provide greater help and care in enabling elderly people to live more normal, happier, fulfilling lives.

Keywords. people health engagement, patient engagement, health technologies, positive technology, well-being, ageing

The European Innovation Partnership on Active and Healthy Ageing

The European Commission identified active and healthy ageing as a societal challenge common to all European countries, and an area which presents considerable potential for Europe to lead the world in providing innovative responses to this challenge (http://ec.europa.eu/active-healthy-ageing). To tackle the challenge of an ageing population, the European Commission launched the European Innovation Partnership (EIP) on Active and Healthy Ageing [1].

It sets a target of increasing the healthy lifespan of EU citizens by 2 years by 2020, and aims to pursue a triple win for Europe by improving health and quality of life of older people, improving the sustainability and efficiency of care systems and creating growth and market opportunities for businesses. Specifically, the Strategic Implementation Plan [1] adopted by the Partnership's Steering Group in November 2011, focuses on actions developed around 3 pillars: prevention, screening and early diagnosis; care and cure; and active ageing and independent living. Within each pillar, it sets out the following limited number of specific actions (see Table 1) to be implemented from 2012.

Pillar	Priority Action Area	Specific Action
Prevention, screening and early diagnosis	Health literacy, patient empowerment, ethics and adherence programmes, using innovative tools and services	Identifying innovative solutions to ensure better adherence to treatment at a regional level
	Personalised health management	Finding innovative solutions to better manage one's own health and prevent falls by older people
	Prevention and early diagnosis of functional decline, both physical and cognitive, in older people	Helping the prevention of functional decline and frailty
Care and Cure	Capacity building and replicability of successful integrated care systems based on innovative tools and services	Promoting integrated care models for chronic diseases, including the use of remote monitoring at a regional level
Active Ageing and Independent Living	Extending active and independent living through Open and Personalised solutions	Developing ICT solutions to help older people stay independent more active and mobile for longer
Horizontal issues	Thematic marketplace: Innovation for age friendly buildings, cities and environments	Promoting innovation for age friendly and accessible buildings, cities and environments

Table 1. The thematic pillars of the European Innovation Partnership on Active and Healthy Ageing

Upon the adoption of the Commission Communication on the EIP's Strategic Implementation Plan (29th February 2012) universities and research groups, public authorities, health providers, industry, non-governmental organizations representing citizens, older people and patients, and others were invited in two rounds (1st: 3 June 2012; 2nd: 28 February 2013) to provide their committment. Further to the invitation for Commitment, six Action Groups were formed [2-3]:

- **Action Plan A1 - Prescription and adherence action at regional level**: Ensuring that patients follow their prescriptions: new approaches to prescription adherence for various chronic diseases in at least 30 EU regions. Today, only 25% of older people with chronic conditions (heart or lung conditions for example, or combinations – multi-morbidity) take their medication correctly at the right times. An effective adherence approach could improve their condition drastically or prevent decline.
- **Action Plan A2 - Falls Prevention**: Launching and scaling-up programmes for fall prevention and early diagnosis in at least 10 European countries by 2015.

Older people sooner or later become prone to falling. Tele-monitoring can help to quickly detect or even prevent falls. By following training programmes and keeping active, older people can prevent falling or recover quicker if it happens.

- **Action Plan A3 - Prevention of functional decline and frailty**: A program for the prevention of functional decline and frailty among the elderly that will reach at least 1000 care providers by 2015. By supporting people in following a healthy and active regime (diet and exercise), they can live independently in their own homes for longer.
- **Action Plan B3 - Integrated Care**: Deploying, in more than 20 regions, programmes for chronic disease management and integrated care that meet the needs of older persons and enhance system efficiency. With tele-monitoring people with chronic conditions and multi-morbidity (but also their carers) do not have to travel back and forth between doctors, hospitals and care institutions and can monitor and self-manage their own condition and health care choices.
- **Action Plan C2 - Independent Living**: Improving the uptake of interoperable solutions for independent living that enable people to live independently for longer by providing for social contacts, alarm functionalities, and various household services. Older people can use many ICT applications to prevent loneliness, social isolation or premature admission to a nursing home, provided these are interoperable, well integrated and senior-friendly.
- **Action Plan D4 - Age-friendly Environments**: Implementing innovative age-friendly practices at regional and local level, and fostering physical /environmental innovation and practice, including the use of ICT, whilst also promoting a campaign for a covenant of major cities, regions, and municipalities. Cities, villages and public areas have to change to adapt to the needs of older people: more places to rest, easier access to buildings and safer public spaces. A systematic approach is needed to prevent older people from becoming confined to their own home.

1. The Assets of Cyberpsychology for Active and Healthy Ageing

Psychology has been traditionally based on face-to-face interactions that involve verbal and non-verbal language without any technological mediation. However, emerging technologies - Internet, mobile devices, virtual reality, etc. - are modifying these traditional settings. As the availability of these technologies expands the ways in which treatment can be provided, psychologists will incorporate these innovations into their practice and research. Cyberpsychology is a recent branch of psychology that is trying to support this process. In particular, it aims at the understanding, forecasting and induction of the different processes of change related to the use of new technologies.

Within this broad focus, cyberpsychology has two souls. On one side, cyberpsychology tries to understand how technologies can be used to induce a clinical change (**cybertherapy**). On the other side, cyberpsychology focuses on the possible use of technology for improving personal development and well-being (**positive technology**). An asset shared by both sides of cyberpsychology is "**engagement**": the emotional involvement and commitment in the task allowed by the interactive capabilities of technology.

The first asset that cyberpsychology can offer is **patient engagement**: cyberpsychology is in the right position to understand, foster and improve patient engagement. The academic and managerial interests in patient engagement are vertiginously growing daily and are becoming a must for researchers, industries and policymakers in healthcare arenas worldwide: from the 1st of January to the 30th of May 2013, 29,100 new web indices appeared on Google.com with the key words "patient engagement". Consistently, the US Department of Health and Human Services recently identified as the second of five health policy priorities the goal of *improving patients' understanding* of their health and related conditions so they take a more active role in their healthcare.

As more fully discussed in the next white paper (*Positive Technology as a Driver for Health Engagement*) it is possible to conceptualize patient engagement as the experience resulting from the conjoint emotional (feel), cognitive (think) and conative (act)enactment of individuals in their management of health issues. The lack of synergy among these dimensions inhibits patients from full engagement limiting the benefit of health care programs.

Technology may offer a solution to this shortcoming. "Positive Technology" [4-5-6] focuses on the use of technology for improving the quality of our personal experience, suggesting specific strategies to modify/improve each of the different dimensions involved, and generating motivation and engagement in the process.

Such a change from a "disease-centered" to a "citizen/client" model based on the engagement of patients in the management of their care thanks to positive technology will also benefit elderly people who are less mobile and who cannot easily obtain the proper care from the current doctor's office/hospital setting where healthcare is commonly administered. This will allow the technological innovations constantly being developed to provide greater help and care in enabling these people to live more normal, happier, fulfilling lives, further benefiting our community.

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SECTION II

WHITE PAPER

Due to advances in treatment and people living longer, chronic diseases are becoming more common amongst our population.

This is contributing to the increasing burden on our current healthcare system. In fact, more than 83% of money spent on European Union healthcare each year goes toward the treatment of chronic diseases such as heart disease, stroke, cancer, and more. This trend is expected to continue burdening the health economic system over the next 10 years.

In order for us to reduce this burden and sufficiently meet the needs of this growing segment of the population, healthcare organizations must have people take a more active role in their own health and well-being.

Wiederhold, Riva & Graffigna, 2013

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Positive Technology as a Driver for Health Engagement

Guendalina GRAFFIGNA [a], Serena BARELLO [a], Brenda K. WIEDERHOLD[b-c], A. Claudio BOSIO [a] & Giuseppe RIVA [a-d]

[a] *Università Cattolica del Sacro Cuore, Milan, Italy*
[b] *Virtual Reality Medical Institute, Brussels, Belgium.*
[c] *Virtual Reality Medical Center, San Diego, California.*
[d] *Istituto Auxologico Italiano, Milan, Italy*

Abstract. Despite the fact that older adults are healthier than in the past, the current trend of an ageing population implies an increased risk and severity of chronic diseases. Low-resource healthcare systems face increased organizational healthcare costs, which is likely to result in an allocation of limited health resources. Healthcare organizations themselves must deal with patients' increasing need for a more active role in all the steps of the care & cure process. Technological advances may play a crucial role in sustaining people's health management in daily life, but only if it is "ecologically" designed and well-attuned to people's health needs and expectations. Healthcare is more and more called to orient innovative research approaches that recognize the crucial role of a person's engagement in health and well-being. This will enable patients to reach a higher quality of life and achieve a general psychophysical well-being. Thus, positive technological innovation can sustain people's engagement in health and invoke community empowerment, as we shall discuss in this document.

Keywords. people health engagement, patient engagement, health technologies, positive technology, well-being

1. Background

With people living longer, the ageing population is rapidly growing. Worldwide, the proportion of elderly people (age 60 and over) is growing faster than any other age group. Between 1970 and 2025, the growth of the elderly community is expected to reach 694 million or 223%. By 2025, there will be approximately 1.2 billion people over the age of 60. By 2050, there will be 2 billion with 80% of them living in developing countries. The proportion of people 65 years and older in European countries is projected to grow from 15% in 2000 to 23.5% by 2030 [1].

Increased longevity is a sign of success for public health and medical advancement, and can be considered as a consequence of the social and economic development but this increase leads to the following three main challenges:

1.1 Healthcare organizations have to face an increased demand for health and well-being in times of economic constraints: how to find a sustainable organizational solution?

Advances in treatment have increased survival leading to an increasing ageing population. This has contributed to the increase of chronic disease conditions, which have internationally become a major concern with a significant burden experienced by individuals, communities and health services. Chronic diseases, such as heart disease,

stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading cause of mortality in the world, representing 63% of all deaths. Out of the 36 million people who died from chronic disease in 2008, 9 million were under 60 and 90% of these deaths occurred in low- and middle-income countries [2]. The increase in chronic conditions related to the progressively ageing population will constitute the major burden of the health economic system in the next 10 years [3-6]. With the global growth of the older generation comes the need to consider a population with a longer life expectancy that have an increased hope for a happy and healthy life status [7, 8].

There is a rise in the demand for "positive health" treatments and interventions based on the active promotion of people's well-being and quality of life. This extends beyond basic care concerns, such as treatment of just the effects of an illness. In this context, patients/clients more exigently evaluate the quality of services received, thus putting extra pressure on healthcare organizations to sustain higher standards in the delivery of their services [9]. However, the global economic crises and the limited availability of resources are affecting the delivery and the quality of health services: that is forcing healthcare organizations to balance declining resources with increased healthcare costs. These challenges call for a revision of care models [7, 8] shifting from a disease-centred model to a more complex citizen/client model (Figure 1).
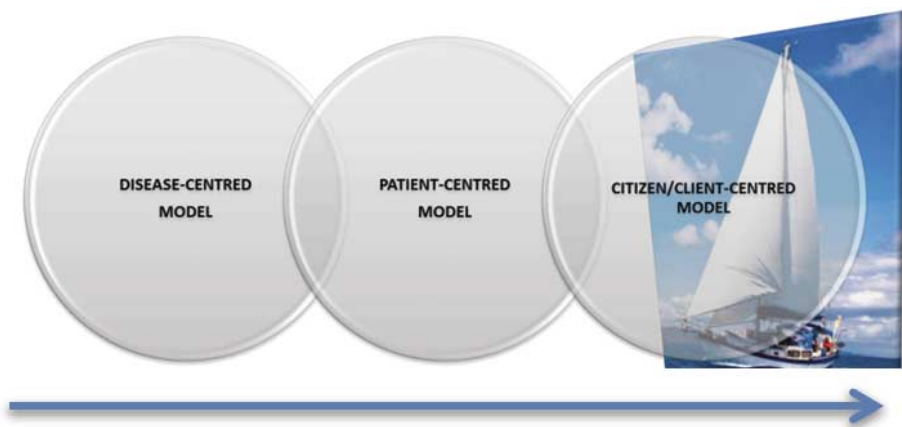
Figure 1. The shift from a disease-centred model to a more complex citizen/client model

1.2 Healthcare organizations are facing having a more "critical" outside: how to establish dialogue and collaborate more with the active community?

The challenges related to the increased demand for health and well-being urge healthcare systems to consider the care & cure boundaries which are now more of the classical setting for treatment (hospitals, clinic, etc.): emergence of new healthcare settings are arising from informal support networks that supply the increased demand for health and well-being.

Health organizations are required to respond to an increasingly active and critical outside and have to consider the patient's increasingly less confined role in the healthcare they receive [10]. This is even more evident when considering the rural/dispersed and immigrated communities that require understanding and specific attention in regard to their cultural, anthropological, economic, and logistical needs and

priorities. The phenomenon of spontaneous peer networks created by patients to receive support and knowledge from other peers on management of their illness as well as other treatment options is growing. These spontaneous peer networks deserve particular attention, not only as a "challenge" for health professionals and the patient relationship, but also as a potential ally in the delivery of health services. Spontaneous networks play a crucial role in patients' knowledge and practices in regards to care & cure.

Peer networks are increasingly diffuse due to development of new technologies and forms of mobile communication (for example: the web 2.0 world and the support that patients receive from web communities, online blogs, and so on). There is the need for new care & cure approaches that shift from the classical disease/doctor centred model based on the expert knowledge and hegemonic role of the doctor, to new healthcare management models (see Figure 2) that recognize citizen-client rights in healthcare [11]. This will also lead to the development of new objectives in health policies not restricted solely to the treatment of disease but also aimed at prevention and the promotion of health and well-being [12].
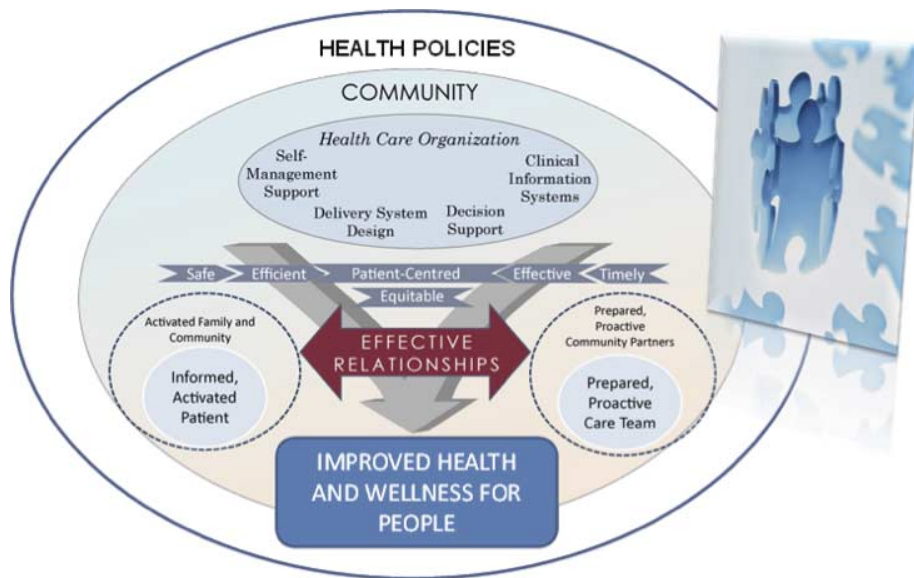
Figure 2. The shift in healthcare management models (adapted from: Haskett, T. "Chronic illness management: Changing the system." *Home Health Care Management & Practice* 18.6 (2006): 492-494)

1.3 Technological innovation for healthy ageing risks being a "top down" application: how to make technological support ecological and attuned to the ageing community's needs and priorities?

Technological advancements can significantly improve the lifestyle of the elderly and dispersed/marginalized communities. Assisted Living Technologies [13] may deliver valuable remote services to people with special needs that will support the management of their daily life. This technology opens the possibility for implementation of

specialized services, such as: assistance for daily activities, health monitoring, and emergency systems.

However, when assisting elderly people and dispersed/marginalized communities it is important to understand how they could benefit from technological innovation that will be ecologically transferred and not a "top down" imposition. The risk of prototypes – although innovative and highly promising – is hardly transferable in the specific anthropological, cultural and psycho-social daily context of elderly people. Often technological innovation answers questions that are not yet being discussed by people.

This could impact their daily life by imposing important change to their normal routines. Some targets within the population/communities may appear resistant, even hostile, to technological innovation. It is important to understand the experiential and emotional mindset of people towards their care & cure process and towards technology in general (i.e. their degree of willingness of adopt technological solutions) in order to better sustain technological integration into the community. In other words, people shouldn't be considered a "target" of new technological solutions, but active partners to involve in the development and delivery of innovative and usable technologies.

2.   Positive technology to support health engagement and community empowerment

As a consequence of the issues previously outlined, there is a need for taking a holistic view of people's healthcare needs to directly engage them in the design and delivery of services really able to meet their needs. Then we must identify and apply the best practices to health services and performance management. To meet these challenges and make healthcare systems equitable and sustainable, policymakers should look at positive technological innovation as a tool for people's engagement in health and community empowerment [14].

2.1 A model of the patient health engagement experience

The discipline of "Positive Psychology" focusing on personal experience may provide a useful theoretical framework to foster people's engagement in health management. In this view, patient engagement can be conceptualized as a subjective experiential process resulting from the conjoint conative (act), cognitive (think) and emotional (feel) enactment of individuals in their health management (see Figure 3). This process consists in four subsequent phases (disengagement, arousal, adhesion and eudaimonic reconfiguration) in which the different experiential dimensions play complementary driving roles, as key factors for promoting patients' advancement in this process [15, 16]. The unachieved synergy among these dimensions inhibits patients from fully engaging in their care process, thus limiting the benefit from the healthcare [17, 18].

People Health Engagement (PHE) relates to higher quality of care and patient-doctor relationship, thus improving patient's clinical markers and compliance to proscribed therapeutic regimens [19]. This makes people aware of their health service options by supporting them in the decision making process and engaging them in preventive health behaviors is vital to achieve successful health outcomes [20]. By favoring a good psychological and emotional tenure, it will foster a self-image as active and engaged and may improve an internal locus of control over disease. This will

reinforce the feeling of empowerment. These components appear crucial in order to guarantee a higher quality of life and a more positive health experience at the hedonic and eudemonic level.

Patients constitute a powerful resource in healthcare and their engagement is essential to gain quality goals and improved outcomes in terms of disease prevention (i.e. cancer screenings), healthy behaviors (i.e. weight control, not smoking) and preventing the waste of resources (i.e., hospitalization, emergency department use) [19]. PHE in the therapeutic process is a crucial element in order to make the patient feel a part of the treatment plan itself, and thus to adhere better to the prescribed therapy with a decrease of relapses. Finally, to engage people in health is vital to social inclusion and the maintenance of an active role in the society. A more engaged and motivated person is active and the main character in his/her community. Thus, people will be more able to maintain social linkage and to strengthen their role and contribution to the society in general.
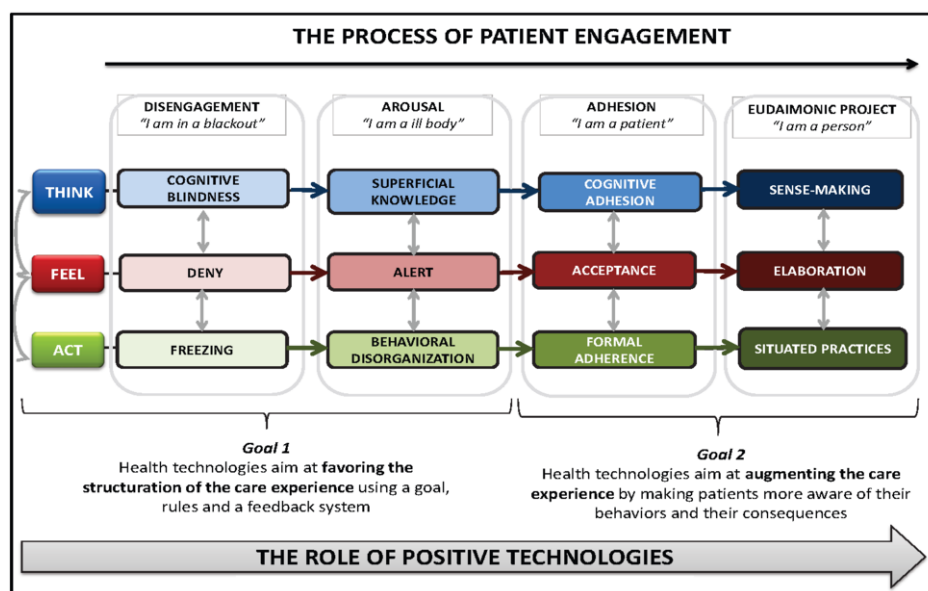
Graffigna G, Barello S, Riva G. How to make health information technology effective? The challenge of patient engagement. Archives of Physical Medicine and Rehabilitation, 2013 (in press)

Figure 3. The role of positive technologies in sustaining the process of people health engagement

2.2 Positive technology as tool for health engagement and community empowerment

Information and communication technologies (ICT) are becoming a strong part in daily lives. ICT can be helpful in fostering personal growth and community empowerment [21]. It is generally assumed that ICT assists individuals in improving the quality of their lives. However, the impact of new technologies and media on well-being and positive applications is still somewhat controversial. Here, we contend that the quality of the treatment experience should become the guiding principle in the design and

development of new technologies. Specifically, we propose the "Positive Technology" approach [22-25] - the scientific and applied approach to the use of technology for improving the quality of our personal experience through its structuring, augmentation and/or replacement. This is a way of framing a suitable object of study in the field of ICT. We suggest that it is possible to use technology to influence three specific features of our experience – affective quality, engagement/actualization and connectedness – that serve to promote adaptive behaviors and positive functioning.

In this framework, positive technologies are classified according to their effects on a specific feature of personal experience (see Figure 4):
• **Hedonic**: technologies used to induce positive and pleasant experiences;
• **Eudaimonic**: technologies used to support individuals in engageing and self-actualizing experiences;
• **Social/Interpersonal**: technologies used to support and improve the connection between individuals, groups, and organizations.
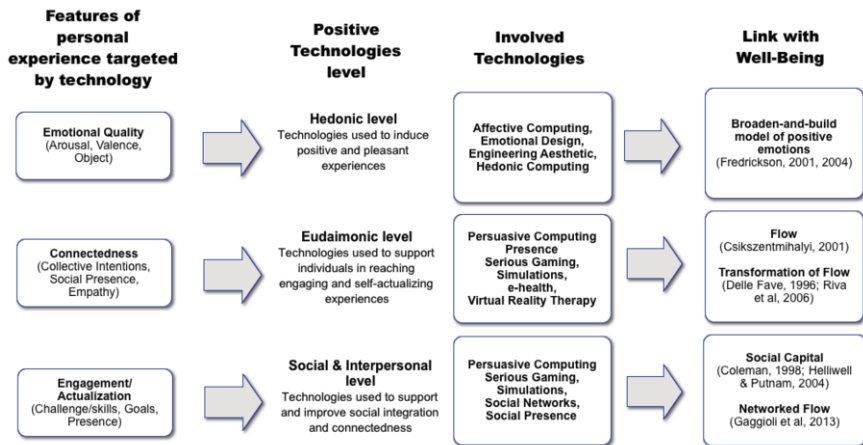
Figure 4. Effects of positive technologies on personal experience (Adapted from [22])

For each level we identified critical variables that can be manipulated to guide the design and development of positive technologies. Technology can be used to manipulate the features of an experience in three separate but related ways (Figure 5):

• **By structuring technology using a goal, rules and a feedback system:** The goal provides subjects with a sense of purpose focusing attention and orienting his/her participation in the experience. The rules, by removing or limiting the obvious ways of getting to the goal, push subjects to see the experience in a different way. The feedback system tells players how close they are to achieving the goal and provides motivation to keep trying.

• **By augmenting technology to achieve multimodal and mixed experiences.** Technology allows multisensory experiences in which content and interaction are offered through more than one of the senses. It is even possible to use technology to overlay virtual objects onto real scenes.

- **By replacing physical experiences with a synthetic one.** Using virtual reality can simulate a physical presence in a synthetic world that reacts to the action of the subject as if he/she were really there. The replacement possibilities offered by technology even extend to the induction of an illusion of ownership over a virtual arm or a virtual body and the use of robotic prostheses to replace healthy or defective body parts with artificial mechanisms and systems to improve function.
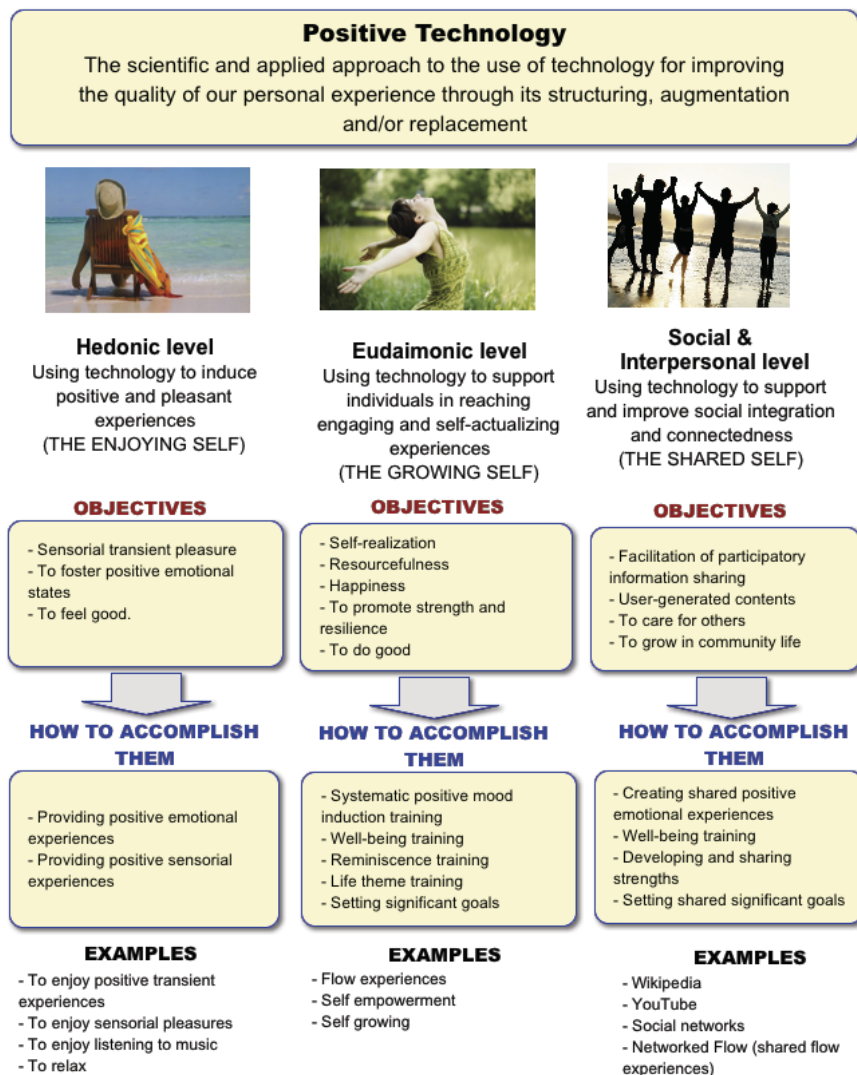
Figure 5. Critical variables guiding the design and development of positive technologies (Adapted from [24])

3. Conclusions

On these bases, we argue that the goal for the future will be to use Technology Engagement (the subjective sense of being fully immersed in the interaction with a given technology - presence and flow) produced by Positive Technologies to improve People Health Engagement (the conjoint conative (act), cognitive (think) and emotional (feel) enactment of individuals in their health management – Figure 6).
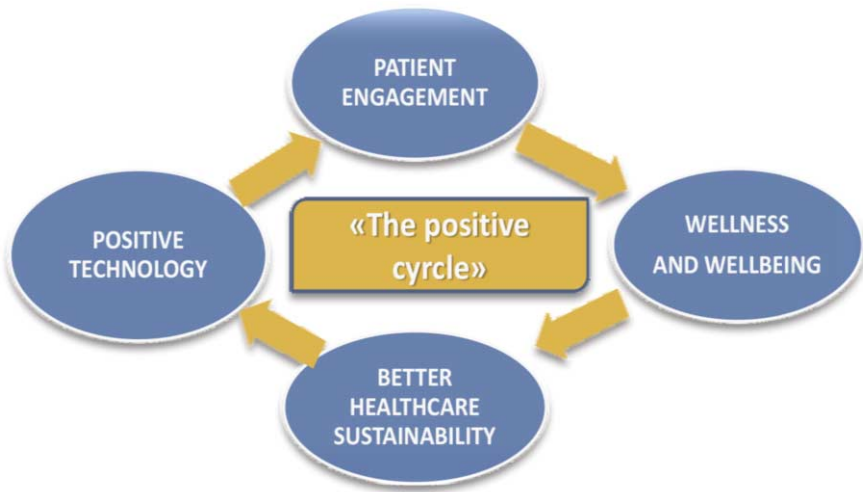
Figure 6. The Positive Cycle

This vision suggests a "continuum of care" where the interaction between the patient and their doctor(s) is not limited to the short ambulatory visits or to the therapeutic sessions in a clinical setting. The process-like modeling of patients' engagement that we propose, potentially leads to a real revolution of healthcare boundaries by posing the bases for a true and sustainable partnership between patients and health providers. In this perspective, while the process of patient engagement evolves, even the individual patient's relationship with the the healthcare system assumes different shapes (relational closure, devolution, alliance, partnership) thus implying a continuous realignment of roles and power dynamics.

By using Technology Engagement to boost Patient Engagement we expect:
- The improvement of prevention and treatment through accurate and engageing real time activities and feedback;
- The increase of reassurance and motivation to a more active participation in illness prevention and care processes.
- The fostering of patients' autonomy by scaffolding them through the engagement process and shaping the power dynamics according to their needs and conditions.

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SECTION III

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 successfully for optimizing health delivery services for 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

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VR Cue-Exposure Treatment For Bulimia Nervosa

José GUTIÉRREZ-MALDONADO[a1], Marta FERRER-GARCÍA[a], & Giuseppe RIVA[b]

[a]*Universitat de Barcelona, Spain*
[b]*Istituto Auxologico Italiano, Milan, Italy*

Abstract. Several approaches to the treatment of bulimia nervosa have proved effective, including cognitive–behavioral therapy; however, not all patients improve. It is therefore necessary to explore the possibilities of increasing the efficacy of such treatments. One way to attempt this is to incorporate new technologies. This review explores the possibility of developing a new, empirically validated procedure for the treatment of bulimia nervosa patients that involves cue exposure via virtual reality.

Keywords. Virtual reality, cue exposure, treatment, binge eating, bulimia nervosa

Problem

Several treatment approaches have proved effective in the treatment of bulimia nervosa (BN); cognitive–behavioral therapy (CBT) produces the best outcomes [1, 2, 3]. However, some BN patients show resistance to conventional treatment and do not improve despite intervention. Therefore, it is necessary to explore whether the incorporation of techniques based on new technologies may enhance the efficacy of current treatment. Our aim is to develop a new treatment method based on cue exposure via virtual reality (VR). The novelty of this proposal is the addition of VR to cue-exposure procedures, which have proved effective in other studies. This addition is aimed at increasing the efficacy of cue-exposure therapy through enhancing ecological validity, while decreasing the logistic complications associated with exposure to real cues (food). The objective of this study is to review the literature on the use of cue exposure with response prevention of bingeing in the treatment of BN, and to discuss the use of VR as the exposure method.

1. Method

The literature on the use of cue-exposure treatment for binge eating in BN is reviewed. The PsycInfo, Medline, and PsycArticles databases were searched by entering the following terms and Boolean operator: *cue exposure* and *binge eating*. Inclusion criteria were broad and no period, language or document type restrictions were considered.

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[1] Corresponding Autor: José Gutiérrez-Maldonado, Facultad de Psicología; Paseo de la Vall d' Hebrón, 171, 08035, Barcelona, Spain; e-mail: jgutierrezm@ub.edu

2. Results

We selected 25 papers from those identified in the searches. Two types of BN treatment based on cue exposure with response prevention were found: exposure with response prevention of purging (ERP-P) and exposure with response prevention of bingeing (ERP-B). Only six studies focused on the assessment of ERP-B: one case study [4], four case series [5-8], and a non-randomized controlled trial [9]. A crossover study comparing ERP-B and ERP-P [10] was also found.

In 1988, Schmidt and Marks [5] first reported results obtained from the treatment of four patients with BN by ERP-B. In that study, patients were exposed to their preferred binge-inducing food. They were asked to eat a small amount of it and they were also encouraged to smell and touch it, in order to trigger an urge to binge; which they then had to resist. Two patients reduced their bingeing and vomiting behavior and also showed improvements in mood and dietary restraint; while one dropped out of the treatment and one did not show improvement during treatment but did it at the follow-up. One year later, these authors conducted a crossover study where two groups of BN patients underwent six sessions of ERP-B and six sessions of ERP-P [10]. After a period of 3 weeks, they were crossed over to six sessions of the other treatment. The authors found that both treatments were reasonably effective at reducing binge-vomiting episodes, but they also found high drop-out rates; particularly during the ERP-B phases. They reported that, compared with ERP-P, ERP-B was less time-consuming and led to greater reductions of urges to binge, anxiety, and liking of food. The same year, Jansen and colleagues [4] reported the case of a patient with BN who was effectively treated by cue exposure plus prevention of bingeing. Food craving declined both during and between cue-exposure sessions, and the frequency of binges reduced radically. These positive results persisted during a 9-month follow-up period. The same research group conducted another study that compared the effectiveness of cue exposure and learning self-control techniques for BN treatment [9]. Both the treatments were successful in reducing craving, depression, and irrational beliefs during and between sessions. However, cue exposure was more effective in the reduction of binge eating frequency; while 100% of the patients treated by cue exposure were abstinent after treatment and during the 1-year follow-up period, only 33% of patients treated by self-control techniques remained abstinent during the follow-up. Jansen and colleagues [9] attribute their better results, compared with those of Schmidts and Marks [5, 10], to the fact that the first group conducted the cue-exposure therapy in the real binge environment of each patient, while the second group conducted it in the therapist's office. In 1995, Kennedy et al. [6] again assessed ERP-B in 20 females with BN and the anorexia bulimia subtype (AN-B). The authors found a significant within-session and pre–post treatment reduction of the urge of binge, a lack of control, feelings of guilt and tension.

The rationale behind the use of cue exposure in these studies is derived from the similarities identified between bulimia nervosa and drug addiction. Both disorders are characterized by substance craving, lack of intake control, and a high relapse rate [4]. Therefore, cue exposure, which has proved to be an effective treatment in addictive disorders, may also be effective for BN. Jansen [4, 9, 11] proposed a model based on the principles of classical conditioning to explain binge behavior present in BN patients. In that model, the intake of binge food is considered the unconditioned stimulus (US) and all the stimuli associated with this binge behavior, the conditioned stimuli (CSs). Exposure to CSs elicits physiological responses, which are subjectively experienced as

food craving, and leads to excessive food intake. In 1994, Jansen [12] postulated that there is a conditioned response (hyperinsulinemia) to food cues that, in turn, elicits a conditioned compensatory response (hypoglycemia). The action of these biochemical responses would explain the experience of craving during food exposure. Thus, the main objective of cue-exposure therapy would be to extinguish food craving by means of breaking the bond between the CSs and the US.

More recent research suggests that the reward associated with food acts on neural circuits in a similar way to the reward associated with drugs, which would explain the addictive nature of food for some people [13]. Besides their primary reinforcing properties, both food and drug intake establish strong Pavlovian associations with stimuli that predict consumption [13, 14]. Those stimuli elicit craving, and recent studies indicate that the search for cue-induced drugs or food have the same neurochemical and neuroanatomical basis [15]. Other studies conducted on animals show that there are individual differences in the intensity of the control exerted by Pavlovian cues over reward-seeking behavior, regardless of the type of reward [16]. There are animals whose behavior is intensively influenced by cues, and such individuals also exist in our species. This means that people with a phenotype that is highly reactive to reward cues may be at increased risk of addictive disorders or at increased risk of relapse after treatment. At the same time, there is general agreement that anxiety, negative moods and subjective distress can trigger episodes of binge eating [17]. Stimuli likely to trigger a binge can cause the anxiety linked to hunger experienced during the bulimic episode.

Eight years after the earliest studies, Toro and colleagues [7] resumed the study of ERP-B. Six severe BN patients, who had shown resistant to drug and cognitive–behavioral treatment, were treated by means of cue-exposure therapy. The patients were asked to touch, smell, look at, and handled food, but they could not eat it. The exposure sessions were conducted in the therapist's office. Subjective anxiety and physiological responses, such as increased blood pressure and heart rate, decreased over the course of the sessions. After treatment, binge eating and vomiting were almost totally suppressed in all 6 patients and during a follow-up period of 2.5-3 years, only two patients reported some occasional vomiting. Given this positive results, the same research group conducted a new study with 22 treatment-resistant BN patients [9]. After 12 cue-exposure sessions, anxiety and blood pressure increase had significantly reduced. Bingeing and purging also decreased. The authors suggest that anticipatory anxiety associated with binge eating cues triggers bulimic hunger; so, the suppression of anxiety reduces the frequency of binge behavior.

The studies reviewed show preliminary evidence of the effectiveness of ERP-B for the treatment of BN patients. The procedure is usually well tolerated and positive results are maintained and even improved during follow-up. Furthermore, ERP-B has proved useful in the treatment of patients who did not improve with CBT or drug treatment [7, 9]. Thus, it has been suggested that cue-exposure treatment may be useful as a second line of treatment in such situations [18]. However, despite initial promising results, research in this field is scarce. Some authors [18, 19] argue that the logistic difficulties and the time necessary for ERP-B have hindered the implementation of this treatment. In the abovementioned studies, patients need to bring sufficient amounts of food to the therapist's office to conduct the exposure session. In other cases, food exposure was conducted in the real environment where patients usually binged; thus requiring the therapist to move location. When exposure is conducted in the therapist's

office, the lack of ecological validity may also make it more difficult to generalize the extinction of craving/anxiety responses to everyday situations.

VR is technology that may be useful for implementing ERP-B. The possibility of simulating a real-life situation by means VR allows good ecological validity to be maintained even when exposure is conducted in the therapist's office: this facilitates generalization to real situations. Moreover, VR allows the therapist to control the different parameters of the situation and, thus, adapt the exposure environment to the needs of each patient at each stage of the treatment. So the use of VR environments, which include both contextual and proximal cues, would solve the logistic and generalization problems related with ERP-B. VR-based cue exposure has previously been used in the treatment of addiction [20-23] with positive results. Given the similarities in the mechanism underlying drug and food craving in addictive disorders and bulimia nervosa, this raises optimistic expectations for the use of VR-based cue exposure in BN treatment. VR cue exposure has also been shown to be effective for eliciting anxiety and negative emotions in patients with eating disorders (ED) [24-26], suggesting that VR cue-exposure treatment may be an effective procedure for reducing food craving and anxiety related with binge eating episodes.

3. Conclusions

The studies reviewed provide evidence of the usefulness of ERP-B for anxiety and binge eating reduction in BN patients, and offer theoretical models based on Pavlovian conditioning to explain the mechanism underlying bingeing behavior and the effectiveness of cue exposure in its reduction. Moreover, ERP-B seems to offer a good alternative for those patients who do not improve with conventional treatment [7, 8]. However, despite the possibility of obtaining positive results, the application of *in vivo* cue exposure in the therapist's office involves logistic difficulties and a lack of ecological validity. VR allows the simulation of real-life situations, providing an ecological, flexible, and controlled environment for patients' cue exposure that may overcome the difficulties detected. Therefore, the addition of VR cue-exposure treatment to conventional treatment programs is proposed as an effective procedure for reducing ED symptoms and binge eating episodes in resistant BN patients.

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Sitting/Setting On A Fence: The Use of (Video)Recording In Producing Data to Study Edge Environments

Carlo GALIMBERTI[a,1] and Eleonora BRIVIO [a]

[a] *Centro Studi e Ricerche di Psicologia della Comunicazione*
Dipartimento di Psicologia
Università Cattolica del Sacro Cuore, Milano

Abstract. The presence of interactive technologies both in field and laboratory research settings makes new instruments and new methodological perspectives to have a complete view of the processes taking place in the setting. This contribution suggests that recording data and taking the researcher position in the setting into consideration may enrich the data production process.

Keywords. Edge environments, methodology, data production, video recording

Introduction

In the last decade research on Human Computer Interaction and Computer Mediated Interaction have become more and more important, and with it also came research *made* with the help of technology (mobile phones, virtual environments, etc.). A methodological reflection did not follow this kind of development though.

This aim of this paper is to reflect critically on the research settings created in producing and analyzing data supported with the use of technology and how to deal with the complexity that comes with it.

1. Edge Environments

Edge environments are interactional contexts created by the use of technology: they are on the border between face-to-face and mediated environments. Most interactions nowadays take place in environments that have this feature. While Applied Social Psychology often makes naturally occurring edge environments its research objects, lab-constructed edge environments appear in Experimental and General Psychology: each time a researcher constructs a setting in which participants are required to interact with and/or through a non-immersive technology, the researcher is creating an edge environment (often defined as *blended* [1]).

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[1] Corresponding Author. Carlo Galimberti, Centro Studi e Ricerche di Psicologia della Comunicazione, Dipartimento di Psicologia, Università Cattolica del Sacro Cuore, L.go Gemelli 1, 20123, Milan, Italy. carlo.galimberti@unicatt.it

This means that the researcher must take into consideration that the borders between the 'real' and the 'virtual' are blurring and useful data are produced not just on one of the two sides of the edge, but simultaneously on both sides, and therefore a research step should be added to the research process to 'gathered' these data, or at least a moment to stop and reflect on the consequences of a edge environment on the research object, to really understand the participants' experience with technology.

2. On the fence: (video) recording data

Researchers must recognize their own limits as observers, data producers and analysts. Studying people in edge environments means that, for most of the time, researchers are sitting on a fence, trying to decide whether to study one side of the phenomenon or the other. Focusing on one side of the fence is a legit choice but it is important that researchers are aware of the consequences of their choices and that there are phenomena that are not constraint by online/off-line boundaries. The second possibility for researchers involves another kinds of technologies: recording research participants' behaviors cameras and logging virtual data are a way to keep track of the complexity of the phenomenon.

The decision to record data is a pondered choice for every researcher, because recording, very much like observing, implies a profound impact on the participants and the research setting, be it on the field or the laboratory.

Rosenstein [2] notes that the use of (video)recording in research is in practice since the 1940s but it is only since the 1990s, when technological costs lowered considerably and equipment got smaller and more portable, that social research actually appropriate it as its own [3]. And while academic debate about methodological issues related to recording has been ongoing since then in anthropology and related fields, it is completely lacking in Psychology.

The advantages of recording audio-visual materials are quite obvious
- It allows researchers to catch every interaction in detail [4]
- It captures the research participants' lived experience and context [5]

The researcher is always present in and conscious of both the choice of technology used to record the participants and in the recording themselves.

While recording, and especially videorecording, is a efficient way to record data in edge environments it is important to remember that the eye of the recording device does not replace the researcher's position as observer: researcher and recording device never look at the same object nor they look in the same way. Recording allows catching details but is limited by the technical features and the position of the device. Knowblaut et al. [4] note that recorded data implies heavy manipulation to be intelligible both during the analysis but also and especially during data production.

3. Who watches the watcher?

When the research calls for it, then recording data through technological device may be a solution but researcher must remember that themselves, the participants, the physical context and the recording process contribute to and influence the data [6], and somehow the recording device is not just recording the participants but also the

researchers' presence in the setting. Table 1 reports some approaches to (video)recording data make data and which dimensions affect the research setting according to different authors.

Table 1. Comparison between approaches to recording data and its consequences on participant-researcher relationship

Authors	Shrum et al. [7]	Gibbs et al. [8]	Galimberti et al. [6]
Metaphor	Invisible Wall	Fluid Wall	Liquid Walls House
Epistemology	Dualism	Critical Realism	Paradigm of Complexity
Level and Unit of analysis	Local – Activity and use of technology	Local – Activity and use of technology	Global – research process
Research setting dimension	Sum of parts, directivity, objectivation of participants and research objects	Validity, Impact, Interpretation	Organizational-functional, pragmatic-normative, symbolic cultural
Participant-researcher relationship	No interaction, no relation (juxtaposed systems)	Reciprocity (videoactive context as observant system)	Intersubjective system made of interactions and relationships between subjectivities

Researcher must pay particular attention to the following dimensions that may influence the data production process.

- Organization-functional dimension: researchers and participants must recognize their own and the other's position in the setting and the necessity of the recording, creating a environment meaningful to the participants and the researchers.
- Pragmatic-normative dimension: researchers and participants must be clear on how to interact in the recorded edge environment.
- Symbolic-cultural dimension: researchers and participants must negotiate the meanings connected to the objects in the research environment and to the relationships people create using these objects.

4. Conclusion

Research about technology and human behaviors conducted with the help of technology potentially create complex research objects that require complex research settings.

To study such objects, researchers may choose to record their data, but they must be conscious that this choice has consequences not just on the setting but on the data they produce.

To say it metaphorically, doing research on edge environments means to move inside an environment resembling more to a liquid walls house than to a space divided in two by invisible, but thick walls (as it was sometimes supposed in traditional research on face to face interaction), or by fluid but not enough 'mastered' walls (as it was and sometimes still is in online interaction research).

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SECTION IV

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 healthcare providers who want to successfully exploit cybertherapy require significant attention to clinical issues, technology, ergonomics, human factors and organizational changes in the structure of the relevant health service.

Wiederhold & Riva, 2004

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The German VR Simulation Realism Scale – Psychometric Construction for Virtual Reality Applications with Virtual Humans

Sandra POESCHL[a,1] and Nicola DOERING[a]
[a]Ilmenau University of Technology

Abstract. Virtual training applications with high levels of immersion or fidelity (for example for social phobia treatment) produce high levels of presence and therefore belong to the most successful Virtual Reality developments. Whereas display and interaction fidelity (as sub-dimensions of immersion) and their influence on presence are well researched, realism of the displayed simulation depends on the specific application and is therefore difficult to measure. We propose to measure simulation realism by using a self-report questionnaire. The German VR Simulation Realism Scale for VR training applications was developed based on a translation of scene realism items from the Witmer-Singer-Presence Questionnaire. Items for realism of virtual humans (for example for social phobia training applications) were supplemented. A sample of N = 151 students rated simulation realism of a Fear of Public Speaking application. Four factors were derived by item- and principle component analysis (Varimax rotation), representing Scene Realism, Audience Behavior, Audience Appearance and Sound Realism. The scale developed can be used as a starting point for future research and measurement of simulation realism for applications including virtual humans.

Keywords. Immersion, simulation realism, virtual environments, psychometrics, virtual agents

Introduction

Virtual Reality (VR) training and therapy applications are a success story among immersive virtual reality developments [1; 15]. Those applications often use high levels of immersion with the goal of producing a realistic experience for the user, thereby creating high levels of presence. The paper presented deals with a way to measure one aspect of immersion, namely simulation realism, as one system determinant of user factors like presence and performance. We propose to use a self-report questionnaire, hence the German Simulation Realism Scale for VR training applications was developed. As social phobia applications (like Fear of Public Speaking) expose users to virtual humans, we specifically included items measuring realism of virtual agents.

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[1] Corresponding Author.

1. Related work and Rationale

Immersive virtual environments (IVEs) are complex technologies that replace real-world sensory information with synthetic stimuli such as 3D visual imagery, spatialized sound, and force or tactile feedback. They are often designed and developed with a specific goal in mind: "to let the user experience a computer-generated world as if it were real – producing a sense of presence, or "being there," in the user's mind" [1]. However, the primary goal is not to induce high levels of presence experienced by the users in itself, but the underlying assumption is rather that higher levels of presence may lead to higher shown performance [7], especially when the application context emphasizes creating certain states (for example inducing emotions like fear in phobia treatment).

State of research shows that immersion or fidelity aspects affect presence and performance [for an overview see 7; 17]. To analyze hard- and software characteristics of IVEs, researchers typically relate on Mel Slater [12] and his definition of "immersion", namely the objective level of sensory fidelity a VR system provides. Presence, in contrast, is defined as user's subjective response to a VR system [12]. However, the terms immersion and presence are often used synonymously [1]. Therefore, researchers have started to use the term fidelity [like given in the definition by Slater, 12] instead of immersion to avoid confusion. In this paper, the terminology proposed by Bowman and colleagues [see for example 5; 6; 11] will be followed.

Three different aspects of fidelity can be distinguished [1]: (a) display fidelity (how close is the system's output to real world stimuli [1]), (b) interaction fidelity (the objective degree of exactness with which real-world interactions can be reproduced in an interactive system [5]), and (c) fidelity or realism of the simulation (how faithfully the environment and objects as seen in the real world are replicated in an IVE [4], including for example their behavior). The first two and their influence on presence are well researched, partly because they directly depend on the systems hard- and software [1].

Realism of the displayed model or simulation depends on the specific application running on the hard- and software and is therefore difficult to measure. However, there are first findings showing a trend of more realistic models leading to higher feelings of presence and performance. For example, including virtual human characters, as well as naturalism of their locomotion animations have a positive effect on distance perception in virtual environments [10]. This also is relevant for VE training applications including virtual humans, for example for social phobias like fear of public speaking [8; 9; 13]. First studies show that higher simulation fidelity does not only lead to higher presence and performance, but also to better transfer of gained skills into practice [3]. Therefore, researchers recently have aimed at integrating realistic virtual human behavior into such applications [2; 9].

Although – as stated above – simulation realism is difficult to measure, it is still the user who has to perceive and interpret information provided by a Virtual Environment. Lee and colleagues for example [4] define visual realism as "the degree to which the images of the simulated world are perceived to be real by the user". Witmer and Singer [16] stress user experience in a similar way, providing a definition for Scene Realism, which "does not require real-world content, but refers to the connectedness and continuity of the stimuli being experienced." (p. 232).

Therefore, we propose to measure realism of VR simulations by using a self-report questionnaire. The German Simulation Realism Scale for VR training applications was

developed. As social phobia applications (like Fear of Public Speaking) confront users with virtual humans, we specifically included items measuring realism of virtual agents.

2. Method

Items from the Witmer-Singer-Presence Questionnaire [16] measuring scene realism were translated into German and adapted to a CAVE scenario (focusing on visual and sound realism). Further, items for realism of a virtual audience (appearance and behavior) were included (see Table 1). A student sample (N = 151) used a virtual training application for Fear of Public Speaking and was then asked to rate simulation realism by means of a 14-item questionnaire. The subscales were derived by item- and principle component factor analysis with Varimax orthogonal rotation.

3. Results

This section will give an overview of the results from the factor and item analysis. Results from the factor analysis are presented in Table 1 and 2. Four factors were derived in accordance to the eigenvalue criterion > 1, explaining a total of 69.37 % of variance (see Table 1). No items were excluded due to cross loadings. Factor loadings for the four sub-scales derived and their respective items are shown in Table 2.

Table 1. Eigenvalues, Percentages of Variance, and Cumulative Percentages for Factors for the Gerrman Simulation Realism Scale

Factor	Eigenvalue	% of variance	Cumulative %
1 Scene Realism	5.40	38.60	38.60
2 Audience Behavior	1.75	12.47	51.08
3 Audience Appearance	1.42	10.12	61.19
4 Sound Realism	1.14	8.18	69.37

The first factor can be summarized as Scene Realism, measuring naturalism of on the one hand visual cues like reflections, lights and shading, and color. On the other hand, three-dimensionality and realistic proportions also converged on this factor, as those cues were also perceived visually in a Fear of Public Speaking scenario were no movement was needed to explore surrounding space.

The next two factors measure audience characteristics. The second factor can be interpreted as measuring realism of Audience Behavior, taking into account nonverbal behavior actions like posture, gestures, and facial expression. Additionally, authenticity of general audience behavior was also subsumed on this factor. The third factor can be best described as realism of Audience Appearance. This factor deals with different aspects of appearance, like authenticity of the virtual humans in general and their outfit, but also adequateness of outfit (as depending on the specific public speaking situation, audiences in real life show different outfits, for example business attire on conferences vs. casual outfits in class).

Lastly, real audience members differ visually from each other, therefore variance of appearance of audience members was also included in this factor. The last and fourth factor consisted of a single item measuring Sound Realism.

All items showed sufficient corrected item-total correlations > .27, with a decrease of Cronbach's alpha if items would have been excluded.

Table 2. Factor Loadings for Varimax Orthogonal Four-Factor Solution for the German Simulation Realism Scale (Items translated into English)

Item	Factor Loading
Factor 1: Scene Realism (α = .82; n = 94)	
6. Reflection in virtual space seemed to be natural.	.81
5. Light and shades in virtual space were realistic.	.79
4. The virtual space seemed to be three-dimensional.	.71
2. Coloring in the CAVE appeared to be natural.	.68
3. Proportions of the virtual space were realistic.	.65
Factor 2: Audience Behavior (α = .84; n = 130)	
7. Posture of virtual humans was natural.	.86
9. Gestures of virtual humans was natural.	.83
14. Behavior of virtual humans in the CAVE was authentic.	.76
8. Facial expressions of virtual humans were realistic.	.68
Factor 3: Audience Appearance (α = .74; n = 104)	
11. Outfit of virtual humans was adequate.	.82
12. Virtual humans differed concerning their appearance.	.68
13. Virtual humans in their entirety seemed to be authentic for this occasion.	.65
10. Outfit of virtual humans was natural.	.62
Factor 4: Sound Realism	
1. Ambience sound intensity in the virtual room was … (1 = too low to 5 = too loud)	.86

Note: N = 67 (due to listwise case exclusion) and α = 87 for entire measure.

Factor 1 and 2 showed sufficient reliability with α > 80. This criterion was not met by the third factor (Audience Appearance), showing α = .74. This could be explained by the low item number. However, as the criterion is nearly met, this scale can be used as a basis for further item development and future scale construction. Factor 4 is a single item "factor", although it showed an eigenvalue > 1. Future research should create more items concerning sound realism, as sound seems to be an important determinant of fidelity [14].

4. Discussion

A scale measuring simulation realism (including virtual humans) was developed based on items of the Witmer-Singer Presence questionnaire. Four sub-scales were derived, measuring Scene Realism, realism of Audience Behavior and Audience Appearance, and Sound Realism. However, the work presented has several limitations. A student sample rated simulation realism with a German questionnaire. Further, the questionnaire was used to evaluate a Fear of Public Speaking Scenario including an audience of 30 people. Different settings (raters, VR applications and questionnaire language) may lead to different ratings. Future research should replicate and supplement our test constructional findings for different settings. Also, one factor (Audience Appearance) showed insufficient reliability, and another one (Sound Realism) consisted of a single item. Still, the study can serve as a starting point for future research. With more and more VR applications including virtual humans, there also is a need to evaluate this specific aspect. Therefore, this questionnaire may be used as a basis for further psychometric test constructions.

Acknowledgments

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Virtual Multiple Errands Test: Reliability, Usability and Possible Applications

Elisa PEDROLI [a,1], Pietro CIPRESSO [a] , Silvia SERINO [a], Federica PALLAVICINI [a],
Giovanni ALBANI [b], Giuseppe RIVA [a,c]

[a] *Applied Technology for Neuro-Psychology Lab, IRCCS Istituto Auxologico Italiano,*
Via Pellizza da Volpedo 41, 20149 Milano, Italy
[b] *Department of Neurosciences, Istituto Auxologico Italiano,*
Piancavallo-Verbania, Italy
[c] *Psychology Department, Catholic University of Sacred Heart, Milan, Italy*

Abstract. Recently, many studies demonstrated the efficacy of using Virtual Reality (VR) in clinical setting, and in particular for neuropsychological assessment. However reliability and usability of the test developed within virtual reality paradigm are often neglect. In this study we test both reliability and usability using well-known psychometrics methods for the Virtual Multiple Errands Test (VMET). In a first experiment, for the reliability, two independent researchers scored the test through several videos. For the usability assessment we analyzed 21 healthy participants and 3 patients with Parkinson's disease.

Keywords: Psychometrics, Virtual Reality, Assessment, Usability, Psychometric Reliability, Executive Functions, NeuroVR, Multiple Errand Test, VMET.

Introduction

Virtual Reality (VR) provides a unique medium suited to the achievement of several requirements for effective rehabilitation intervention: repetitive practice, feedback about performance, and motivation to endure practice [1-10]. VR leads to constantly monitor patient's performance and to quantify his improvements giving an objective evaluation. Another important advantage regards the benefits of the experience of "presence", that is the perception of the simulation as it is a real experience [11-13]. Recently, many studies demonstrated the efficacy of using Virtual Reality (VR) in clinical setting, and in particular for neuropsychological assessment. VR is based on the use of a technology that allow to simulate daily life experiences through 3D interactive environments generated by the computer. Enriching the simulation of 3D virtual environments with prototypical daily situations, it's possible to induce in the patient the feeling of interacting in a real environment and so to create situations which could help the therapeutic assessment, within the safe context of the therapist's laboratory.

In particular, the Virtual Multiple Errands Test was used as a validated protocol to assess executive functions by using a virtual supermarket. Using virtual reality devices may be difficult for subject, for this reason we decided to analyze usability of this tool.

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[1] Corresponding Author.

To developed this test we created a virtual environment with NeuroVR software [13] and displayed on a desktop monitor; specifically a supermarket to explore with the help of the joypad. It consists of a Blender-based application that enables active exploration of a virtual supermarket where users are requested to select and buy various products presented on shelves. The patients enters the supermarket and is presented with icons of the various items to be purchased. to collect products subjects can pressing a button placed on the right side of the joypad after having selected them with the viewfinder. In the virtual supermarket the products are divided into the main grocery categories including beverages, fruits and vegetables, breakfast foods, hygiene products, frozen foods, garden products, and animal products. Signs at the top of each section indicate the product categories as an aid to navigation. The original procedure of the Multiple Errands Test (MET) was modified to be adapted to the virtual scenario of the supermarket [14-17]. It consists of some tasks (to buy some products from a shop and to obtain some information) that are performed in a mall-like setting or shopping center and abide by certain rules (e.g., to carry out all tasks but in any order; not to go into the same aisle more than once; not to buy more than two items per category of item).

To analyzed the performance the examiner analyzes the following variables.

Errors: Errors are task failures or partial omissions (defined as failing to attempt the task).

Inefficiencies: defined as a failure to do more than one thing in one place when is the only place to accomplish that task.

Rule Breaks: defined as anything that violates the rules listed in the MET task list.

Strategies: Examples of the 13 strategies are planning before starting the tasks and marking off the tasks completed.

Interpretation Failures: insight into the type of errors and interpretation failures experienced by the subject in the testing situation.

Before our test we administer a complete neuropsychological battery. To assess the general cognitive level we employed the Mini-Mental Status Evaluations [18], for memory we used the Auditory-Verbal Learning Test and the Novelli's Battery composed Digit Span [20], Corsi's Span [20] and supra-span [21], Short Story [22]. For the assessment of executive function we used the Tower of London test and Verbal Fluency (semantic and phonemic) [22]. We used BIT and Benton's Judgment of Line Orientation to evaluated the visuospatial function and Similarities from WAIS-R and Laiacona's Naming Test to assessment language [23]. The Trial Making Test [24] and the Digit Span Backward from WAIS-R was used to evaluate attention and working memory. To evaluate the level of state and trait anxiety and depression we used State and Trait Anxiety Index [25] and the Back Depression Inventory [25]. All the test score were recorded and corrected for age, education level and gender.

1. Reliability

VMET is a test that might strongly depends on the scorer interpretation. Results are reported in table 1. To assess the variability among different scorers that came to use this test, we asked to two independent scorer to score 11 videos, each one of a subject running the VMET.

At the end of each scoring a researcher inserted data scored into a database for the statistical analysis. There are several methods and measures that can be used to calculate the test reliability [26, 27]. The following measures have been used:

Intra-class correlation coefficient (ICC), a measure of reliability, was used to assess the two observers agreement. ICC can be computed using a one-way or a two-way model.

information-based measure of disagreement (IBMD) provides a useful tool to compare the degree of observer disagreement among different methods, populations or circumstances [26, 27].

Table 1. Reliability Statistics for two scorer disagreement tests

	ICC (one-way)		ICC (two-way)		IBMD	
	ICC	**95% CI**	**ICC**	**95% CI**	**ICC**	**95% CI**
Errors	0.880	(0.633, 0.966)	0.880	(0.616, 0.966)	0.06	(0.029, 0.109)
Inefficiencies	0.717	(0.264, 0.914)	0.732	(0.127, 0.972)	0.14	(0.074, 0.215)
Rule breaks	0.696	(0.266, 0.907)	0.710	(0.178, 0.915)	0.10	(0.072, 0.164)
Strategies	O.266	(-0.343, 0.727)	0.243	(-0.445, 0.727)	0.15	(0.107, 0.226)
Interpretation Failures	0.286	(-0.324, 0.737)	0.306	(-0.258, 0.74)	0.10	(0.044, 0.189)

Our results showed a good reliability of the VMET Test. Even if a more extended data collection is needed, these results seems to be highly encouraging. Studies that make use of VMET scoring as here indicated can also consider to have just one scorer for their tests [27].

2. Usability

Usability can be identified through the following factors [28]:

Effectiveness: can users complete tasks, achieve goals with the product, i.e. do what they want to do?

Efficiency - how much effort do users require to do this? (Often measured in time)

Satisfaction: what do users think about the products ease of use?

These factors are affected by:

The users: who is using the product? e.g. are they highly trained and experienced users, or novices?

Their goals: what are the users trying to do with the product - does it support what they want to do with it?

The usage situation (or 'context of use'): where and how is the product being used?

Usability is defined by the international standard, ISO 9241-11 as [29]: "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."

To evaluate usability we used The System Usability Scale (SUS), a "quick and easy to use" measure developed by Brooke [30]. He define usability as "the subjective perception of interaction with a system." The original SUS instrument [30], is composed of 10 statements that are scored on a 5-point scale of strength of agreement. Final scores for the SUS can range from 0 to 100, where higher scores indicate better usability. Products with scores less than 50 should be considered candidates for

increased scrutiny and continued improvement and should be judged to be marginal at best, between 50 and 70 the product can be defined good and over 80 is excellent [30].

The results of the tests of the 21 healthy subjects are reported in table 2. Healthy participants gave a good usability for the VMET.

Table 2. Descriptive Statistics.

	N	Min	Max	Mean	Std. Dev.
Age	21	21	66	40.86	17.318
SUS Test	21	20	97.5	70.59	19.103

We have also analyzed the SUS of a PD patient. In addition to physical problems can also occur in Parkinson's Disease (PD) cognitive problems, especially dysexecutive disorders. For this reason individuals with PD are the potential users of our tests and it is important to understand how to assess the usability.

The results, collected in three PD patient (mean: 64.17), showed that there needs more than an improvement to VMET, even if it can be consider a valid test when the patient is well trained to use the Virtual Reality settings.

3. Discussion

Although the test has good reliability is important to make some changes that lead to improve the usability. We have to make the test easier to use to make the interaction patients-test as natural and intuitive as possible. This problem exists because our target often presents motors problems that may influence the use of virtual reality. To do this we can show a part of the arm in VR. This could be done through an 3D avatars and real time video capture of the body of the user that will be integrated directly in the virtual environment. This may also increase the sense of immersion and feeling of presence, both these factors are important to increase the ecological validity of the test.

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Validation of a Low-Cost EEG Device for Mood Induction Studies

Alejandro RODRÍGUEZ[a,1] Beatriz REY[a,b] and Mariano ALCAÑIZ[a,b]

[a] *Instituto Interuniversitario de Investigación en Bioingeniería y Tecnología Orientada al Ser Humano, Universitat Politècnica de València, I3BH/LabHuman, Camino de Vera s/n, 46022 Valencia, España*
[b] *Ciber, Fisiopatología de Obesidad y Nutrición, CB06/03 Instituto de Salud Carlos III, Spain*

Abstract. New electroencephalography (EEG) devices, more portable and cheaper, are appearing on the market. Studying the reliability of these EEG devices for emotional studies would be interesting, as these devices could be more economical and compatible with Virtual Reality (VR) settings. Therefore, the aim in this work was to validate a low-cost EEG device (Emotiv Epoc) to monitor brain activity during a positive emotional induction procedure. Emotional pictures (IAPS) were used to induce a positive mood in sixteen participants. Changes in the brain activity of subjects were compared between positive induction and neutral conditions. Obtained results were in accordance with previous scientific literature regarding frontal EEG asymmetry, which supports the possibility of using this low-cost EEG device in future mood induction studies combined with VR.

Keywords. EEG, Emotiv Epoc, Mood Induction, EEGLAB, IAPS

Introduction

In emotional studies, the frontal electroencephalographic (EEG) asymmetry model states that each hemisphere is specialized in processing different emotions [1]. This model declares that there exists an asymmetry in the activity of the frontal lobe of the brain, and by means of this asymmetric activity it is possible to moderate and process different emotional responses. Consequently, frontal EEG asymmetry can be evaluated and applied to distinguish the affective valence of an emotion felt.

Findings from numerous studies show an evident consensus that an increase of left frontal activity and a decrease of right frontal activity are associated with positive emotions, and that an increase of right frontal activity and a decrease of left frontal activity are associated with negative emotions. This has originated the approach/withdrawal model of Davidson [2-3] and is consistent with brain injury studies.

The results of previous studies were obtained through EEG signal measurements, where the participants were in a rest moment. Others studies have complemented this interpretation about frontal EEG asymmetry during a mood induction procedure. They have considered interesting to measure the frontal EEG signal in specific emotional

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[1] Corresponding Author.

contexts with the aim of analyzing the ability of each individual to respond emotionally [2-3]. It was observed that frontal EEG asymmetry, during a fear induction, was a better negative affect predictor than an analysis of EEG in a rest condition. However, the positive affect could be predicted by EEG analysis both during a rest condition and a positive induction moment.

Clinical EEG devices have been used in most of these studies. The majority of these systems are very precise but they have as disadvantages that they are expensive, intrusive and difficult to use by the therapist.

Recently, the new low-cost EEG devices, which are appearing on the market, provide great portability and a good quality brain signal. Moreover, these EEG devices have a great compatibility with other technologies, such as Virtual Reality. Low-cost EEG devices could be used in a Virtual Reality study without influencing the progress of this study.

In the present work, the possibilities of EEG monitoring through a portable device to evaluate mood induction of participants were analyzed. Therefore, the goal of this study was to analyze if a low-cost EEG device (specifically, the Emotiv EPOC) was able to measure changes in brain activation in the frontal EEG while a positive mood was inducted to the subjects.

1. Materials and Methods

Sixteen healthy participants, 8 men and 8 women, were evaluated in this study, all of them right-handed and with ages between 23-30 years old with normal o corrected-to-normal vision. The subjects were university students without any psychological disorder and none of them was an expert in the use of the technologies applied in this study. They signed an informed consent for allowing their data to be used in this study. It was not necessary to exclude any participant due to wrong registration of the EEG signal.

The EEG signal was monitored by means of an EEG portable device, Emotiv EPOC [4] which had 14 EEG channels using the standard 10/20 layout and 2 reference channels (CMS/DRL), Fig 1.

Figure 1. Emotiv EPOC device and Emotiv EPOC electrodes positioning on standard 10/20 layout.

EEG recordings were analyzed off-line using custom software written in MATLAB. This custom software was based on EEGLAB [5] tools. Many EEG functions were used to clean the EEG-data and analyze changes in alpha-spectral power.

In the study, the participants had to watch positive and neutral pictures of IAPS [6], which were used as mood induction stimulus, in a desktop screen.

The experimental session was divided into four steps of two minutes each. In the first step, the participants had to watch a black screen (rest stage). In the second step, the emotional pictures were presented (15 neutral pictures). In the third step, another rest stage was presented. And in the last step, the other emotional pictures were presented (15 positive pictures). Steps number two and four were counterbalanced.

A two way repeated measured ANOVA was applied, being the independent factors the experimental moment, Neutral Condition versus Positive Induction, and brain hemisphere (right/left). Alpha-ERD (1) values, calculated for F3 (left hemisphere) and F4 (right hemisphere) [2, 7, 8] sensors, were used as dependent variables. F3 and F4 were used because they are the sensors more used in the scientific literature to analyze the valence of the participants as they are located above the dorsolateral prefrontal cortex [9].

$$AlphaERD = \frac{Alpha\ Power\ Rest - Alpha\ Power\ Induction}{Alpha\ Power\ Rest} \tag{1}$$

2. Results

Results showed significant differences between neutral and positive moments $(F(1,15)=5.859; p=0.029)$ and a significant influence of the intersection factor between hemisphere and moment $(F(1,15)=9.594; p=0.007)$.

Pair-wise comparisons only showed significant differences between hemispheres during the positive induction $(p=0.010)$.

Table 1. Mean and standard deviation Alpha-ERD values of the F3 and F4 sensors.

Sensor	Neutral Condition		Positive Induction	
	Mean	*Std.*	*Mean*	*Std.*
F3	1.094	5.074	1.600	5.803
F4	0.386	4.545	-3.649	1.026

A decrease was observed in the Alpha-ERD in the right hemisphere and an increase in the left hemisphere when the positive emotion was inducted. Mean values and standard deviation values of each sensor can be seen in the Table 1.

Figure 2 shows three topographic scalp maps, which give a visual representation about the distribution of average alpha ERD values around scalp in the positive moment, the neutral moment and the difference between positive and neutral moments, respectively.
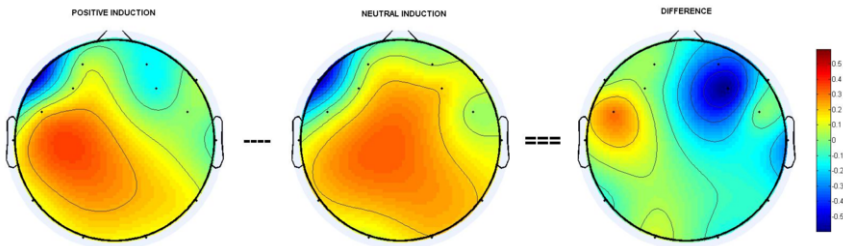
Figure 2. Topographic scalp map of average alpha ERD values.

3. Discussion

The goal of this study was to analyze if a low-cost EEG device would be able to measure changes in brain activation in the frontal EEG while a positive mood was inducted to the subjects through emotional pictures.

Statistical results show activation in the left hemisphere significantly greater than in the right hemisphere during the positive images visualization. This activation was greater during positive induction than during neutral induction.

In the figure 2, the difference between alpha ERD values for each moment can be seen. It shows that there is a right hemisphere deactivation and an increase in the left hemisphere during the positive induction, in comparison with the neutral induction moment.

These results show evidence of a frontal asymmetry in the EEG of the participants during a positive induction, which is in accordance with science literature [1, 2, 8], that affirms that activation of left hemisphere is linked with positive emotion induction [1, 2, 7, 8, 9].

This results support the possibility of using the low-cost EEG devices, in particular Emotiv Epoc, as an emotional measuring tool in future studies.

Acknowledgments

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Virtual Reality as a Method For Evaluation And Therapy After Traumatic Hand Surgery

Adriana Sarah NICA[1,2], Consuela Monica BRAILESCU[1,2], Rodica Gabriela SCARLET[1,2]
[1]*National Institute for Rehabilitation, Physical Medicine and Balneology Bucharest, Romania*
[2]*Physical Medicine and Rehabilitation Department, „Carol Davila" University of General Medicine and Pharmacy, Bucharest, Romania*

Abstract. In the last decade, Virtual Reality has encountered a continuous development concerning medical purposes and there are a lot of devices based on the classic „ cyberglove" concept that are used as new therapeutic method for upper limb pathology, especially neurologic problems [1 ;2;3]. One of the VR devices is Pablo (Tyromotion), with very sensitive sensors that can measure the hand grip strenght and the pinch force, also the ROM (range of motion) for all the joints of the upper limb (shoulder, elbow, wrist) and offering the possibility of interactive games based on Virtual Reality concept with application in occupational therapy programs. We used Pablo in our study on patients with hand surgery as an objective tool for assessment and as additional therapeutic method to the classic Rehabilitation program [4; 5]. The results of the study proved that Pablo represents a modern option for evaluation of hand deficits and dysfunctions, with objective measurement replacement of classic goniometry and dynamometry, with computerized data base of patients with monitoring of parameters during the recovery program and with better muscular and neuro-cognitive feedback during the interactive therapeutic modules.

Keywords: Virtual Reality; Hand Surgery; Hand Evaluation and Therapy; PABLO"device; Functional Rehabilitation

Introduction

The post-traumatic hand surgery sequelaes represents an important part of pathology who addresses to a Hand Rehabilitation Center, not only from statistic percentages, but especially because of the major dysfunctionalities and handicaps for daily and professional activities. The causes of the hand traumatic injuries are very complex (burns, amputations, electric lessions, work-related accidents) and most of them require surgical intervention; after surgery, depending upon the severity of the sequelaes, the patients are integrated in a Rehabilitation program in a Hand Center. For establishing the therapeutic management of the patients, the doctors need to evaluate all the post-surgical sequelaes, especially neurologic sensitive and motor deficits, muscle force and joint mobility, but also the functional status of the patient (hand grip strenght, pinch force). The Pablo system from Tyromotion [1;2] is a new

device with very sensitive sensors that can measure the hand grip strenght and the pinch force, also the ROM (range of motion) for all the joints of the upper limb (shoulder, elbow, wrist). These measurements allows the PRM doctor to have an objective evaluation of joint mobility and muscular strenght of the entire upper limb, with better clinical and functional diagnosis for specific pathologies and with better computerised evaluation during the rehabilitation programs. Figure 1 [1] shows an example of the computerised evaluation of the ROM –eg for extension.
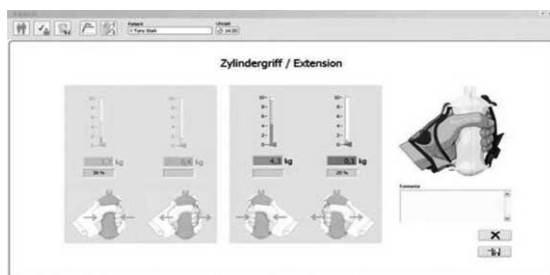
Figure 1. Computerised evaluation of ROM using Pablo

1. Purpose

We started to use Pablo in our Clinique of National Institute of Rehabilitation for patients hospitalised here after hand surgeries for various hand traumas. Our purpose was to demonstrate that Pablo can be useful as an assessment tool for hand pathology (instead of classic goniometry and dynamometry) also, that it can be part of the classic rehabilitation program for these patients (together with other specific therapeutic methods). [3;4;5]

2. Material and Method

The study was performed between May 2011 – October 2012 on 54 patients hospitalised here with complex sequelaes after hand surgery for traumatic injuries. At the beginning and at the end of each ten-days rehabilitation sessions in our Clinique, all of them were assessed clinical, pain score (VAS and McGill score) neurologic (specific sensitive and motor testings), classic goniometry and dynamometry (Jamar hand test) and also, using Pablo. The functional measurements consists in FIM scale (functional independence measurement), DASH score (Disability of Arm-Shoulder-Hand Score), Michigan score (Michigan Hand Outcomes Questionnaire) and dexterity and coordination test (using the 9-hole Peg board test) [5;6;7]. The rehabilitation program consisted in daily physical procedures for all the patients, with kinetics, occupational therapy, therapeutic massage, electric stimulations for hypotrophic muscles (the classic program). There was a group of 15 patients who had the whole classic program, but also an hour per day with Pablo therapy module. Figure 2 shows a young patient with surgery for a traumatic lesion in the wrist region working with Pablo as an adjuvant ergotherapy to the classic occupational therapy.

Figure 2. Ergotherapy using Pablo

Figure 3. Balloon game

Pablo offers the possibility of interactive sessions of occupational therapy based on Virtual Reality principles [3;4], representing a continuity of the standard possibilities for ergotherapy from the Hand Center, with adjustment for each patient clinical status and task-oriented based on usual daily activities and profession. The doctor or the kineto-therapist selects for each session the movement parameters, the strength and the grip/pinch that could be achieved by the patient based on realistic and accurate evaluation of ROM and muscular force (performed also with Pablo) and selects the most fitted „virtual game" to the clinical deficit of the patient. After training and daily performance using the device, the patient himself learn to adjust the parameters and the program may be performed at home as a continuation of the classic ergotherapy performed under supervision at the Hand Rehabilitation Center [5;6;7]. There are many games, each of them with specific target („Baloon" as shown in Figure 3 [1] is for improving eye-hand coordination, „Firefighters" enhances mobility and strength, etc).

3. Results

The study is completely finished; the statistic analysis of all individual assessments (clinic tests and Pablo soft database) was based on MicrosoftExcel, Kynos Modalisa, t-student test, chi ^{2} test and ANOVA and showed the following results:

- For pain and all local sequelaes (oedemas, vascular and trophic disturbancies) [8] the results showed improvement for all the studied patients, but no statistic significance for the Pablo group
- For coordination and dexterity: statistic significant better results for the Pablo group, with 32% better results at the 9-hole Peg board test
- For functional tests: all the patients integrated in Rehabilitation program improved the functionality for the operated hand and decreased the disability score, but the differences between the results at the patients who had Pablo therapy were statistic significant better versus those who didn't work with Pablo, as shown on the evolution of the Michigan score (377.9 points versus 355.1points). The improvement of the FIM score with 4.3 points at the end o the study comparing with its beginning, at patients who worked additional with Pablo, has an important functional and clinic implication: a greater measure of functional independence for the patient, better performance for daily activities and better chances for social and economic re-integration. Figure 4 shows 39.4 points improvement for the

DASH score at the patients who worked with Pablo versus 32.6 points at the patients who didn't work with Pablo.
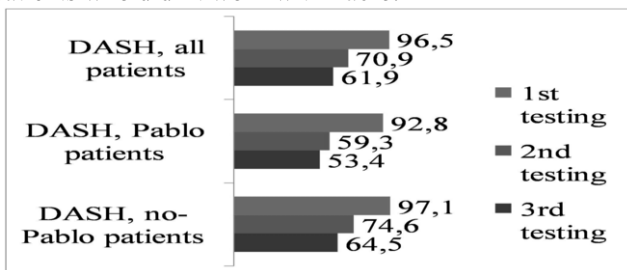
Figure 4. DASH score evolution during treatment

- For prehension, all the 10 types of grips and pinches evaluated with Pablo showed essential improvement for all the patients, but with significant improvement for those patients who worked with Pablo, as shown in Figure 5: the grip force flexion, policis-index finger, policis-medius finger and tri-digital pinch, which are the grips with the greatest practical and functional importance for daily activities (eating, dressing, manipulating objects).
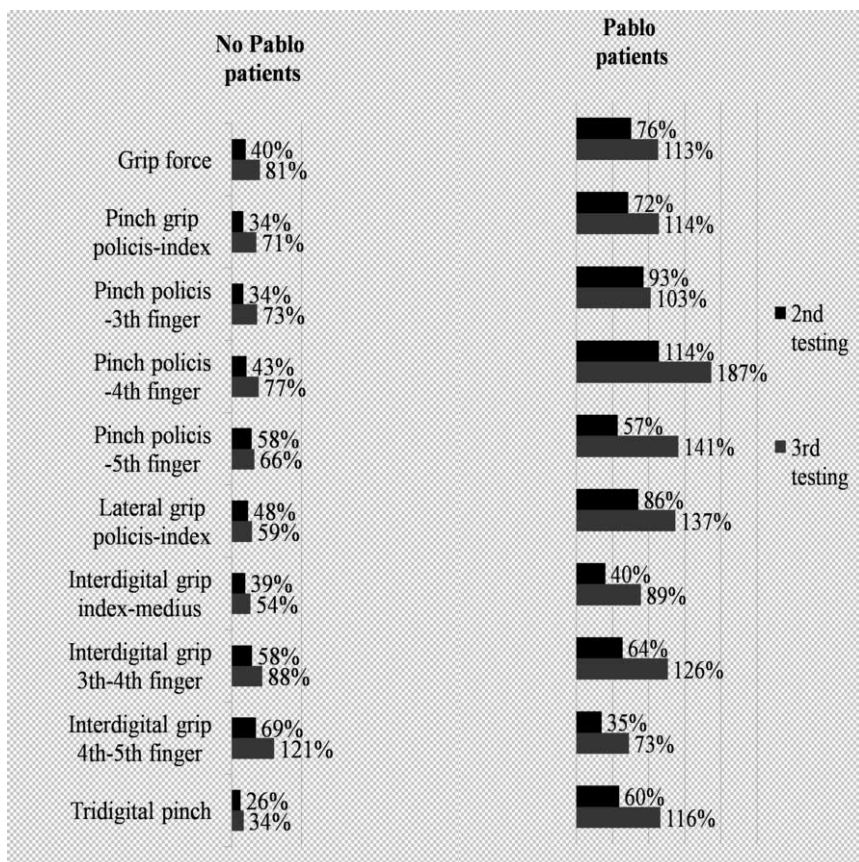
Figure 5. Grips and pinches evolution during treatment

4. Conclusions

- Pablo is a device that allows better, more objective and more rapid assessment of joints and strength of all upper limb segments, including prehension assessment with greater possibility for clinical and functional evaluation of a patient with hand pathology. The results are memorized in a computerized data-base for each patient, allowing the PRM specialists for objectively monitoring the progression in time of the recovery process [6; 7].

- Pablo game therapy sessions represents a continuation of the classical occupational therapy program that can be performed also by the patient himself, at home and they give the opportunity to adapt the game parameters to the realistic functional status of the patient. The benefits are on improving not only locomotor values (ROM, force, prehension), but also attention, motivation, dexterity, based on audio-visual and haptic feedback that can help the patient from early recovery process [6;7].

- Pablo can improve the results of the classic Rehabilitation program and can be integrated in Occupational Therapy methods only as a supplement, but not a substitute and only under professional medical supervision.

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Methodology Case Study of the Application of Haptics to Combat Medic Training Programs

Kenneth GAO[a], Brenda K. WIEDERHOLD[b], Lingjun KONG[a], Mark D. WIEDERHOLD[a]

[a]*Virtual Reality Medical Center,* [b]*Interactive Media Institute*

Abstract. Of the available training methods for emergency responders, including other methods based on computer technology, virtual reality video game training with haptics (tactile) features will be shown to provide the most effective transfer of skills to real-world emergency situations, providing a model for the development of new training products for combat medics and civilian first responders. This paper aims to provide a methodological case study of haptics use in medical training programs and highlight achievements in terms of performance. Review of these cases show that the addition of haptics to an existing simulation-based training program increases user performance in terms of completion time, error rates, and learning rate. With this case study, haptics can be further incorporated into training programs designed for military combat medics.

Keywords. Haptics, Virtual Reality Training, Combat Medic, Kinesthetic Learning Style

Introduction

It is now fairly common knowledge that each person learns in a different way. Gardner proposed presented in 1983 that there are eight different kinds of intelligence that contribute to an individual's successful learning. Linguistic and logical and mathematical intelligences have long been the focus of lessons taught in a classroom, limiting the achievement of students who learn better through kinesthetic, visual/special, musical and interpersonal channels. Gardner's Theory of Multiple Intelligences, arguing that all people possess some degree of each intelligence, has encouraged educators to include a variety of experiences in their curriculum development [1].

A typically underutilized learning style in traditional classrooms is the Bodily-Kinesthetic Intelligence which refers to one's ability to learn through the use of body movements and sense of touch. Kinesthetic activities tap into what Piaget termed "sensorimotor learning," in which physical activity transforms into representative mental symbols [2]. Kinesthetic Learning Activities (KLAs) are activities that utilize this distinct intelligence to physically engage students. These exercises energize students and achieve especially challenging learning goals [2]. Other learning frameworks, such as Fleming and Bonwell's "VARK" learning styles model [3], also recognize the central role of physical learning.

The term "haptics" is the study of touch and human interaction with the external environment via touch. This field has grown dramatically as haptics researchers are involved in the development, testing, and refinement of tactile and force feedback devices as well as supporting software that allow users to sense ("feel") and manipulate three-dimensional virtual objects [4]. In addition to basic psychophysical research on human haptics, work is being done in application areas such as surgical simulation, medical training, scientific visualization, and assistive technology for the blind and visually impaired.

Technological advances now allow for haptics to be added to a variety of computer applications. Physicians use remote touch in minimally invasive surgery through the use of haptic interfaces with force sensors that allow the surgeon to "feel" tissues and organs during surgery [5]. A recent study found that participants were able to more efficiently learn virtual mazes when haptics were added than when there were no haptic feedback cues [6]. Within the last decade, haptics has been introduced to virtual reality environments.

One specific educational area that could heavily utilize haptics is the training of military combat medics. Providing medical treatment in combat zones creates major challenges for front line medics and surgeons. The United States Defense Department is investing millions of dollars in training medical personnel who perform the primary assessment and treatment of personnel with injury, yet current methods of instruction for Army, Air Force and Navy medical personnel can be improved. Many are investing heavily in developing training technologies to address the issue. One such example is the creation of realistic prosthetics that simulate the look, smell, and feel of severe trauma situations [7][8]. To supplement the current combat medic tools, including textbooks with vignettes, real-life learning, and mannequins, and these developing technologies, the Virtual Reality Medical Center (VRMC) is currently developing a Combat Medic virtual reality video game (VRVG) training system. The VRVG will incorporate a haptics element to add an increased element of realism to increase players' competence in performing specific life-threatening emergency procedures. The system is an adaptation of commercial off-the-shelf (COTS) video game environments that can be easily changed and updated as well as programmed to react to the user's skill level. The current effort focuses on U.S. Army 68W combat medics who are receiving training at the Directorate of Combat Medic Training, Army Medical Department (AMEDD) Center and School, Ft. Sam Houston, TX and is being considered for AMEDD curriculum implementation. This paper addresses the methodology of employing haptics to combat medic training programs with various case studies.

1. Methodology and Discussion

As the objective of this case study is to evaluate the impact of haptics utilization, specifically in virtual reality training programs for military combat medics, it was necessary to understand current use of haptics in similar training programs. Thus, "haptics," "virtual reality," and "medical training" were important keywords that were taken into account when searching for cases. Cases were pulled from journals that specialize in either technology and virtual reality or clinical surgery.

Haptics is defined as a force feedback system that incorporates a "haptics interface." The interface is a device that allows a user to interact with a virtual environment by receiving tactile and kinesthetic feedback. All haptic interface feedback devices share the unparalleled ability to provide for simultaneous information exchange between a user and a machine. Currently available devices include gloves, body suits, and specialized monitors, mice, and joysticks.

Cases were evaluated based upon subjects' ability to remember and accurately execute procedures while negotiating a virtual environment. Several questions were asked during evaluation:

1. Which forms of feedback were used prior to incorporating haptics? Do haptics provide an additional channel for communication between user and machine?
2. Do subjects feel greater immersion when using haptics as compared to conventional virtual reality?
3. Are subjects able to improve performance of medical procedures? Do completion times decrease? Do subjects make fewer errors?
4. How does the rate of learning change when using haptics training programs with repeated use as compared to other programs?
5. Does the addition of haptics increase anxiety, stress, headaches, dizziness, or any other mental side effect during the program?

2. Case Studies

#	Title	Year	Author(s)	Method	Achievement	Reference
1	Reducing Error Rates with Low-Cost Haptic Feedback in Virtual Reality-Based Training Applications	2005	Jiang L, Girotra R, Cutkosky MR, Ullrich C	Subjects participated in simulated exercises for clearing a damaged building, implemented using a modified commercial videogame engine and USB-compatible force and vibration feedback devices.	Experiments showed fewer errors by subjects performing a task with force feedback, implying higher levels of immersion. There was improvement in performance speed and recall accuracy, when negotiating a dark, cluttered environment using vibration feedback devices.	Digital Object Identifier: 10.1109/WHC. 2005.111 420-425
2	Simulation improves resident performance in catheter-based intervention: results of a randomized, controlled study	2006	Chaer RA, Derubertis BG, Lin SC, Buch HL, Karwowski JK, Birk D, Morrissey NJ, Faries PL, McKinsey JF, Kent KC	20 general surgery residents received didactic training in the techniques of catheter intervention. Residents were then randomized with 10 receiving additional training with the Procedicus, computer-based, haptic simulator and then participated in 2 consecutive mentored catheter-based interventions for lower extremity occlusive disease in an OR/angiography suite. Performance was graded by surgeons blinded to the resident's training status, using 18 procedural steps and a global rating scale.	Overall, residents exposed to simulation scored higher than controls during the first angio/OR intervention. The advantage provided by simulator training persisted with the second intervention. Moreover, simulation training, particularly for the second intervention, led to enhancement in almost all of the individual measures of performance.	Ann Surg. 2006 Sep;244(3):34 3-352
3	Passive haptics in a knee arthroscopy simulator: is it valid for core skills training?	2006	McCarthy AD, Moody L, Waterworth AR, Bickerstaff DR.	The Sheffield Knee Arthroscopy Training System (SKATS) indicated the desirability of including haptic feedback. A formal task analysis confirmed the importance of knee positioning as a core skill for trainees learning to navigate the knee arthroscopically. The system cost and existing limb interface, which permits knee positioning, would be compromised by the addition of commercial active haptic devices available currently.	The validation results obtained when passive haptic feedback was provided indicated that SKATS had construct, predictive and face validity for navigation and triangulation training. After SKATS training sessions, novices showed improvements in: completion time, shorter arthroscope path lengths, shorter probe path lengths, and fewer arthroscope tip contacts. Main improvements occurred after the first two sessions, indicating rapid familiarization.	Clin Orthop Relat Res. 2006 Jan;442:13-20

4	Early exposure to haptic feedback enhances performance in surgical simulator training: a prospective randomized crossover study in surgical residents.	2006	Strom P, Hedman L, Sarna L, Kjellin A, Wredmark T, Fellander-Tsai L	A randomized crossover study design was used, in which 38 surgical residents were randomized to begin a 2-h simulator training session with either haptic or nonhaptic training followed by crossover after 1 h. The graphic context was a virtual upper abdomen. The residents performed two diathermy tasks. Two validated tests were used to control for differences in visual-spatial ability: the BasIQ general cognitive ability test and Mental Rotation Test A (MRT-A)	After 2 h of training, the group that had started with haptic feedback performed the two diathermy tasks significantly better (p < 0.05, unpaired t-test). Only the group that had started with haptic training significantly improved during the last 1-h session (p < 0.01, paired t-test).	Surg Endosc. 2006 Sep;20(9):138 3-1388. Epub 2006 Jul 3.
5	Application of virtual reality force feedback haptic device for oral implant surgery	2006	Kusumoto N, Sohmura T, Yamada S, Wakabayash i K, Nakamura T, Yatani H	A novel support system for implant surgery was tried out, which involved manipulating a 3-D computed tomography (CT) image of a jawbone with a VR force feedback haptic device. Through this virtual system, the haptic experience of bone drilling with vibration and the sound of the contra-angle handpiece could be realized. It was expected to be useful for training inexperienced dentists and educating dental students. Cross-sections of the guide holes in the surgical template were imaged, and misalignment between the guide holes of the surgical template and the drilled holes on the jawbone was measured.	Cross-sections of the guide holes in the surgical template were imaged, and misalignment between the guide holes of the surgical template and the drilled holes on the jawbone was measured. The average misalignment was less than 0.2 mm, and it indicated that the system was potentially applicable to oral implant surgery.	Clin. Oral Impl. Res.17, 2006; 708-713 doi: 10.1111/j.1600 - 0501.2006.012 18.x.
6	Augmented Kinematic Feedback from Haptic Virtual Reality or Dental Skill Acquisition.		Suebnukarn S., Haddaway P., Rhienmora P., Jittimanee P., & Viratket P.,	A randomized experiment was designed to determine the role of variations of movement-pattern feedback on dental skill acquisition as compared to performance without augmented feedback. The augmented kinematic information was given during student performances of endodontic access opening on the upper first molar using VR simulation that provided haptic and visual sensation. Three experimental groups were tested, involving force utilization, mirror	Results show that the group with both force utilization and mirror view performed most proficiently, followed by the F group, M group, and finally the control. All augmented kinematic groups were significantly more efficient than the non-augmented control (p < 0.05).	*Journal of Dental Education,* Vol. 74, No. 12, 1357-1366.

Table 1. List of Cases Including Methods and Achievements [9]-[14]

3. Discussion

We see that in each case, training programs that utilize haptics and force feedback systems have improved overall results in terms of user performance. Prior to incorporation of haptics, these training programs were set in primarily virtual environments that focused on visual and audio feedback. The addition of haptics presumably created another channel of information for the users, thus increasing attention and presence in the various training situations. When performing virtual reality therapy, the addition of vibration, smell, and other tactile augmentation improves patient immersion and the effectiveness of therapy.

Immersion was also improved through haptics. Study (1) correlates the significantly lower error rate in the haptics experimental group with greater engagement with the virtual environment, an essential component to learning through virtual reality. Similar results are shown in study (4) using a comparison of haptics and non-haptics diathermy training simulations.

In the battlefield, a limited number of focused procedures can yield great dividends in saving of human lives. The training of combat medics who perform those medical procedures is crucial in decreasing losses in military efforts. Medical professionals can gain the special training and experience they need by training in an authentic environment with haptic interfaces without facing serious consequences when mistakes are made. Recent results from Iraq and Afghanistan point to a high failure rate in the performance of field cricothyrotomies [15]. Our hope is to improve real world performance with the addition of haptics to such procedural training. By performing a case study that exemplifies the effectiveness of incorporating haptics into medical

training programs, we hope to understand how haptics can benefit training combat medics and medical professionals in general. Further development into the application of haptics in virtual reality training programs for these medical professionals can be an essential tool in lowering costs and improving performance.

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Clinical Experiment to Assess Effectiveness of Virtual Reality Teen Smoking Cessation Program

Kenneth GAO[a], Mark D. WIEDERHOLD[b], Lingjun KONG[b], Brenda K. WIEDERHOLD[a]

[a]*Interactive Media Institute,*
[b]*Virtual Reality Medical Center*

Abstract. Smoking has increasingly become a burden on America's health and economic status. The fact that four out of every five adult smokers begins tobacco use before the age of eighteen indicates a need for teenage smoking cessation programs. The Virtual Reality Medical Center created an internet-based program that addresses the issue by utilizing cue exposure therapy in home and school environments to teach teens which cues trigger nicotine cravings and how to combat those cravings. The effectiveness of the program was measured through questionnaires administered before and after its use. Results indicated that the participants were engaged in the virtual environment, and that, in every aspect of the program, at least 8% more participants were knowledgeable about the subject than prior to the use of the program. Success of such a program could reduce teen smoking rates, ultimately leading to reduced smoking mortalities, complications, and costs overall.

Keywords. Teen smoking, virtual reality, cue exposure therapy

Introduction

Smoking has increasingly become a burden on America's health and economic status, causing over 440,000 deaths and $96 billion in healthcare costs every year in the United States [1]. Evidence shows that earlier exposure to nicotine correlates with more severe dependency and that eighty percent of adult smokers start smoking before the age of eighteen [2]. Teenage smokers who wish to quit rarely seek support. An effective cessation program that addresses teenage needs could prevent heavy tobacco-related mortalities, complications, and costs.
 "The Smoking Zine" addressed some of the primary reasons for teen smoking. Some smoke because it gives them a "buzz" that simulates a relaxed sensation. Many teenagers believe that they look more mature and that tobacco helps them fit in with their friends. Others simply use the substance to pass the time. They are concerned that if they quit smoking, they will not be able to relax, will be in a bad mood, and must change their social life if they discontinue the habit [3].

In adolescents, smoking can lead to cough and phlegm production, an increase of respiratory illnesses, a decrease of physical performance, changes in blood cholesterol levels, and a reduced rate of lung growth and function. Long-term effects include heart disease, stroke, lung disease, and cancers of the lung, mouth, pharynx, esophagus and bladder [4]. Although teenagers are aware of the risks, many believe they can quit at any time, associating their youth with invincibility, and therefore do not seek assistance in quitting. Those who would like help quitting are unfamiliar with smoking-cessation programs and are concerned with parent involvement, confidentiality, and the ability of counselors to relate to their experiences [5].

Most smoking cessation programs are geared towards adults, and there has not been much effort put into teen smoking cessation programs [6]. The Virtual Reality Medical Center (VRMC) has created Teen Smoking, an online smoking program to help adolescents discontinue their nicotine usage, utilizing informal and convenient tobacco cessation support techniques favored by adolescents. VRMC's smoking cessation program is designed to utilize virtual reality (VR) to engage user attention, while employing cue exposure therapy (CET) to treat addictive behaviors.

CET uses repeated exposure to eliminate the association of smoking with objects and situations [7]. VRMC has conducted several previous investigations in collaboration with Korea's Chung-Ang University using VR to study smoking cues. In a study exploring nicotine craving, virtual environments were set up for smokers to virtually navigate. The rooms contained different smoking cues, such as an ashtray and an open pack of cigarettes on a bar. Overall, the study was determined to have helped reduce cravings in those who are nicotine dependent. A previous study used functional resonance magnetic imaging (fMRI) to test whether smokers could experience cue-induced smoking craving inside an MRI scanner by using a VR system, and if so, whether the magnitude of the craving differed between the classical device using 2D pictures and the virtual environment. The study concluded that smoking cues in the virtual world were stronger than in the 2D world [8][9].

VRMC's program contains virtual smoking cues such as packs of cigarettes, ashtrays, and peer pressure to trigger user cravings in home and school environments. Users are able to realize common triggers of cravings and can learn to distract themselves from smoking. According to "The Smoking Zine," methods of distraction include exercise, music, art, cooking, naps, chewing gum, and conversing with friends. VRMC's Teen Smoking online program has incorporated some of these distraction ideas into the game to help teach the users how to fight their cravings. As users continue through the program, they attempt to quit the habit before the designated "quit date" chosen at the beginning of the program.

1. Method

1.1 Participants

Clinical trials were conducted with 15 high school students. Ages of the participants ranged from 14-17. All participants had basic knowledge of smoking risks, had no exposure to previous smoking cessation treatments, and signed participant and parent consent forms prior to the study.

1.2 Measures

Effectiveness of the Teen Smoking program was measured using scores from four standardized questionnaires: the Pre-Questionnaire and Post-Questionnaire gauged user knowledge in areas such as craving triggers, actions to take following strong cravings, and benefits of quitting smoking prior to and after the use of the Teen Smoking program, the Presence and Realism Questionnaire (PRQ) measured the engagement of the user with the virtual environment, and the Post-Exposure Simulator Sickness Questionnaire (PESSQ) was used to examine the possibility of side effects due to virtual reality.

1.3 Procedure

Clinical trials were conducted under a protocol placed from BIOMED IRB. The first portion of the clinical trial consisted of each participant completing the Pre-Questionnaire. Following the questionnaire, each individual participant was placed into a private clinic room where they began the Teen Smoking VR program. Researchers were available to answer questions but did not intervene otherwise, allowing the participants to play the game and explore the VR environment at their own pace. Following completion of the game or the passing of thirty minutes, whichever came first, the participants were invited to take the Post-Questionnaire, PRQ, and the PESSQ.

2. Results

2.1 Teen Smoking Pre- and Post-Questionnaires

The Wilcoxon signed rank test was used to analyze questionnaire scores. The test confirmed that there were significant differences among the group scores in the Pre- and Post-Questionnaire results ($p < 0.004$). The total questionnaire score decreased after the participants played the game, indicating that they understood the negative habits associated with smoking and decided to spend less effort in activities which increase their smoking cravings.

Table 1. Wilcoxon signed rank test results

	Mean	Range	SEM
Before	62	52--77	2.7
After	49	40--56	1.65
	TOTAL After – TOTAL Before		
Z	-2.668		
Asymp. Sig. (2-tailed)	.004		

Table 2 shows the degree to which participants agreed with the statements proposed in the questionnaires and the percent change before and after use of the Teen Smoking program. Each questionnaire statement is based upon previous smoking cessation research and correlates to either supportive statements that help participants quit smoking or myths that are generally accepted about smoking. In Table 2, supportive statements are marked with an * in the 'Agree' column, while myths are marked with an * in the 'Disagree' column, as those are the answers of interest.

Table 2. Teen Smoking Questionnaire responses

Questionnaire Statement	# Participants in Pre-Questionnaire			# Participants in Post-Questionnaire			% Change in Sought Answer (*)
	Disagree	Neutral	Agree	Disagree	Neutral	Agree	
a. Physical exercise makes you want to smoke	6*	0	9	9*	0	6	+50%
b. Keeping busy helps you quit smoking	1	1	13*	1	0	14*	+8%
c. Setting a quit date helps you to quit	0	6	9*	1	4	10*	+11%
d. Once you decide to quit, it is easy to turn down a cigarette	6	7	2*	6	6	3*	+50%
e. Craving increases when you are bored	1	2	12*	1	0	14*	+17%

2.2 Presence and Realism Questionnaire
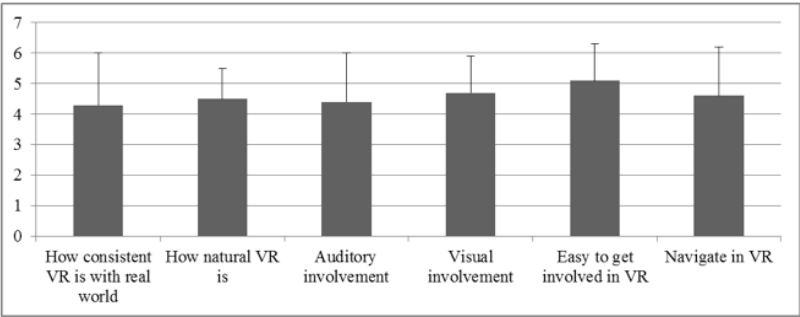
Figure 1: Mean value of responses in PRQ

3. Discussion

The results of the Teen Smoking Questionnaires show that teenagers are able to learn new material effectively with this software program. Both general and specific knowledge were improved. The difference in scores between the Teen Smoking Pre-Questionnaire and Post-Questionnaire represents the growth of the participants' cessation awareness. Previous research indicates the correct response of cessation techniques, and Table 2 shows a positive percent change in the number of clinical trial participants who agreed with the statement. The percent increases range from 8% to 50%, demonstrating that the program accentuated certain techniques over others. A possible explanation could be that certain techniques were better learned through cue exposure therapy. For example, in Table 2, statement a., "Physical exercise makes you want to smoke" is taught with CET through the mini-game where the game avatar travels through an obstacle course which directly leads to decreased cravings. Due to the variability in the effectiveness of content delivery, another study could be conducted to test the best methods of content delivery through VR.

PRQ tested the consistency of the virtual environment with the real world. In every aspect, the mean response was above average. Specifically, users indicated a positive

response regarding the level of realism when compared to the real world as well as in their ability to get immersed in the VR. We can conclude that the program is realistic and engaging, both of which are necessary to deliver content that is applicable to real world cessation program. Moreover, we can deduce from the positive responses to the ease of navigation and the naturalness of the VR environment that the program is easy-to-use and user friendly.

In summary, the Teen Smoking program used virtual reality to engage the participants in a virtual learning environment. Utilizing an intuitive and immersive virtual environment, the program effectively delivered smoking cessation information that was designed for teenagers. Through a cue exposure therapy model, participants gained knowledge in dispelling common cessation myths and in utilizing proper techniques for quitting smoking. Effectively, these trials provide supportive evidence for additional research into utilizing CET and VR to combat teenage smoking.

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SECTION V

ORIGINAL RESEARCH

Healthcare 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 offers greater interactivity and better tailoring of information to individual needs.

Wiederhold & Riva, 2004

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Psychophysiological Correlates of Flow During Daily Activities

Andrea GAGGIOLI [a,b,1], Pietro CIPRESSO [a,b], Silvia SERINO [a,b],
and Giuseppe RIVA [a,b]
[a] *Applied Technology for Neuro-Psychology Lab,*
Istituto Auxologico Italiano, Milan, Italy
[b] *Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy*

Abstract. Flow is an optimal experience characterized by the perception of high challenges and high skills, positive affect, complete absorption in the activity carried out and intrinsic motivation. Although much research has examined the psychological features of flow, little is known about its biological underpinnings. The present study aimed at contributing to this gap by investigating the psychophysiological correlates of flow experience during daily routines. To this end, 15 university students took part in an experience sampling study, in which they provided real-time information on daily activities and associated experience while cardiac activity was monitored. After seven days of observation, 32 flow events were identified among 10 participants. A multilevel regression analysis revealed a significant correlation between optimal experience and specific cardiovascular indexes. In particular, the experience of flow was associated with increased heart rate and increased LF/HF ratio, suggesting relative sympathetic enhancement. These findings are in line with those obtained by previous related studies and indicate the feasibility of investigating physiological correlates of subjective experience in ecological contexts.

Keywords. Flow, psychophysiology, experience sampling method, ECG, wearable sensors.

Introduction

The concept of flow, also called "optimal experience", was introduced by psychologist Mihaly Csikszentmihalyi almost three decades ago, in the attempt to understand the nature of self-rewarding, "autotelic" activities [1]. Since then, a large body of research has documented the psychological characteristics of this experience, which includes positive emotions, complete absorption in the ongoing activity, effortless attention, merging of action and awareness, heightened sense of control, and time distortion. Additional defining features are perception of high challenges and high skills, and clear feedback from the task at hand. By contrast, a very small number of studies have examined the psychophysiological correlates of flow [2]. Moreover, the studies conducted so far have been limited to the lab, because of the technical and technological challenges associated with the measurement of physiological parameters in naturalistic contexts. However, the analysis of psychophysiology of flow experience in everyday situations would allow identifying objective markers of this experience to integrate the subjective assessment used until now. In addition, the identification of the

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[1] Corresponding Author.

physiological mechanisms underlying the experience of flow can contribute to a deeper understanding of this mental state, i.e. by helping to identify the role played by emotions during optimal experience. Finally, in the field of human-computer interaction, the definition of physiological indicators of flow could be useful in order to develop interactive systems (i.e. videogames) that optimize the user experience by automatically adapting to his/her level of engagement. In an attempt to contribute to these issues, the present study examined the feasibility and reliability of assessing cardiac correlates of flow in naturalistic environments, using a wearable electrocardiogram (ECG) wirelessly connected to a smartphone.

1. Previous Research On The Psychophysiology of Flow Experience

Up to now, research on psychophysiological correlates of flow has been sporadic (for a review, see [2]), mostly due to the difficulty in operationalizing this concept. Recently, Peifer [2] developed a theoretical model that integrates the concepts of flow and stress. Moving from Lazarus' cognitive-relational theory of emotions [3], the model posits that stress can be transformed into an optimal experience through reappraisal of a negative situation into a pleasant challenge (p. 154); in this view, hence, flow can be considered a cognitive coping strategy. More specifically, the experience of flow results in an "optimized physiological activation" which is associated with i) a decreased activation in default networks of the brain; and ii) moderate peripheral arousal following a U-shaped function of activation (p. 160). Arousal can be measured by several techniques, such as Galvanic Skin Response (GSR), respiration/pulse rates, blood pressure and muscle tension. However, the measurement of these parameters together in daily-life settings using non-invasive equipment can be problematic. For the purpose of the present study, thus, we decided to focus the investigation on cardiovascular measures, with specific reference to heart-rate variability (HRV) indexes. HRV is regarded as an indicator of the autonomic regulation of cardiac activity [4]. In particular, power spectrum analysis (PSD) is used to study the effect of sympathetic and parasympathetic activities on heart activity. Generally, in a short-term recordings spectrum, three main components are commonly distinguished: the very low frequency band (VLF; below 0.04 Hz), the low frequency band (LF; 0.04 - 0.15 Hz) and the high frequency band (HF; 0.15-0.4 Hz) [4].

2. Materials and Method

Fifteen university students (8 males and 7 females, $M = 23,33$, $SD = 1,49$) volunteered in a seven-day ESM study, implemented through the mobile phone-based data collection platform *PsychLog* [5]. This smartphone-based tool allows administering self-report questionnaires at specific times or randomly within a day and to simultaneously collect heart rate and activity information from a wireless ECG equipped with a three-axial accelerometer. Participants received a short briefing about the objective of the experiment and filled the informed consent. Then, they were provided with the mobile phone with pre-installed PsychLog application, the wearable ECG and accelerometer sensor (Shimmer Research™) and a user manual including experimental instructions. The application was pre-programmed to collect data over 7 consecutive days, at random intervals during waking hours. During the observation week, participants filled out self-report forms after being signalled at random times during the course of their daily routines. Each ESM form includes questions about

place, activities carried out, social context, and 1-7 Likert-type scales investigating the affective, motivational and cognitive dimensions of experience; two additional scales assessed participants' perceived levels of challenges and skills in the activity carried out when beeped. At the end of the experiment, participants returned both the phone and the sensors to the laboratory staff.
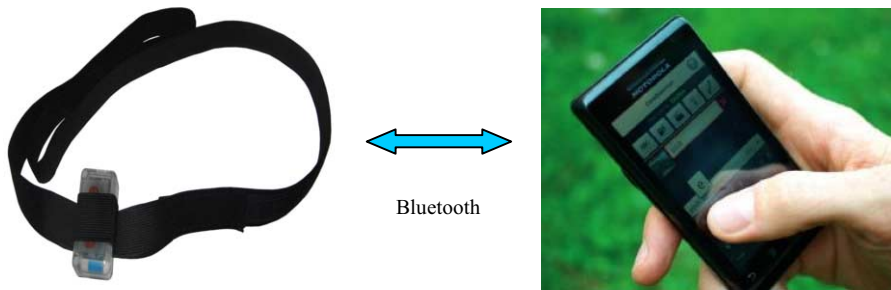

Figure 1. The wearable ECG sensor platform used in the experiment

3. Data Analysis

Overall, 561 self-reports were collected, including 377 valid ECG records. Lykert-type scales data were standardized ($M = 0$; $SD = 1$) on each participant's weekly mean for every variable. Flow episodes were identified by i) above-average balance between perceived challenges and skills and ii) above-average values of positive emotions: *cheerful*, *satisfied*, *energetic*/*vigorous*, *enthusiastic*. These criteria allowed identifying 32 flow events across 10 participants. The ECG recording window started 20 minutes before the onset of the beep and ended 20 minutes after the beep, totalling 40 minutes of cardiac monitoring for each flow event. To analyze ECG sampling, QRS peaks and RR interval time series were processed in order to compute a set of heart rate variability (HRV) indexes. ECG plots were first inspected for artefact correction, and then a fast Fourier transform was used to compute power spectrum in the LF (0.04– 0.15 Hz) and HF (0.15–0.40 Hz) bands and LF/HF ratio, which is an indicator of the balance between sympathetic and parasympathetic tone. Since data are nested within participants, in order to examine the relationship between flow and cardiovascular measures a multilevel regression analysis was applied.

4. Results and Discussion

Data analysis revealed that the experience of flow was associated with increased heart rate, i.e decreased RR Interval mean [B = -0.628; S.E. = 0.269; p < .020] and increased LF/HF ratio [B = 0.079; S.E. = 0.034; p < .021] (generally assumed to reflect sympathetic dominance). The model showed a good fitness according to the Quasi Likelihood under Independence Model Criterion (QIC) [Value: 217.64] and the Corrected Quasi Likelihood under Independence Model Criterion (QICC) [Value: 219.641]. Overall, these findings are in line with those obtained by a previous study conducted by De Manzano et al. [6], who investigated psychophysiological correlates of optimal experience in piano players. These observations also resonate with the psychophysiological model of flow elaborated by Peifer [2], which posits an inverted-

U function of physiological arousal and optimal experience, with low and high cardiovascular activation indicating a state of relaxation or a state of stress respectively and a moderate arousal associated with flow.
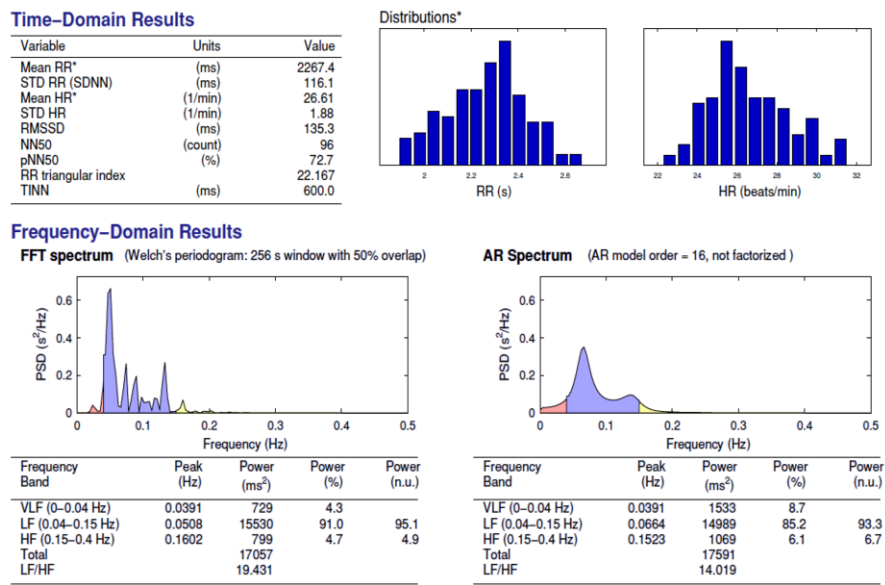
Figure 2. Example of the HRV indexes profile (in both time and frequency domains) associated with a specific flow episode

Conclusion

To our best knowledge, this is the first study to show the feasibility of exploring the psychophysiological correlates of flow in naturalistic environments. Although preliminary, our findings are in line with previous related studies and may provide further support to the hypothesis that optimal experience and "eustress" share strong similarities [2].

Acknowledgments

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Designing a Serious Game For In-Field Interventions To Promote Nightlife Well-Being

Luciano GAMBERINI[a,1], Luca ZAMBONI[a], Alessandro PRIVITERA[a], Gianni De GIULI[a], Chiara VILLA[a], Anna SPAGNOLLI[a]

[a]*HTLab, Dept. of General Psychology, University of Padua, Italy*

Abstract. Nightlife well-being interventions, although much needed, face several challenges related to the specificity of the context addressed. We argue that a game-facilitated intervention helps with facing these challenges. The characteristics of a game developed to this goal and the results of user tests conducted in situ are presented.

Keywords. Serious game, nightlife well-being, design, satisfaction.

Introduction

In clubs, festivals, and social events the abuse of recreational drugs is high [1], and so is the need for in situ interventions to promote safety and well-being. Interventions of this sort, however, have to face three critical challenges: a potentially reluctant audience looking for entertainment; unfamiliar nightlife cultures and values; and a hectic environment hampering reflection and sustained attention.

To face these three challenges, we designed an intervention with three main characteristics. First, in order to attract an audience looking for entertainment, the delivery of information on the physical, legal, and social consequences of recreational substances abuse was obtained through a serious game [5]. The game is called "What the Dope!" (henceforth WTD) and was designed based on a set of recommendations especially collected [3]. A peer-operator supervised the game session and was available to complement the game with other information material (e.g., leaflets).

Second, in order to get familiar with nightlife culture and taste, the game graphics and music are close to those adopted in nightlife parties and advertising and the game content is generated through a participatory design process. In particular, the design process involves different groups (i.e., university students, young people at risk, peer operators. and experts) and included the following three phases:

a)   young people at risk and peer operators produced the game content taxonomy through a brainstorming session and assimilation tasks; the resulting categories distinguish between different sources of risk (i.e., alcohol, cannabis, ecstasy & methamphetamine, hallucinogenic substances, amphetamines and other stimulants,

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[1] Corresponding Author: Luciano Gamberini, Dipartimento di Psicologia Generale, Università di Padova, Via Venezia 12, 35131   Padova, luciano.gamberini@unipd.it.

ketamine, GHB/GBL, popper and other solvents, cocaine, heroine, mix, friendship & sexuality) and different consequences of risky behavior (desired effects; undesirable acute psychological effects; undesirable long-term psychological effects; undesirable physical/medical effects; legal issues, history, politics, and geography; curiosities, myths, and urban legends; gender specificities & pregnancy; driving; sexually transmitted diseases; violence, bullying and microinterethnic conflicts; first aid, precautions, and context; other).

b) scientific material and prevention material (e.g., flyers, web portals) from reliable sources was collected and examined to extract the quiz content and its related explanations; all content was then double-checked for correctness by experts, entered into the system, and categorized according to the double taxonomy described in point a) above.

c) the game was then populated by visual narratives [4] (Figure 1), where a sequence of pictures recounts the events connected to risky behaviors and undesired consequences; storyboard and pictures were developed by target users during dedicated workshops.
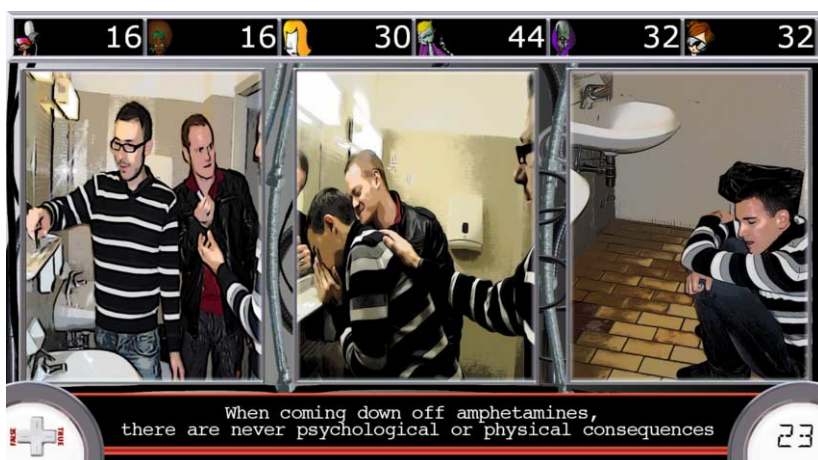
Figure 1. Screenshot of a visual narrative and its related true/false question.

Third, in order to fit the environment in which WTD is going to be played, while at the same time incorporating basic game characteristics such as competition, chance, and simulation [5], the game is designed for multiple players (up to six people can play simultaneously) and is presented on a large screen, since players in a public space often approach games in groups, surrounded by an occasional audience [6]. Also, since the environmental conditions do not allow comprehension of complex game plots, the game has a simple quiz structure; and it allows different configurations that vary in difficulty, content categories, number of questions, number of players, and response time. At the beginning of each game session, the operator can easily choose the configuration s/he deems most appropriate to the intervention and its specific audience.

1. WTD: Rationale and appearance of the serious game

The game was developed with Ruby On Rails Framework, as well as C# and WiiMoteLib for WiiMote input. A game session comprises a predefined number of questions at a difficulty level that is selected by players at the beginning of the game within the range of levels activated by the operator for that particular intervention. Before starting to play, a brief video explains the commands and the rationale of the game. Each player interacts with the game though a Wiimote® to select his/her avatar (Figure 2) and then to enter the answers to the quiz questions. The quiz includes true/false questions or multiple-choice questions. Once all players have entered their answer or after the time allotted to answer has elapsed, the results are displayed showing which player answered correctly, the updated scores of each player, and the explanation for the answer (Figure 2). Instructions are not given vocally in the game, since it is assumed that the environment can be very noisy; instead, all information is given with enticing text and graphics displayed on the screen and always accompanied by a musical soundtrack. The game is currently offered in five languages (English, Italian, French, German, and Spanish).

Figure 2. Screenshot of the avatar selection panel (top), and of the score panel (bottom).

The field interventions use a gazebo (Figure 3) especially designed to host an information desk where operators can distribute dissemination material and have a white wall onto which the game can be projected at night. Players are assumed to sit outside the gazebo, in front of the game wall, so that other people can follow the game as an audience and learn passively. The projected game enhances the visibility of the gazebo and helps to attract visitors. The location of the gazebo should be central enough to reach as many players as possible, while at the same time quite it should avoid crowded areas to allow gameplay and some verbal exchanges.

Figure 3. The intervention gazebo with the information desk (left) and the game wall (right)

2. Users' satisfaction

Access to summer events was negotiated with the event organizers in order to have an official space where WTD could be shown and tested. In this way, the game underwent a set of pilot tests with 90 people at night, during two major summer festivals in Croatia ("Outlook" and "Dimensions" festivals), in order to identify main issues in the overall procedure or in the system that could emerge only by trying out the protocol and the game in the field.

Once technical bugs and procedural awkwardness were fixed, players' satisfaction with the game usage and interface was assessed during two events in Italy ("Cerebration" and "Pop Corn"). Participants (N = 73, 24 women, 49 men, Mean age = 26.5, DS = 4.79) signed an informed consent and were then administered a written questionnaire after playing one game session; questionnaire items were 8 simple statements about which respondents were asked to express their agreement on a 6-degree Likert scale. The questionnaire items are listed in Table 1.

Results were positive (Table 1), showing that the effort in designing the game led to a positive usage experience and to an appreciated aesthetic appearance. Of particular importance to us was the high score obtained in Item 5 ($M = 5.14$, $DS = 0.90$), which asked whether the information provided in the game was reliable in the users' opinion.

The high score means that a format such as a game, in the specific context of a night festival, is believed to be able to convey reliable information.

Table 1. Scale ranging from 1 to 6, 1 = very negative.

Item	M	DS
1. Did you like playing the "What the Dope!" game?	4.66	1.20
2. Are the "What the Dope!" graphics cool?	4.29	1.25
3. Was the "What the Dope!" game entertaining?	4.64	1.23
4. Do you like the idea of having the "What the Dope" game at the [event name] festival?	5.29	0.92
5. Did you get reliable information from the game?	5.14	0.90
6. Did you learn anything new about substances from the game?	4.62	1.39
7. Is the game information useful for [event name] people's health	4.82	1.13
8. Please rate the following aspects of the game:		
Graphics	4.04	1.20
Sound	3.66	1.27
Multiplayer modality	4.80	1.13
Large screen	5.25	1.13
Content (substances)	5.04	0.98

3. Conclusions

In conclusion, a game-based intervention needs to acknowledge the specific challenges set by its target context and to be validated for effectiveness. We described how "What the Dope!" was designed to meet such challenges, both in its game rationale and in the process through which the game content was built. We also provided evidence of users' satisfaction with the game. The future work will consist of assessing its credibility/appropriateness as well as its ability to improve players' knowledge.

Acknowledgments

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The Impact of Different Perceptual Cues On Fear And Presence In Virtual Reality

Henrik M. PEPERKORN[a,1] and Andreas MÜHLBERGER[a],[b]
[a] *Institute of Psychology, University of Würzburg, Germany*
[b] *Institute of Psychology, University of Regensburg, Germany*

Abstract. The impact of perceptual visual cues on spider phobic reactions has been thoroughly investigated over the last years. Although the fear of being touched by a spider is part of the clinical picture of spider phobia, findings on the impact of tactile fear cues are rare. This study uses virtual reality to selectively apply visual and tactile fear cues. Self-reported fear and the experience of presence in VR were measured in 20 phobic and 20 non-phobic participants. All participants were repeatedly exposed to visual cues, tactile cues, the combination of both and no fear relevant perceptual cues. Participants were exposed in each condition for five times in random order. Results show that tactile fear cues have the power to trigger fear independent of visual cues. Participants experienced highest levels of presence in the combined and the control condition. Presence may not only be seen in association with the emotional impact of specific cues in VR but also appears to depend on the comparability of a virtual environment to a real life situation.

Keywords. virtual reality, fear, visual cues, tactile cues, presence

Introduction

In experimental and therapeutic settings fear reactions are mainly triggered by the presentation or imagination of specific (visual) cues. The neuronal basis for this conditioned stimulus-response linkage is well described by LeDoux [10]. In animal phobia, especially pathological fear of spiders, these specific cues influence fear reactions predominantly. Spider-phobic reactions towards relevant cues (e.g. pictures) are triggered very fast [7]. Phobics show typical activation patterns of the sympathetic nervous system [8], enhanced startle response [7], enhanced neural activation [13] , and are easily distracted by task-irrelevant phobic cues [6]. In conclusion, specific cues are processed in a highly automated way.

Strikingly, the individual impact of specific tactile cues has not been studied as intensely as the impact of visual cues. Single-case studies by Carlin, Hoffman, & Weghorst [4] and Hoffman et al. [9] suggest that the addition of tactile cues can

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intensify initially experienced fear and a controlled study by Garcia-Palacios, Hoffman, Carlin, Furness, & Botella [5] confirms a positive therapeutic effect of combined visual and tactile cues.

It has been well documented that virtual reality (VR) induces ecologically valid emotions and virtual environments can activate fear networks in fearful participants (e.g. [11]). It is highly likely that this effect is influenced by the experience of presence ("*being there*") in VR [2]. On the other hand, it is also possible that the extent of experienced fear influences presence in VR [3]. In this experiment we measure spider phobic reactions and presence in VR as reactions to either specific visual cues in VR, specific tactile cues or a combination of both. To our knowledge it is the first study in which different specific fear triggers are systematically manipulated.

1. Materials and methods

1.1 Participants

Twenty female spider-phobic participants (ages 18-35, $M = 22,50$, $SD = 4.07$) as well as 20 healthy control participants, matched for age and gender, completed the study. All participants were recruited from university notice-boards and finished an online questionnaire prior to the study, in which their individual level of fear of spiders was assessed on a scale from 0 (no fear) to 100 (maximum fear). For spider-phobic participants threshold values of this scale were 70 and above, values of 20 and below for control participants.

1.2 Experimental conditions and procedure

All participants were immersed into a virtual lab via a Head-Mounted Display (Z800 3DVisor, eMagin; Bellevue, Washington, USA) and a 6-DOF tracking system (Polhemus 3space Fastrak; Polhemus; Colchester, USA) for movements of the head and the right hand. Participants were asked to take a seat at a table and put their right hand on it with their palm down. In VR they saw themselves sitting at a virtual table and a multi-directional movable virtual representation of their right hand in the position of their real right hand.

To induce fearful reactions exclusively to specific visual cues, a virtual spider was depicted sitting on the virtual representation of the participant's back of the hand. Fear reactions, exclusively to specific tactile cues, were triggered by a spider dummy, which the experimenter put on the participant's back of the hand. The size of the spider dummy was carefully chosen and positioning thoroughly trained in order to mimic the visual appearance of the virtual spider as good as possible. Participants did not see the spider dummy, while being exposed to it. In a third condition, a combination of visual and tactile cues was applied. While participants saw a virtual spider sitting on the back of their hand, the experimenter put the spider dummy on the back of the participant's hand. In a control condition, neither visual, nor tactile cues were applied.

At the beginning, participants were introduced to the technical equipment and all materials, which used. They were familiarized with the experimental procedure and gave written informed consent to participate in this study. After completing the Fear of Spiders Questionnaire (FSQ; [14]) participants were immersed to the virtual lab

and confronted with all four experimental conditions, each in random order for five times. Each confrontation lasted 40 seconds in which visual, tactile, or combined fear cues were continuously applied. Fear ratings were assessed after 10 seconds, presence ratings after 20 seconds in each trial. At the end of the experiment they completed the FSQ for a second time.

This study was approved by the ethics committee of the Medical Department of the University of Würzburg and was conducted according to the principles expressed in the Declaration of Helsinki.

1.3 Data processing and analysis

Self-reported fear and presence ratings in each condition were averaged over all repetitions. Both variables were analyzed with analyses of variance (ANOVAs) with the within factor condition (visual, tactile, combined, control) and the between subject factor group (phobic vs. control). Pearson correlations between fear and presence were calculated. The significance level was $\alpha = .05$ and effect sizes are reported as partial η^2 (η_p^2) scores. False-Discovery-Rate (FDR) corrected significance criteria for multiple comparisons were applied [1].

2. Results

2.1 Fear ratings

Fear ratings reveal significant main effects for condition, $F(3, 114) = 37.23$, $p < .001$, $\eta^2 = .495$, group, $F(1, 38) = 42.11$, $p < .001$, $\eta^2 = .557$, and a significant Condition x Group interaction, $F(3, 108) = 13.66$, $p < .001$, $\eta^2 = .264$.

Separate Analyses for phobic patients and control participants were calculated to gain further insights in the differences between conditions. Only for phobics a significant main effect for condition was found, phobics, $F(3, 57) = 35.77$, $p < 001$, $\eta^2 = .653$. Planned comparisons between conditions in phobics were calculated. In Phobics the combination of visual and tactile cues led to the highest fear ratings throughout the experiment ($M = 49.40$, $SD = 13.99$). It was significantly higher than isolated tactile cues ($M = 38.76$, $SD = 18.42$), $t(19) = 3.71$, $p = .001$, visual cues ($M = 32.30$, $SD = 18.75$), $t(19) = 5.97$, $p < .001$, or the control condition ($M = 15.88$, $SD = 16.77$), in which nothing was displayed, $t(19) = 8.11$, $p < .001$. The tactile condition led to the second highest fear ratings. Fear in this condition was significantly higher than in the visual condition, $t(19) = 2.34$, $p = .030$, or the control condition $t(19) = 6.75$, $p < .001$. Fear in the visual cue condition triggered significantly higher fear ratings than the control condition, $t(19) = 4.48$, $p < .001$.

2.2 Presence ratings

ANOVA analysis of presence ratings show significant main effects for condition $F(3, 114) = 37.23$, $p = .011$, $\eta^2 = .124$, and group $F(1, 38) = 8$, $p < .001$, $\eta^2 = .557$, confirming higher presence ratings for phobics ($M = 57.55$, $SD = 11.03$) than controls ($M = 44.87$, $SD = 15.85$) throughout the experiment, but no significant interaction.

Single comparisons between conditions show a significantly higher presence in the combined visual & tactile condition (*M* = 56.21, *SD* = 16.13) compared to both isolated conditions (which did not differ significantly [visual: *M* = 47.66, *SD* = 18.12; tactile: *M* = 48.29, *SD* = 18.46]), "visual & tactile" vs. "visual": *t*(39) = 3.32, *p* = .002; "visual & tactile" vs. "tactile": *t*(39) = 3.17, *p* = .003. Presence in the combined condition was only marginally significant higher than in the control condition (*M* = 52.69, *SD* = 17.82), *t*(39) = 2.01, *p* = .051.

2.3 Correlation analysis between fear and presence

In correlation analyses we found a significantly positive correlation between experienced fear and presence for phobic participants (*r* = .396, *p* = .042). For control participants the correlation between fear and presence was on chance level (*r* = .001, *p* = .498)

2.4 Questionnaire Data

FSQ scores before exposure for phobic participants ranged from 34 to 101 (*M* = 73.20, *SD* = 14.03) and for controls from 0 to 31 (*M* = 7.85, *SD* = 11.95). After exposure scores for phobics ranged from 10 to 91 (*M* = 60.80, *SD* = 22.06) and for controls from 0 to 32 (*M* = 5.40, *SD* = 9.53). Comparing pre and post exposure scores, the data revealed a main effect of time $F(1, 38) = 16.67$, $p < .001$, $\eta_p^2 = .305$, describing a reduction of the fear score; a main effect of group, $F(1, 38) = 185.75$ $p < .001$, $\eta_p^2 = .830$, with higher fear scores in phobics than controls; and a significant Time x Group interaction, $F(1, 38) = 7.48$, $p = .009$, $\eta_p^2 = .165$. Only for phobic participants fear scores changed significantly after the exposure, *t*(19) = -3.75, *p* = .001.

3. Discussion

This is the first study, in which the isolated and combined impact of perceptual tactile and visual fear cues was analyzed. Different perceptual modalities influence the intensity of experienced fear and presence in a virtual lab.

The combination of visual and tactile cues, mimicking the real-life experience of being touched by a large spider, led to highest fear and presence ratings in phobic participants. This confirms the efficacy of a multimodal confrontation in VR. Results further suggest, that perceptual tactile cues do not only serve as an addition to a visual confrontation, but that touch itself triggers respective reactions, if it is associated with a fear cue. This leads to the further assumption of a highly intertwined cross-modal interaction of perceptual triggers on the fear network (compare [12]).

Beyond that, data show, that presence is neither only a prerequisite of fear, nor that fear inevitably triggers presence in virtual reality. A reciprocal relationship between presence and fear appears to exist, but its causal relationship still remains unclear. As participants reported the highest presence in situation with the highest similarity to reality (either multimodal fear cues or no fear cue) the experienced realism of the situation may impact presence in VR.

Some limitations of this study have to be considered. The level of fear towards spiders in this sample had a large variance and it was exclusively measured with self-reported data. A systematic selection of a phobic sample, diagnosed in clinical

interviews, may have provided deeper information on the impact of different cues on fear and presence. Furthermore, in some respect, the generalization of the results is complicated. It remains unclear, if these findings exclusively apply for women suffering from spider phobia, or if they are valid for a broader range of anxiety disorders. Future studies should overcome these shortcomings and focus on identifying factors, which are relevant for designing virtual experience to be equivalent to real life experience.

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The Development of a Haptic Virtual Reality Environment to Study Body Image and Affect

Line TREMBLAY[a,1], Stephane BOUCHARD[b], Brahim CHEBBI[a], Lai WEI[a], Johana MONTHUY-BLANC[c] and Dominic BOULANGER[b]

[a] *Laurentian University, Canada*
[b] *Université de Québec à Gatineau, Canada*
[c] *Université de Québec à Trois-Rivières, Canada*

Abstract. We report the results of a preliminary study testing the effect of participants' mood rating on visual motor performance using a haptic device to manipulate a cartoonish human body. Our results suggest that moods involving high arousal (e.g. happiness) produce larger movements whereas mood involving low arousal (e.g. sadness) produce slower speed of performance. Our results are used for the development of a new haptic virtual reality application that we briefly present here. This application is intended to create a more interactive and motivational environment to treat body image issues and for emotional communication.

Keywords. Haptics, Virtual reality, Mood, Body image.

Introduction

Interpersonal touch serves several adaptive functions such as soothing, signaling safety, reinforcing reciprocity and contributes to the cognitive and socioemotional development [1]. Interpersonal touch elicits and modulates human emotions and can convey immediacy and produce an effect more powerful than language (for a review see Gallace and Spence [2]). Despite its importance, Gallace and Spence [2] pointed out the fact that '*emotional aspects of touch have been neglected by cognitive scientists over the year*s'. They added that the development of Internet has changed the way we interact with each other and researchers are now trying to bring back touch into virtual reality setting. The importance of adding touch (haptics or digitalized sense of touch) to remote online social interaction emerged first, from the recognized limits associated with the attenuation, in virtual environment (VE), of social cues normally available to face to face interaction [3] and second, from the growing use of avatars (digitalized representation of self), which have the advantage of not only actively engaging the participants by creating immediacy and increasing the sense of presence [4]), but also affect the users online behaviors [5]). We found two studies aimed at assessing the effectiveness of haptics to communicate affect and emotions in VE. Bailenson and his

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[1] Corresponding author: ltremblay@laurentian.ca

colleagues [6] found that participants can recognize emotions conveyed by another participant through the same device and that the accuracy of emotion recognition is comparable to those measured in real life handshake [1][6]. Bailenson et al., [6] instructed their adult males and females participants to convey each basic emotion (anger, disgust, fear, interest, joy, sadness, and surprise) through a forced feedback joystick they held from a handshake position. They found that participants moved the joystick more and faster when expressing joy and anger, and move the joystick less and slower when expressing sadness than other emotions.

Smith and MacLean, [7] found similar results among their participants who communicated through a haptic link (simple knob) while performing different computerized games. In that study, emotions required to be conveyed were at the extremes of orthogonal dimensions of valence (pleasure/displeasure) and arousal (low/high). Two conditions of video games were designed to represent two levels of intimacy: low (ping pong game) and high (handstroke). They found that emotions (anger, happiness, delight, relaxation) were more successfully communicated in the handstroke videogame (high intimacy) than in the ping pong game (low intimacy).

The first limit of these studies is the lack of ecological validity as real life emotions were not elicited in participants who were simply required to try to reproduce some basic emotions. The second limit was that they did not take the advantage of using avatars, which will permit to study how they affect online social interaction.

The current project objective is to study emotional interactions between a research participant and an avatar through the development of a haptic interface. This project is the first part of our larger research program aiming at studying body image, attitudes and behaviors in immersive virtual environments. This paper presents preliminary data on the effect of participants' mood on performance using a first version of a system using a haptic device [8] and, second, the development of our new system involving haptic interaction with an avatar. We hypothesized that self reported mood with negative valence and arousal (anxiety, frustration) will predict faster speed in performing the task but also more errors compared to negative mood with low arousal (sad, passive).

1. **Method**

1.1 Instrument

Participants were trained to use a virtual reality version of the game "Operation", where the user lifts organs from enclosures in a human body which makes use of 3D computer graphics and simulates the sensation of touch through the use of a haptic device [8]. The task requires the participant to lift the organs without touching the enclosure's walls, and to achieve this using the least amount of time. Three difficulty levels (1-easy, 2- moderate, and 3- hard) were implemented by narrowing the enclosures or increasing the weight of the organs. A sensory feedback consisting of vibration and noise is generated when the organs touch the enclosure. Participants were instructed not to consume any caffeinated beverage one hour prior the experiment.

1.2 Participants

Thirty-two university female students with no history of motor skills deficit were recruited to participate. Mean age was 21 years (SD= 4.5).

1.3 Procedure

Testing condition was designed to create a mild to moderate level of anxiety as the participant had to perform a new and unfamiliar task while being observed by a research assistant. The presence of an observer increases the individual's self awareness and the participant's perception of performance failure or success is likely to trigger positive or negative emotion and arousal [1].The participants were administered questionnaires measuring their current mood, arousal, and experience with video game. After completing these questionnaires, and getting practice on the tool, the participant started the testing procedures by increasing the level of difficulty. A second measure of mood was taken.

1.4 Measures

- Mood pre and post-test: six visual analog scales (0-13.5) measuring 1) passive/active 2) frustrated/calm 3) bad/good 4) sad/happy 5) sedated/aroused and 6) calm/anxious
- Pre-test measure of number of years of experience with games and computer program and perception of skills.
- Pre-test measures of arousal: amount of sleep and number of caffeinated beverages
- Performance: number of collisions (errors) and time to complete the task (speed) measured at the three levels of difficulty.

2. Results

Preliminary analyses showed no significant association between participants experience with videogames, perceived skills, and arousal on any of the measures of performance. Examination of bivariate scatterplots between reported measures of mood and performance showed curvilinear relationships between mood and the two first levels of difficulty whereas these relationships were linear at the third level of difficulty. Therefore, participants' number of errors and speed at levels 1 and 2 were classified into three categories of performance based on the participants' percentile rank: 1) high (T score at 75 and higher), 2) average (T score between 26 and 74), and 3) low (T score at 25 and lower). We performed a series of analyses of variance (ANOVA) to compare groups on reported mood. Results presented in Figure 1a show that there were significant differences of pre-test bad/good mood ($F(2,29) = 7.2$, $p = .003$), and of pre-test sad/happy mood ($F(2,29) = 6.6$, $p = .004$) on the performance levels associated with the number of collisions at level 1. Participants with the highest performance (less collisions) significantly assessed their mood as less good (M=8.1, SD=2.0) and less happy (M=7.7, SD=1.2) than participants with average score (M=11.0, SD=1.8) (M=10.4, SD=1.8) for bad/good and sad/happy continuum respectively and participants with low score (M=10.8, SD=1.8) and (M=10.1, SD=2.2) for bad/good and sad/happy continuum respectively. Figure 1b shows that there were

significant differences of pre-test frustrated/calm mood ($F(2,29) = 4.3$, $p = .024$), and of pre-test sad/happy mood ($F(2,29) = 4.8$, $p = .016$) on the speed performance at the level 1. Participants with the lowest performance (slower speed) significantly assessed their mood as less calm (M=7.6, SD=2.7) and less happy (M=8.2, SD=1.7) than participants with average score (M=11.0, SD=2.3) and (M=10.6, SD=1.7) for frustrated/calm and sad/happy continuum respectively. Finally, there was significant differences of pre-test calm/anxious mood ($F(2,29) = 6.2$, $p = .006$) on the number of collisions at level 2. Participants with the highest performance (faster speed) significantly assessed their mood as more calm (M=1.8, SD=1.3) than participants with average score (M=5.3, SD=2.7) and participants with the lowest score (M=5.9, SD=3.6). Analysis of variance comparing the performance groups on speed performance at level 2 was not significant.
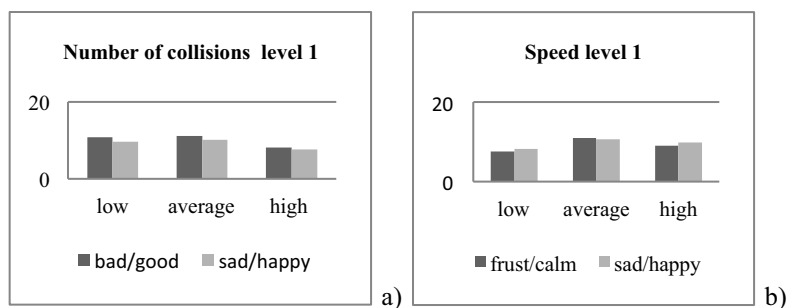
Figure 1. Means of mood rating by performance for a) collisions and b) speed

Finally, we performed multiple regression analyses with pre-post measures of mood as independent variables to predict the number of collisions and speed at the third level of difficulty. We found a significant regression model predicting speed performance at level 3 ($F(7,24) = 2.7$, $p = .037$, $R=.66$, $R^2=.43$). Only pre-test sad mood ($T= -2.3$, $p= .032$, $B = -.51$) and anxious mood ($T= 3.5$, $p= .002$, $B = .71$) predicted a slower speed performance at level 3. We did not find a significant regression model predicting number of collisions at level 3.

3. Discussion

Compared to the cutting point score of 6.75 on our analog scales indicating a neutral mood, our results show that slightly happy and feeling good moods were associated with fewer collisions, whereas ratings of these moods at the end of this continuum (very happy) were associated with the larger amount of collisions. These results suggest that participants hand movements were larger when in a *very happy* mood. We also found that sadness was associated with lower speed. Our results are consistent with previous work [6] showing that fast, larger, and jerkier movements using a joystick are found in participants expressing joy whereas slower movements are used to convey sadness. Our results are also consistent with empirical support of the classical theories of activation [9] showing that as the difficulty of a task increases, the optimal level of arousal necessary for a good performance decreases.

4. Application Development

Based on our preliminary results, and using similar parameters, we are in the process of developing new software allowing the participants to interact with an avatar. The system is developed using an Omni haptic device (Sensable^{TM}). Avatars were created in 3DStudio Max. Models were developed by first building the skeletons, and then adding muscles, tissue and skin. A fine mesh is used on the surface which deforms when the user interacts with it using the haptic device giving realistic visual and haptic feedback. The addition of haptics will create a more realistic and motivational environment and will permit the study of emotions conveyed during interpersonal touch in VR. Not only that the results of such study are expected to improve our understanding of online social interaction and improve human-computer interface, we intend to use our system to develop clinical application to be used for people with body image distortions and those who would benefit by being able to touch the curves, bones, and fatty mass of their avatar's body based on research evidence of the usefulness of virtual reality environments to treat body image has been reported in the literature [10][11].

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Cyberbullying In Cyprus – Associated Parenting Style and Psychopathology

Georgios FLOROS[1], Anna PARADEISIOTI[2], Michalis HADJIMARCOU[3], Demetrios G. MAPPOURAS[3], Olga KALAKOUTA[4], Penelope AVAGIANOU[1], Konstantinos SIOMOS[1]

[1] *Hellenic Association for the Study of Internet Addiction Disorder, Larissa, Greece*
[2] *Mental Health Services for Children and Adolescents, Cyprus Ministry of Health*
[3] *Inspectorate of Biology, Secondary Education, Cyprus Ministry of Education and Culture*
[4] *European Coordination Sector, Cyprus Ministry of Health*

Abstract. In this paper we present data from a cross-sectional study on cyberbullying experiences and cyberbullying perpetration in the Republic of Cyprus. Data were collected from a representative sample of the adolescent student population of the first and fourth grades of high school. Total sample was 2684 students, 48.5% of them male and 51.5% female. Research material included extended demographics, a detailed questionnaire on Internet activities, the Parental Bonding Index (PBI) and the Strengths and Difficulties Questionnaire (SDQ). We compared the results on psychometry for those students who did not report being bullied or having bullied others with those who were bullied, those who bullied others and those who were both sufferers and perpetrators of cyberbullying. Those students who reported being both victims and perpetrators tended to show similar or higher dysfunction than those students who only perpetrated cyberbullying. High maternal and paternal protection in combination with low maternal and paternal care ('affectionless control' parenting style) was associated with perpetrating cyberbullying, either with or without any experience of oneself being bullied as well. Results support a hypothesis that the perpetration of cyberbullying is associated with inefficient parenting styles. They also point to the existence of significant emotional symptoms for the involved adolescents and also general conduct problems, hyperactivity, peer problems and antisocial tendencies. It is important to note that perpetrators of cyberbullying were in most cases victims themselves at some point in time.

Keywords: Cyberbullying, adolescents, parenting style, psychopathology

Introduction

An increasing number of cases of cyberbullying and online victimization have been reported worldwide with victims reportedly suffering with increased mental distress, decreased socialization and failure to achieve at school [1, 2]. Inefficient parenting has been implicated in a recent survey as a possible mediating factor in cyberbullying perpetration [3]. It is unclear to what degree those who perpetrate cyberbullying and those who fall victims to it differ with regards to reported difficulties and psychopathology; this holds even more for those adolescents who are both victims and

perpetrators. The Republic of Cyprus is at the present time mostly inhabited by Cypriots of ethnic Greek origin, following the 1974 invasion of the island and subsequent division along ethnic lines. Greek high school student populations in mainland Greece have been recently demonstrated as being at a high risk with regards to falling victims to cyberbullying but also being perpetrators of cyberbullying [3]. After those results from mainland Greece, a decision was made from the Cypriot Ministry of Health and the Ministry of Education and Culture to investigate the impact of cyberbullying in Cyprus with a research program, in cooperation with the Hellenic Association for the Study of Internet Addiction Disorder. This was decided to be a part of a wider program on online addictive behaviors. In order to have an accurate picture of the problem in each area of Cyprus and achieve our stated goals, we proceeded with a study with a student sample representative of the entire student population. This is the first published report from the island of Cyprus on cyberbullying.

1. Method

The research sample was drawn nationwide to be representative of the first and fourth grades of the Cypriot high schools. Research material included extended demographics, a detailed questionnaire on Internet activities, and the Greek versions of the Parental Bonding Index (PBI) and the Strengths and Difficulties Questionnaire (SDQ). The PBI consists of 25 items rated on a four-item Likert scale with separate questionnaires for father and mother. Two factors are extracted, Care with one pole defined by empathy, closeness, emotional warmth, affection and another by neglect, indifference and emotional coldness. Overprotection, ranging from overprotection, intrusion, excessive contact, control and prevention of independent behavior to autonomy and allowance of independence. The SDQ is a brief behavioral screening questionnaire for children and adolescents ages 4 - 16 years old. The Greek versions of the PBI and the SDQ were backtranslated into English and possess satisfactory test-retest reliability and internal consistency [4] [5].

2. Results

Our research sample consisted of 2684 teen students between 12 and 18 years of age, 1302 (48.5%) of them male and 1382 (51.5%) female. Group frequencies on the type of bullying experience a student had (none, victim, perpetrator or both) across the genders are presented in Table 1. Female students were more likely to have fallen victims to cyberbullying, less likely to have perpetrated cyberbullying and less likely to have been both victims and perpetrators (p<.001) with a large effect size (eta, η) of .223

Table 1. Types of cyberbullying experiences across the genders with between-gender comparison.

Bullying experience	Gender		
	Male	Female	Totals
None	965 (74.1%)	1017 (73.6%)	1982 (73.8%)
Victim	101 (7.8%)	264 (19.1%)	365 (13.6%)
Bully	92 (7.1%)	23 (1.7%)	115 (4.3%)
Victim and Bully	144 (11.1%)	78 (5.6%)	222 (8.3%)
Comparison between (sex)	$\chi^2(3)=132.911, p<.001, \eta=.223$		

Each student was asked a series of questions regarding the type of bullying behavior. Results are presented in Table 2. Included in this table are also comparisons between the sexes on each item. Those results are similar to those obtained in a survey which employed the exact same questions in the Greek island of Kos, two years earlier [3] although effect sizes (etas) for the gender differences tend to be lower. We compared the results on psychometry for those students who did not report being bullied or having bullied others with those who were bullied, those who bullied others and those who were both sufferers and perpetrators of cyberbullying. ANOVA testing of groups with different cyberbullying experiences (not being victimized, having being bullied, baving bullied others and having being both bullied and a bully) showed that bullied students showed significantly more dysfunction than those who were not, while those students who reported being both victims and perpetrators tended to show similar or higher dysfunction than those students who only perpetrated cyberbullying. This was evident in the analyses of all related SDQ factors, namely Emotional Symptoms Scale , Conduct Problem Scale, Hyperactivity Scale, Hyperactivity Scale, Prosocial scale, Total Difficulties, Summary score, Impact score (p<.001). High maternal and paternal protection in combination with low maternal and paternal care ('affectionless control' parenting style) was associated with perpetrating cyberbullying, either with or without any experience of oneself being bullied as well (p<.05) (Figure 1). Results support a hypothesis that the perpetration of cyberbullying is associated with inefficient parenting styles. They also point to the existence of significant emotional symptoms for the involved adolescents and also general conduct problems, hyperactivity, peer problems and antisocial tendencies. It is important to note that perpetrators of cyberbullying were in most cases (Table 1) victims themselves at some point in time. Unfortunately there wasn't a practical way to query the participants of this survey as to what came first, being bullied or bullying others, yet this fact is in itself alarming either way; either the adolescent bullied first and likely provoked a response, or he/she responded in kind after having been bullied himself/herself.

Following these findings, our research group formulated the following priorities in the prevention and intervention program: The first priority would be to educate the students in what ways cyberbullying can be hurtful to others. Contrary to more common forms of bullying, cyberbullying follows the victim for an indefinite period of time even if the perpetrator expresses remorse; it is much harder to take down offensive online content than uploading it. Furthermore, online socialization has become in its own right an important part of normal adolescent behaviors and being 'digitally' excluded can be crippling for the fragile adolescent self-esteem. Adolescents may impulsively write a post on an Internet board or upload a photograph without realizing that their intention to provoke a laugh may inflict psychic pain. Role-play during class can help place anyone into the shoes of the victim, and help understand what it feels to be discriminated and marginalized. Another priority is to make it easier for the

adolescent to come forward whenever such an incident took place rather than take it upon himself to retaliate and prolong a vicious circle. This includes educating parents so as to not overreact and blame the victim for being targeted thus making it harder to confide in them. It also includes having a technology-savvy teacher in each school designated as a contact person for cases of cyberbullying whom a student could reach either anonymously or in person, knowing that specialized support is available. Finally cyberbullying can be a useful social example for adolescents of placing your need for justice to the hands of authorities rather than avenging with the same means used against you; fairness, solving interpersonal problems directly rather than plotting schemes and adequate behavioral self-control are essential for integration into society.

Table 2. Cyberbullying experiences for victims and perpetrators with comparisons between the sexes.

Answer	Having been bullied			Having bullied others		
	Male	Female	Totals	Male	Female	Totals
Yes	245 (18.8%)	342 (24.7%)	587 (21.9%)	97 (7.5%)	62 (4.5%)	159 (5.9%)
No	1057 (81.2%)	1040 (75.3%)	2097 (78.1%)	1205 (92.5%)	1320 (95.5%)	2525 (94.1%)
Comparison	$\chi^2(1)=13.795\ p<.001.\eta=.072$			$\chi^2(1)=10.567\ p=.001.\eta=.063$		
	Offensive remarks from someone I knew			Offended someone I knew		
Yes	118 (9.1%)	132 (9.6%)	250 (9.3%)	108 (10.7%)	43 (4.5%)	151 (7.7%)
No	1184 (90.9%)	1250 (90.4%)	2434 (90.7%)	903 (89.3%)	905 (95.5%)	1808 (92.3%)
Comparison	$\chi^2(1)=.089\ p=NS,\ ,\eta=.008$			$\chi^2(1)=25.983,\ p<.001,\eta=.115$		
	Offensive remarks from unknown			Offended someone who didn't know		
Yes	60 (4.6%)	95 (6.9%)	155 (5.8%)	56 (4.3%)	18 (1.3%)	74 (2.8%)
No	1242 (95.4%)	1287 (93.1%)	2529 (94.2%)	1246 (95.7%)	1364 (98.7%)	2610 (97.2%)
Comparison	$\chi^2(1)=6.325,\ p=.012,\eta=.049$			$\chi^2(1)=22.484,\ p<.001,\eta=.092$		
	Unsolicited erotic advances from someone I knew			Solicited erotic advances from someone I knew offline		
Yes	22 (1.7%)	40 (2.9%)	62 (2.3%)	36 (2.8%)	5 (0.4%)	41 (1.5%)
No	1280 (98.3%)	1342 (97.1%)	2622 (97.7%)	1266 (97.2%)	1377 (99.6%)	2643 (98.5%)
Comparison	$\chi^2(1)=4.311,\ p=.04,\ ,\eta=.04$			$\chi^2(1)=25.739,\ p<.001,\eta=.098$		
	Received unprovoked erotic advances from online acquaintance			Made unprovoked erotic advances to someone I only knew online		
Yes	34 (2.6%)	109 (7.9%)	143 (5.3%)	38 (2.9%)	5 (0.4%)	43 (1.6%)
No	1268 (97.4%)	1273 (92.1%)	2541 (94.7%)	1264 (97.1%)	1377 (99.6%)	2641 (98.4%)
Comparison	$\chi^2(1)=36.994\ p<.001,\eta=.117$			$\chi^2(1)=27.801,\ p<.001,\eta=.102$		
	I was bullied in another manner			I bullied in another manner		
Yes	17 (1.3%)	33 (2.4%)	50 (1.9%)	16 (1.2%)	6 (0.4%)	22 (0.8%)
No	1285 (98.7%)	1349 (97.6%)	2634 (98.1%)	1286 (98.8%)	1376 (99.6%)	2662 (99.2%)
Comparison	$\chi^2(1)=4.294,\ p=.038,\ ,\eta=.04$			$\chi^2(1)=5.208,\ p=.022,\eta=.044$		

Figure 1. Graphical representation of mean values of parental bonding factors across all types of bullying experiences
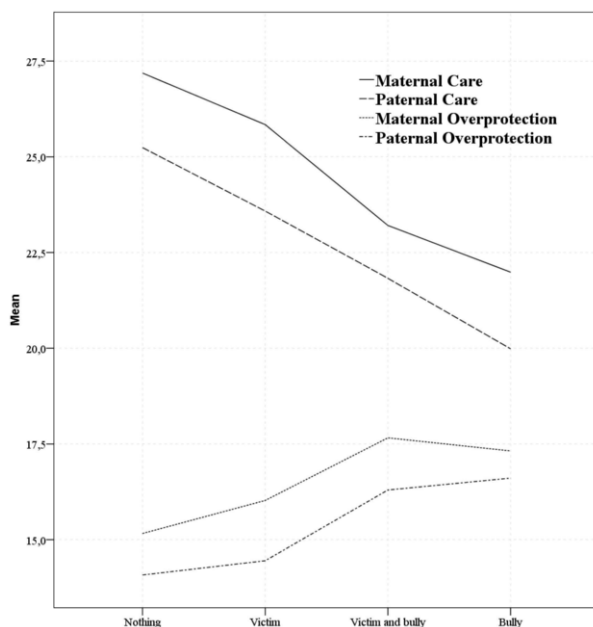
3. Conclusion

Cyberbullying is a two-faced construct; those who perpetrate it may have been victims themselves before and vice-versa. Since electronic means for bullying offer an asymmetry of force, they may be reciprocally employed by those targeted in the first place. Stopping this vicious circle is essential in any preventive effort. The negative consequences in an adolescent associated with cyberbullying are grave and there's also a need to broaden the scope with a renewed push for better parenting practices as well.

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The Impact of Internet and PC Addiction In School Performance of Cypriot Adolescents

Konstantinos SIOMOS[1], Anna PARADEISIOTI[2], Michalis HADJIMARCOU[3],
Demetrios G. MAPPOURAS[3], Olga KALAKOUTA[4], Penelope AVAGIANOU[1],
Georgios FLOROS[1]

[1] *Hellenic Association for the Study of Internet Addiction Disorder, Larissa, Greece*
[2] *Mental Health Services for Children and Adolescents, Cyprus Ministry of Health*
[3] *Inspectorate of Biology, Secondary Education, Cyprus Ministry of Education and Culture*
[4] *European Coordination Sector, Cyprus Ministry of Health*

Abstract. In this paper we present the results of a cross-sectional survey designed to ascertain Internet and personal computer (PC) addiction in the Republic of Cyprus. This is a follow-up to a pilot study conducted one year earlier. Data were collected from a representative sample of the adolescent student population of the first and fourth grades of high school. Total sample was 2684 students, 48.5% of them male and 51.5% female. Research material included extended demographics and an Internet security questionnaire, the Young's Diagnostic questionnaire (YDQ), the Adolescent Computer Addiction Test (ACAT). Results indicated that the Cypriot population had comparable addiction statistics with other Greek-speaking populations in Greece; 15.3% of the students were classified as Internet addicted by their YDQ scores and 16.3% as PC addicted by their ACAT scores. Those results are among the highest in Europe. Our results were alarming and have led to the creation of an Internet and PC addiction prevention program which will focus on high-school professor training and the creation of appropriate prevention material for all high-schools, starting immediately after the conclusion of the pan-Cypriot survey, focusing especially on those areas where the frequency of addictive behaviors will be highest.

Keywords. Internet addiction, computer addiction, adolescents, high school

Introduction

Internet addiction has been characterized as a possible major public health problem for the 21st century.[1] The Republic of Cyprus is at the present time mostly inhabited by Cypriots of ethnic Greek origin, following the 1974 invasion of the island and subsequent division along ethnic lines. Greek high school student populations in mainland Greece have been repeatedly demonstrated as being at increased risk compared to other European populations with regards to addictive Internet use. Results from the latest related studies showed elevated percentages of online addiction [2], particularly online gaming [3], social networking [4] and gambling [5]. After those results from mainland Greece, a decision was made from the Cypriot Ministry of Health and the Ministry of Education and Culture to investigate the impact of online

addictive behaviors in Cyprus with a research program, in cooperation with the Hellenic Association for the Study of Internet Addiction Disorder. Initially, a pilot study which our research team coordinated last year [6] revealed large percentages for Internet addiction and computer addiction in the Republic of Cyprus; 15.3% of the 884 polled students were classified as Internet addicted and 16.3% as PC addicted. Those results were among the highest in Europe and have led to the creation of an Internet and PC addiction prevention program which will focus on high-school professor training and the creation of appropriate prevention material for all high-schools. The program is scheduled to commence this summer of 2013 focusing especially on those geographical areas where the frequency of addictive behaviors in this survey is the highest. In order to have an accurate picture of the problem in each area of Cyprus and achieve our stated goals, we proceeded with a study with a student sample representative of the entire student population. This way we minimized the possibility of focusing in an individual problem area of online behaviors unique to the pilot study group. The methodology and research material were similar to those employed in the aforementioned studies in Greece in order to facilitate comparison between the two countries which shared common language and culture.

1. Method

Our research sample consisted of 2684 teen students between 12 and 18 years of age, 48.5% of them male and 51.5% female. The sample was drawn nationwide to be representative of the first and fourth grades of the Cypriot high schools (Gymnasium and Lyceum or Technical school respectively). Research material included extended demographics, a detailed questionnaire on Internet activities, the Greek versions of Young's Diagnostic questionnaire (YDQ)[7] and the Adolescent Computer Addiction Test (ACAT)[8]. The YDQ is an eight item yes-no scale, widely employed to measure Internet addiction. The ACAT scale is a twenty item Likert scale (1-5), employed for computer addiction. Both scales have cut-off values for three groups, minimal, moderate and addictive use. Both scales are validated for the Greek population.

2. Results

Seven percent of all students reported being online for ten hours or more, on a daily basis. The most frequent online activities were social networking and online gaming with 41.8% and 24.6% of all respondents respectively reporting visiting them multiple times per day.

8.1% of respondents were classified in the addicted range of the YDQ and 17.6% in the addicted range of the ACAT scale (Table 1). Contrary to results from prior quoted research the percentages of males and females in the addicted categories were similar, yet there persisted a higher frequency for males in the moderate use category versus a higher frequency for females in the minimal use categories which drove the comparison to statistical significance in both cases. This is reflected at the low effect sizes (etas) obtained from the comparisons. Learning how to use a PC and surf the Internet at a younger age correlated with higher means in addiction as did learning at an Internet café and by being initially enticed with video games (p<.05). PC and Internet use frequency correlated most with siblings and least with parents. Results also indicated that scores in the Internet and PC addiction measures (YDQ and ACAT) correlated negatively with subjective feelings of happiness, and content with living in own environment (p<.05).

Table 1. Results on the addiction measures and comparisons within genders

	YDQ categories			ACAT categories		
	Minimal	Moderate	Addictive	Minimal	Moderate	Addictive
Male	542 (44.6%)	575 (47.3%)	98 (8.1%)	451 (40.8%)	460 (41.6%)	194 (17.6%)
Female	702 (53.4%)	503 (38.3%)	109 (8.3%)	548 (46.6%)	433 (36.8%)	196 (16.7%)
Totals	1244	1078	207	999	893	390
Comparison within (sex)	$\chi^2(2)=22.131, p<.001, \eta=.067$			$\chi^2(2)=7.981, p=.018, \eta=.045$		

14.3% of respondents consider Internet use as more of a hindrance than a benefit for their studies with 1.6% of all respondents claiming that due to their Internet use their school year is in jeopardy. The third category, in which the student claims that the Internet is helpful, yet he/she can function satisfactorily without using it, presents with the lowest means for Internet and PC addiction. The highest means were reported for the responses related to obvious drop in academic performance, 'Using the Internet has brought about a drop in my performance' and 'Because of my Internet use I am at risk of missing my school year'.

There were also negative correlations of the addiction scores with achievement in class (both in literature and mathematics), with self-comparison to other students' achievements and general intelligence ($p<.05$) and a positive correlation with truancy ($p<.05$). There is an evident drop in achievement when comparing YDQ and ACAT groups to one another with higher addiction groups presenting with lower means in general achievement and literature and mathematics classes as well.

A comparison was made between student scores in mathematics and literature the given year to those scores from a year before. Although it was normal to expect a slight drop since course material each year is tougher than the year before, the effect sizes of those drops were higher in absolute terms as Internet and PC use increased. This fact is best depicted graphically in figures 1 and 2 which present the mean year-to-year drop in student achievement in literature and mathematics across the YDQ and ACAT categories respectively. The magnitude of those differences is more pronounced in the mathematics courses where there's almost a linear trend ($p<.001$). Literature seems more affected at the shift from users at risk to addicted users ($p<.001$). There is another significant difference in the student's perception on future progress with the vast majority of those addicted to either Internet or PC use making gloomy predictions on losing a school year or dropping out of school altogether ($p<.001$).

3. Conclusion

Our results show that a high percentage of Cypriot adolescents is affected by Internet and PC addiction; their test scores compare to other Greek-speaking populations at the time [2] and are among the highest in Europe [9]. This addiction has a detrimental effect in their school performance, and this is recognized by a considerable percentage of them as well. Learning how to use those technological mediums at school under a controlled environment appears to be related to less adverse outcomes while parental use and introduction by the parents to the medium is not associated with fewer chances
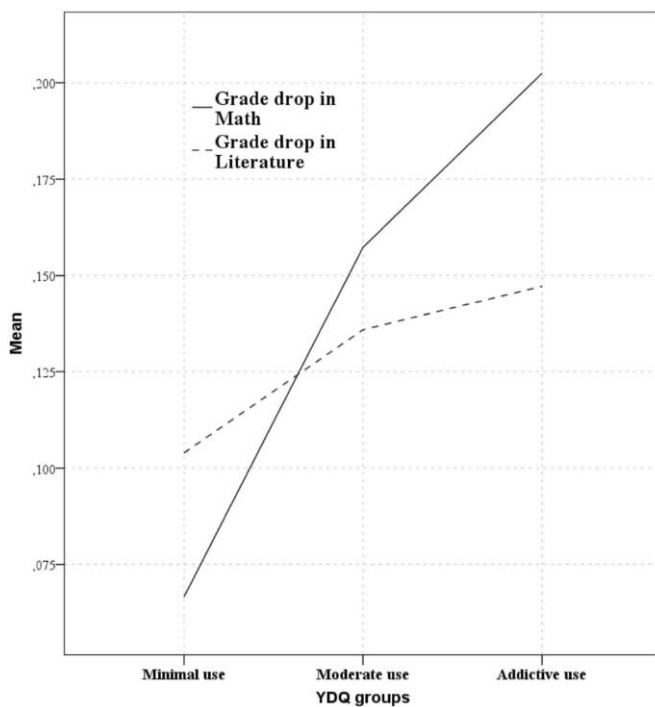
Figure 1. Graphical representation of mean drop in student achievement across the YDQ groups
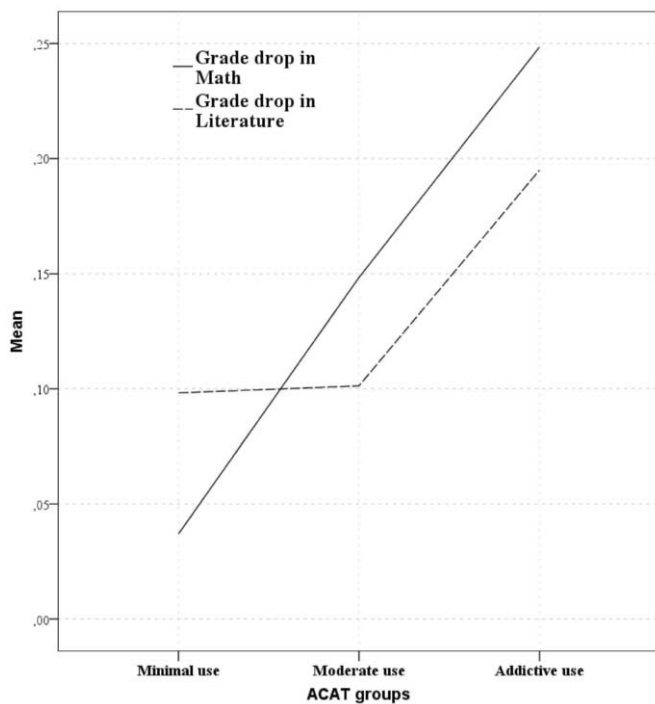

Figure 2. Graphical representation of mean drop in student achievement across the ACAT groups

of the adolescent developing addictive behaviors. These facts demonstrate the need for a comprehensive program which will focus on prevention by aiming both at technology adoption in a controlled and safe manner and managing individual cases where addiction problems are emerging.

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Priming to Induce Paranoid Thought in a Non Clinical Population

Reza Giga ISNANDA[a], Willem-Paul BRINKMAN[a], Wim VELING[b]
Mark van der GAAG[b,c], Mark NEERINCX[a]
[a] *Delft University of Technology, The Netherlands*
[b] *Parnassia Psychiatric Institute, The Hague, The Netherlands*
[c] *VU University and EMGO Institute of Health and Care Research, Amsterdam, The Netherlands*

Abstract. Freeman et al. reported that a substantial minority of the general population has paranoid thoughts while exposed in a virtual environment. This suggested that in a development phase of a virtual reality exposure system for paranoid patients initially a non-clinical sample could be used to evaluate the system's ability to induce paranoid thoughts. To increase the efficiency of such an evaluation, this paper takes the position that when appropriately primed a larger group of a non-clinical sample will display paranoid thoughts. A 2-by-2 experiment was conducted with priming for insecurity and vigilance as a within-subject factor and prior-paranoid thoughts (low or high) as a between-subjects factor. Before exposure into the virtual world, participants ($n = 24$) were shown a video and read a text about violence or about mountain animals. While exposed, participants were asked to comment freely on their virtual environment. The results of the experiment confirmed that exposure in a virtual environment could induce paranoid thought. In addition, priming with an aim to create a feeling of insecurity and vigilance increased paranoid comments in the non-clinical group that otherwise would less often exhibit ideas of persecution.

Keywords. Paranoia, priming, virtual reality, exposure, mental health computing

Introduction

Paranoia is a state of mind where the subject has a belief that other people have intention to harm them. This state is characterized by hyper vigilance, emotional arousal and selective attention for threat. Paranoia can be delusional in psychotic disorder, but also occurs in the general population where people have no history of mental illness [1]. This creates the opportunity to study paranoia evoking stimuli in a non-clinical population, which is specifically relevant when evaluating new virtual reality (VR) applications in this area. Before studying with actual patients, research could be done with non-patients initially. Furthermore, Freeman et al. [2] reported that, although substantial, only a minority of above 40% of their 200 participants recruited from the general population had paranoid thoughts when exposed in a neutral VR world, suggesting the need for relative large samples to evaluate a VR application on its ability to evoke paranoid thoughts in non-patients. Because of the impracticability of using a large sample, this paper takes the position that when appropriately primed a larger group of the general population will more intensely display paranoid ideation in

a VR world. That priming is effective in VR has already been demonstrated by Bouchard et al. [3]. They showed that informing individuals, with a snake phobia, prior to the VR exposure about the existence of dangerous snakes in the VR world, could increase the anxiety experienced in VR later on. In addition, Qu et al. [4] also showed that text and video priming could increase the chance that an individual would mention a specific keyword in a discussion with a virtual character. Results from both studies encouraged an investigation into whether it is also possible to induce paranoid thought to a non-clinical sample using priming prior to the exposure. Therefore, this study aims to demonstrate that video and textual priming prior to exposure can indeed increase paranoid thought during VR exposure.

1. Method

1.1. Procedures and Participants

The experiment was set up with a two by two design, with type of priming (paranoid or neutral) as a within-subjects factor, and prior-paranoid thoughts (low or high) as a between-subjects factor. In addition, the experiment was controlled by a computer that followed a double-blind procedure where both the participants and experimenter did not know the order of the priming condition. 24 students of Delft University of Technology (16 male and 8 female) participated in the experiment. The participants' age ranged between 23 and 33 ($M = 27.8$, $SD = 2.8$). All the participants had at least a bachelor degree and reported to have no history of psychosis. Ethical approval for this experiment was obtained from the university ethics committee. Before the experiments, all the participants read, and signed a consent form. They were not informed about the hypothesis of the experiment until the experiment had ended. They were only informed that their participation would help in the developing a VR environment that could be used to help treating people with a mental disorder.

1.2. Interventions

The type of priming in the experimental condition consisted of two levels: paranoid priming and neutral priming. In the paranoid priming condition, the participants were shown a 6.5 minutes video of a news report on street violence[1] and read an A4 page long fake news report about violence in the Netherlands. The aims of the video and the text was to raise attention to threat and increase the level of vigilance so that participants could carry-over these feelings into the VR exposure to influence the way they perceive the VR world. In the neutral-priming condition, participants were shown a 6.5 minutes wildlife video [5] and read an A4 page long text about mountain animals. Both this text and video were selected with the intention not to evoke suspicious thoughts or feelings. After reading the text and watching the video, participants were either exposed to a VR environment of a restaurant or a train platform [6] for 5 minutes each. The orders of the two priming conditions and the VR worlds were counterbalanced. Both environments included virtual characters that had no specific tasks, did not show specific emotions, and did not initiate conversations or physical

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[1] Downloaded on 27 February 2012 from http://www.youtube.com/watch?v=jQjZpiJt5ic

interactions with the participants. Some virtual characters walked around, either following a fixed path, or a random path, and stopped at random points to look around. Furthermore, some virtual characters looked occasionally at the participants. Figure 1 shows pictures from the VR environments. To establish a baseline measurement and to train the participants with a commenting protocol, participants were exposed in a training VR environment [5] at the start of the experiment after which they were presented with priming video and text.

Figure 1. The VR environment. Left the restaurant world and right the train platform world.

1.3. Materials and Measurements

The participants were exposed in the VR world by wearing a Sony HMZ-T1 Personal 3D Viewer head mounted display with resolution of 1280x720. The tracking was done using 6DOF Ascension Flock of Birds tracker. Mobi8 data recorder from TMSi was used to collect heart rate data from the participants. Throughout the exposure, the participants were instructed to comment freely on their environment, including the virtual characters. They were asked to focus on how they experienced and perceived the environment rather than simply providing an 'objective' description of the environment or an assessment of the quality of the VR environment. During the exposure the experimenter recorded what the participants said and also saw in the VR environment at that moment. The participants' voice and screen view were recorded using Camstudio software. To measure the participants' paranoid comments, two independent coders went through all 48 commentaries and counted the number of times participants made comments that could be labeled as paranoid thoughts (Table 1). In addition, The Green et al. Paranoid Thoughts Scale (GPTS) [7] was used as a measure of the participants' base paranoid level prior to the experiment, and the State Social Paranoia Scale (SSPS) [8] was used as a measure of the participants' paranoid thought directly after the VR exposure.

2. Result

A strong level of inter-observer correlation (Spearman $r = .83$, $n = 48$, $p. < .01$) suggested an acceptable reliability level of the coded comments. For further analysis the average value of two coders was used. Taking the median score of 58.5 on the Green et al. Paranoid Thoughts Scale (GPTS) as a cut off point, the participants were split into two equal groups, a low and a high GPTS group. As the SSPS score and the paranoid comments deviated from a normal distribution, an Aligned Rank Transformation (ART) for nonparametric factorial data analysis [9] was conducted first. Afterwards, repeated-measures ANOVA analyses were conducted using the

priming condition and the two GPTS groups each time as independent factors and the ART of SSPS score, Heart Rate, and the ART of the number of paranoid comments as dependent variables. Table 2 shows the result of the analyses.

Table 1. Coding Scheme Paranoid thoughts commentaries.

- **Persecution/accusation**: a reference that suggests that a virtual character is acting suspiciously or is dangerous.
- Examples: *he looks suspicious; I believe he has bad intentions; he is up to no good.*
- **Distress**: a reference regarding feeling uncomfortable or distressed, which was caused by a virtual character or the environment.
- Examples: *the way he looks at me makes me feel uncomfortable; people keep staring at me and it feels uncomfortable; I am not feeling comfortable to sit beside him.*
- Not included: references to feelings that are caused by unrelated events or objects, such as: *I feel uncomfortable since there is no food on my table; I am bored.*
- **Threat**: a reference towards a threat from a virtual character or the environment or a feeling of insecurity.
- Examples: *the way he looks at me makes me feel insecure; I do not think this place is a safe place.*
- Not included: references that are caused by unrelated events or objects such as: *I am afraid that the HMD will fall if I move too actively; I am not feeling safe wearing all these gadgets.*

Table 2. Results of analyses on SSPS, Heart Rate, and Paranoid comments.

Measures	GPTS group		Priming		GPTS group x Priming	
	$F(1, 22)$	*p.*	$F(1, 22)$	*p.*	$F(1, 22)$	*p.*
SSPS	3.05	.095	< 0.01	.941	0.14	.247
Heart Rate	4.22	.052	0.06	.808	0.79	.384
Paranoid comments	0.75	.395	0.77	.389	5.10	.034

Although no significant main effects were found, analyses revealed a significant two-way interaction effect between GPTS groups and the priming condition ($F(1,22) = 5.10$, $p = .034$) on the number of paranoid comments (Figure 2).
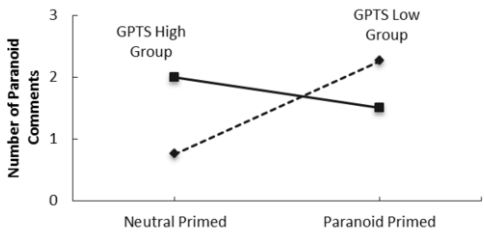
Figure 2. Median number of paranoid comments mentioned in the exposure.

In the neutral priming condition, the low GPTS group (*Mdn* = 0.75) made significant ($z = -2.08$, $p = .04$) fewer paranoid comments than the high GPTS group (*Mdn* = 2.0), whereas in the paranoid priming condition no significant ($z = -.29$, $p = .80$) difference was found between the low (*Mdn* = 2.25) and the high GPTS group (*Mdn* = 1.5). Also for the low GPTS group, the number of paranoid comments significantly increased between the neutral and the paranoid priming condition ($z = -2.68$, $p < .01$), while for high GPTS group, no significant difference ($z = -0.55$, $p = .58$) was found between the neutral and the paranoid priming condition. Instead, the number of comments seemed to remain relatively high. Furthermore, although the main effect for the GPTS groups on SSPS scores (low GPTS group *Mdn* = 15.5; high GPTS group

Mdn = 24.5) and participants' heart rate (low GPTS group *M* = 86.2; high GPTS group *M* = 79.6) approached a significant level of .05, no significant main effect for priming or an interaction effect between priming and GPTS groups was found on both.

3. Discussion

The result of the effects of priming on paranoid comments seems similar to the result of Fett et al[10]. In a trust game, they found that the paranoid individuals were inflexibly mistrusting, while non-paranoid individuals were more trusting in neutral situations and mistrusting in situations in which they were cheated. No significant interaction effect between the GPTS groups and priming was found on the SSPS score and the heart rate. Presumably priming might not result in a large physiological effect, while SSPS score was only collected after the exposure, where the priming effect might have worn off, or might not have a large effect on the recollected experience of this non-clinical sample.

4. Conclusion

The results of the experiment confirmed that exposure in a virtual environment could induce paranoid thought. In addition, priming with an aim to create feelings of threat and vigilance could increase paranoid comments in a non-clinical group that otherwise would less often exhibit ideas of persecution. Together these findings suggested that when appropriately primed a non-clinical sample could be used to evaluate VR environment ability to elicit paranoid thought.

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Drugs Don't Work in Patients Who Don't Take Them: Dr.Drin, The New ICT Paradigm For Chronic Therapies

Raffaello BRONDI [a, b, 1], Filippo BANNÒ [b], Sara BENDINELLI [b], Christian
CASTELLI [b], Antonio MANCINA [b], Mauro MARINONI [a, b], Daniele SARTIANO [b, c],
Francesca SERNISSI [b, d], and Paolo BONGIOANNI [e].

[a] *TeCip Institute, Scuola Superiore Sant'Anna (Pisa) – Italy*
[b] *BioCare Provider Srl (Pisa) – Italy*
[c] *Department of Computer Science, University of Pisa (Pisa) – Italy*
[d] *Rheumatology Unit, Azienda Ospedaliero Universitaria Pisana (Pisa) – Italy*
[e] *Neurorheabilitation Unit, Azienda Ospedaliero Universitaria Pisana (Pisa) – Italy*

Abstract. Poor adherence to drug therapies still represents an unsolved problem.
In order to provide a useful solution to chronic patients of all ages – with particular
attention to the elderly – who are subjected to complex therapeutic regimen, an
innovative ICT solution, called Dr.Drin, has been designed and tested . The aim of
the developed framework is to assist the patient during the therapy and to enable
and support a bidirectional communication between all healthcare stakeholders
(doctors, caregivers and family members) and the patient. During the screening
phase, patients were interviewed to understand what are the common practices
they usually adopt to remember when and how to take a drug. The solutions which
they rely the most on are the list of drugs, writing on the packaging, and setting up
alarms. Patients who complained about difficulties of adherence and who had a
smartphone were subsequently recruited to test Dr.Drin over a three-months
period. In the following, preliminary results from the first twelve patients are
presented and analyzed to prove the effectiveness of Dr.Drin in supporting patients
adherence to therapies.

Keywords. Pharmacological Adherence, Compliance, Social Networking in
Healthcare, Telehealth, Mobile healthcare, Health Aging, Health Applications,
Positive Technology

Introduction

Over the centuries the average age of the western countries population has steadily
increased, and so has the incidence of chronic diseases and the use of drugs.

In some of the major European countries, such as France, Germany, UK and
Poland, the number of people reporting any long standing illness or long standing
health is around 30-35 million. It has been estimated that the overall number of chronic

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[1] Corresponding Author: Co-founder BioCare Provider S.r.l., Via Grande 225, 57123 Livorno, Italy;
e-mail : raffaello.brondi@biocareprovider.com

patients in Europe is about 150 million of people [1], while in US the number is even higher, with 162 million of people [2]. Considering only Italy, people who suffer from chronic disease are 27 million [3], and the most of them take more than five different drugs every day [4]. A high consumption of drugs causes problems of adherence to treatment; indeed about the 50% of these patients have problems in remembering when and how to assume medicines [5]. The World Health Organization (WHO) defines adherence to long-term therapy as "the extent to which a person's behavior - taking medication, following a diet, and/or executing lifestyle changes - corresponds with agreed recommendations from a health care provider" [6].

A lack of compliance with treatments may cause a deterioration of the patient's health conditions, also leading to an increase in direct as well as indirect costs for the National Health Service (NHS) and the patient himself. To improve medication adherence, the multifactorial causes of decreased adherence must be understood. The WHO classifies these factors into five categories: patient-related factors, disease-related factors, socioeconomic factors, therapy-related factors, and factors associated with the healthcare team and system in place [5]. More generally speaking, main actors involved in the therapeutic process, which the treatment success depends on, are the patient, the doctor and the health system/team building. A recent Cochrane review of 78 randomized trials found no one simple intervention and relatively few complex ones to be effective at improving long-term medication adherence and health outcomes, underscoring the difficulty of improving medication adherence [7]. Communication among physicians is often insufficient and may contribute to medication non-adherence. In an overtaxed health care system in which physicians see a large volume of patients without resources to meet individual patient needs, the amount of time a clinician spends with patients may be insufficient to properly assess and understand their medication-taking behaviors. This lack of time may preclude engaging the patient in a discussion on the importance of medication adherence and strategies to achieve success [5].

In order to provide a concrete solution to this problem, patients need to be motivated and educated. On the other hand it is as much important to provide doctors and also caregivers with effective instruments that allow them to follow the patient during the therapy. This is the reason why we developed Dr.Drin[2], a new doctor-patient communication channel, able to actively involve all healthcare stakeholders in the medical treatment.

1. Methods and Tools

Dr.Drin is a social innovation designed thanks to the advices of doctors and patients, and thus ensuring ease and speed of use. The framework architecture adopts a Software as a Service (SaaS) distribution model to extend services access to all kind of devices, in particular on mobiles. A smartphone/tablet application has been developed for Android and iOS Operating Systems (OSs) in order to enable all framework functionalities, and to guarantee an optimal user experience.

Through a web interface, the physician can set up one or more drug therapies along with any clinical parameters useful for monitoring the disease. The interface has been designed fulfilling the user-centered design criteria. Once the patient has been

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[2] Dr.Drin is a software developed by BioCare Provider S.r.l.

identified, the mobile application is able to access the list of therapies that were set up through the cloud services. The app is configured to issue visual and sound notifications, reminding the patient (or his/her caregiver) to take (or dispense) the drug, indicating dosage and reason why it is important to take the medicine, according to the prescriptions received.

The application collects data related to the intake of drugs (amount, type, frequency), in order to calculate a rate of compliance for each prescribed medication. Indeed the patient was asked to answer "taken" or "not taken" for each drug, and if not to provide an explanation (personal choice, doctor decision or empty stocks). Patients receives also a short survey on their smartphones on a monthly base. The survey consists of 0-5 digital scales concerning general health, quality of life, difficulties of compliance with drugs, perception of usefulness and simplicity of use of Dr.Drin. The collected data are available in the form of a structured report to all healthcare stakeholders.

In order to prove Dr.Drin to be effective in improving patients' adherence to therapies, we performed a pilot clinical study on chronic outpatients recruited at the Neurorehabilitation Unit of Pisa University Hospital. The study was performed in accordance with the principles stated in the Declaration of Helsinki and the protocol approved by the local Ethical Committee

Herein we present preliminary results from the first twelve patients recruited, over a three-months period.

2. Results

A screening interview, aimed at evaluating the knowledge of patients on the risk of not being adherent to treatments and to discover the solutions they used to develop to improve pharmacological compliance, was initially performed on 155 random patients (45 men and 110 women; mean age ± SD, 56.9 ±14.6). Concerning the methods developed/used by patients to remember the daily intakes, 110 people in the sample (71%) used various types of artifices to remember the time to take medications. The methods used were drawing up a list of drug with name, dosage and time of administration (44% of those who used a method), writing the dosage and time of administration on the packaging of the product (19%), setting alarms on the mobile phone (15%), keeping medicines in plain sight (11%). Sixteen subjects used two of the above mentioned methods simultaneously. Patients were asked also to judge their real performance on a 0-10 visual scale. Only 29 patients (18.7%) admitted or were aware of having poor compliance.

Twelve patients, who complained about difficulty of compliance and had a smartphone, entered the study. Taken all together patients were affected by severe disease and therefore subjected to complex therapeutic regimen (see Table 1 and Table 2). At the baseline all patients complained about difficulty of compliance, and for that reason were invited to test the application. After the first month of the trial, most of the patients reported a 100% compliance, with the only exceptions to compliance being two patients who decided to discontinue the experiment.

The overall results of the survey were positive for all questions (see Table 3). As for the patients' perception on ease of use and usefulness of Dr.Drin, the lower answer (score 1) was given by a caregiver.

3. Conclusions

The results achieved during the screening phase highlighted the importance of three elements in helping patients in the management of medicines: the drug list, the alarm, the posology. All these features have been already included and stressed in Dr.Drin. As previously reviewed by Vervloet et al [7], several studies proved effectiveness of drug reminders in improving patients' compliance, but these solutions are far from being adopted by the chronic patients' community, probably because they are based on scarcely attractive technologies and functionalities or because these solutions require a complex error-prone procedure in manually adding reminders to a calendar.

Preliminary data reported here prove that web and smartphone application solutions can represent an effective approach for improving patient-doctor communication and, ultimately, to support adherence to treatments. Moreover, patients advices have been very useful to us in order to improve Dr.Drin user experience.

Table 1. Demographic data

N. of recruited patients	12
Age, mean (SD)	58.92 (16.27)
Sex (F/M)	3/9

Table 2. Clinical data

N. of diseases	N. of patients
1-3	6
4-6	4
> 7	2
Type of disease	**Prevalence (%)**
Neuro-degenerative	13 (27,66)
Psychiatric	10 (21,28)
Cardio-vascular	8 (17,02)
Other	16 (34,04)
Medications	**Mean (min-max)**
N. of medications	6.58 (2-12)

Table 3. Survey results. Q1: please quantify your ability to be adherent to the therapy (0=nothing, 5=totally); Q2: please evaluate the quality of your life (0=not good, 5=very good); Q3: please evaluate the quality of your global health (0=not good, 5=very good); Q4: please evaluate Dr.Drin ease of use (0=not easy, 5=very easy); Q5: please evaluate Dr.Drin usefulness (0=totally unuseful, 5=very useful). All shown results are mean (SD).

	Mean (SD)		
	T1	**T2**	**T3**
Q1	4.83 (0.41)	4.80 (0.45)	5.00 (0.00)
Q2	4.33 (1.63)	4.80 (0.45)	5.00 (0.00)
Q3	4.00 (1.67)	4.00 (1.41)	4.00 (2.12)
Q4	3.17 (1.17)	3.00 (1.58)	3.00 (2.83)
Q5	2.67 (1.21)	3.00 (1.58)	3.00 (2.83)

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Cue-Elicited Anxiety and Craving For Food Using Virtual Reality Scenarios

Marta FERRER-GARCÍA[1], José GUTIÉRREZ-MALDONADO, and Joana PLA
Universitat de Barcelona

Abstract. Cue exposure therapy has been reported to be an effective intervention for reducing binge eating behavior in patients with eating disorders and obesity. However, in vivo food exposure conducted in the therapist's office presents logistical problems and lacks ecological validity. This study proposes the use of virtual reality technology as an alternative to in vivo exposure, and assesses the ability of different virtual environments to elicit anxiety and craving for food in a non-clinical sample. The results show that exposure to virtual environments provokes changes in reported craving for food. High-calorie food cues are the ones that elicit the highest increases in craving.

Keywords. Virtual reality, cue exposure, food craving, anxiety, non-clinical sample.

Introduction

Eating disorders (ED) and obesity are major problems in today's society. Though certain treatment approaches such as cognitive-behavioral therapy (CBT) have proved effective, a large percentage of patients do not greatly improve or suffer relapses. Therefore, new intervention techniques must be explored.

Binge eating behavior has been associated with both ED and obesity. Previous studies have proposed that cue-exposure therapy may be an effective intervention for bingeing [1-7]. In these studies, patients were exposed to binge food but were prevented from bingeing: they could look at, smell, touch, and even consume a small portion of the food, but they could not engage in binge behavior. The objective of cue-exposure therapy is to extinguish physiological responses such as craving and anxiety which are elicited in presence of binge-related cues and increase the probability of bingeing [2,3,5].

Though few studies have been carried out to date, cue-exposure therapy has shown positive results in BN [8], even in patients who did not improve with CBT or pharmacological treatments [6]. However, in vivo food exposure conducted in the therapist's office presents logistical problems and lacks ecological validity [8]. Virtual reality (VR), which allows the displaying of food cues in a contextual setting, may increase ecological validity and facilitate the availability of proximal and contextual cues [9-11]. The main objective of this study was to assess whether VR environments

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[1] Corresponding Author: Marta Ferrer-Garcia, Paseo de la Vall d' Hebrón, 171, 08035, Barcelona, Spain; Email: martaferrerg@ub.edu

simulating intake situations can provoke different levels of anxiety and craving for food in a non-clinical sample.

1. Methods

1.1. Participants

Fifteen men and 68 women were recruited from the population of students of the Faculty of Psychology at the University of Barcelona (Spain) and received course credits as compensation for their participation. Age ranged from 21 to 43 (*M*= 23.91, *SD*=3.80) and body mass index (BMI) from 16.85 to 39.31 (*M*= 22.70, *SD*=3.91). Two female participants reported history of an ED during adolescence. All participants gave written consent to participate in the study and were informed that they could withdraw at any time during the experiment. Table 1 shows data for men and women separately.

Table 1. Between-subject *t*-test, means, and standard deviations for age, BMI, and EAT-26 scores in men and women.

	Men		**Women**		*t*	*p*
	Mean	*SD*	Mean	*SD*		
Age	25.47	4.61	23.57	3.55	1.495	.152
BMI	23.93	2.99	22.43	4.06	1.343	.183
EAT-26	1	1.60	3.85	5.86	3.468	.001*

*p<.05

1.2. Assessment

- ED symptoms: Measured with the Spanish version [12] of the Eating Attitudes Test-26 (EAT-26) [13].
- Anxiety: Measured with a visual analogical scale (0-100)
- Food craving: Measured with a visual analogical scale (0-100)

1.3. Procedure

Before starting the experiment, participants were administered the EAT-26 and demographic information was recorded. They were also measured and weighed in order to obtain their BMI. During the experiment, participants were first exposed to a blank screen on a laptop. After two minutes of exposure, anxiety and food craving were assessed. Next, participants were exposed in random order to four virtual environments (VEs): a low-calorie kitchen, a high-calorie kitchen, a low-calorie restaurant, and a high-calorie restaurant. VEs were displayed by means of software which creates a stereoscopic effect, duly processed by polarized glasses. Anxiety and craving for food were assessed after two minutes of passive exposure. Once the exposure to each virtual environment was completed, participants were again exposed to the blank screen for two minutes in order to return to the base line condition, and anxiety and craving were measured again.

1.4. Statistical analysis

Since significant differences were found between males and females on the EAT-26 scores (see table 1), two mixed between-within subject ANOVAs 5(situation) x 2(sex) were conducted to assess the ability of the VE to elicit anxiety and food craving in participants. The mean scores obtained for anxiety and craving in front of the blank screen were used as baseline in the analysis. Two more mixed between-within subject ANOVAs 2x2x2 were also conducted in order to assess the specific influence of the kind of food (low-calorie versus high-calorie) and the contextual stimuli (kitchen versus restaurant) on the anxiety and food craving experienced by males and females. In all the analyses, time elapsed since the last meal was introduced as a covariate to control cue responses produced by food deprivation.

2. Results

Mixed between-within subject ANOVAs (5x2) showed no significant differences between the mean score for anxiety obtained in front of the blank screen and the anxiety experienced in the different VEs, but the interaction between the sex of participants and the situation showed a significant effect (F[4, 82]=2.507; p=.049; η^2=.12). Men felt more anxious in situations with low-calorie food, while women displayed higher anxiety in high-calorie food environments.
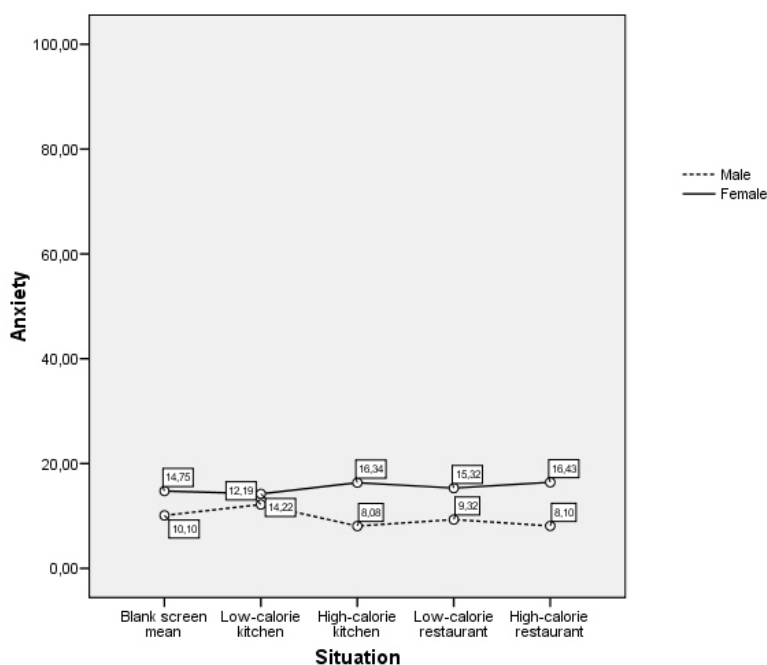

Figure 1. Anxiety experienced for males and females in the different situations

On the other hand, significant differences were found between levels of craving for food in the blank screen situation and in the VEs (F[4, 82]=5.161; p=.001; η^2=.21). Situations with high-calorie food provoked higher levels of food craving in both males and females.
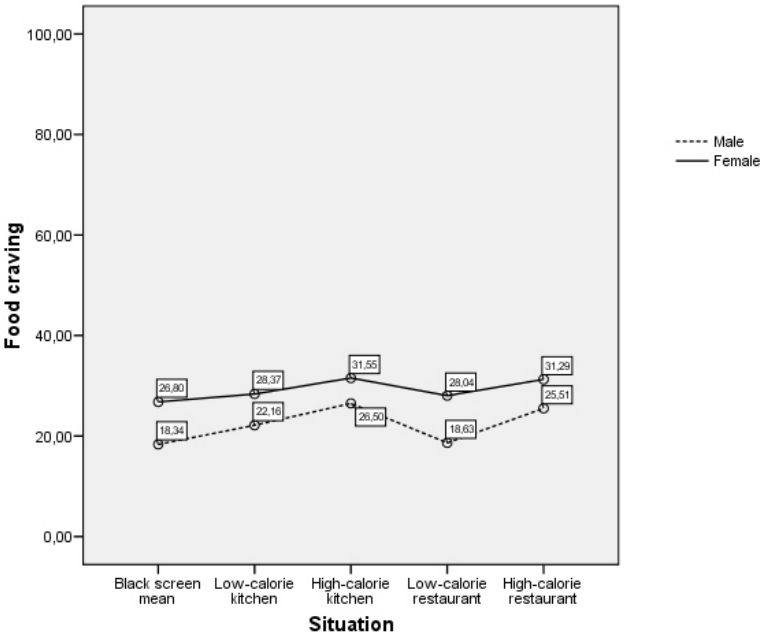

Figure 2. Craving for food experienced for male and females in the different situations

Mixed between-within subject ANOVAs (2x2x2) showed no significant effects of the kind of food or the context on the anxiety experienced by participants, but the interaction between the kind of food and sex was significant (F[1, 81]=5.291; p=.024; η^2=.064). Men showed more anxiety when exposed to low-calorie than to high-calorie food, while women were more anxious when exposed to high-calorie food. The kind of food was the only variable to show a significant effect on food craving (F[1, 81]=10.299; p=.002; η^2=.115): high-calorie food produced higher food craving than low-calorie food.

3. Conclusions

VR cue exposure proved to be an effective procedure for eliciting craving for food in a non-clinical sample. Exposure to high-calorie food produced the highest levels of food craving both in males and females. On the other hand, no significant changes in reported anxiety were found. Anxiety and craving for food are considered to be antecedents of binge eating behavior. However, since participants in this study were from a non-clinical sample, no cue-elicited anxiety was produced. Results suggest that

VR could be a useful technology for cue-exposure therapy in the treatment of binge eating. Future research should assess the capability of VR environments to elicit food craving and anxiety responses in patients with ED and obesity. The sex differences found here should also be explored further.

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Assessment of Frontal Brain Functions In Alcoholics Following A Health Mobile Cognitive Stimulation Approach

Pedro GAMITO[a,b,1], Jorge OLIVEIRA[a,b], Paulo LOPES[a,b], Diogo MORAIS[a,b], Rodrigo BRITO[a,b], Tomaz SARAIVA[a], Marta BASTOS[c], Sara CRISTÓVÃO[c], Cristiana CAÇÔETE[c], Felipe PICARELI[a]

[a]*School of Psychology and Life Sciences, Lusophone University of Humanities and Technologies (ULHT), Campo Grande, 376, Lisbon, Portugal*
[b]*CEPCA - Centre for Research in Cognitive and Learning Psychology (ULHT)*
[c]*Instituto São João de Deus*

Abstract. The consequences of alcohol dependence syndrome are severe, ranging from physical diseases to neuropsychological deficits in several cognitive domains. Alcohol abuse has also been related to brain dysfunction specifically in the prefrontal cortex. We assessed these deficits and the effects of traditional (pen-and-paper) and novel (mobile technology) approaches to cognitive stimulation of alcoholics in a neuropsychological intervention program. Thirty alcoholics in treatment of alcohol dependence syndrome were assessed during four weeks on a three-day/week basis. The results showed an overall increase in frontal lobe function between the first and the final assessment, being more pronounced in alcoholics who were assigned to a treatment group with mobile technologies than to those assigned to a paper-and-pencil treatment and to a control group. These results support the use of ecologically sound and available approaches of neuropsychological stimulation to treat executive dysfunction in patients with alcohol dependence syndrome.

Keywords. Mobile Technology, Cognitive Stimulation, Frontal Brain Functions, Alcoholics, Rehabilitation

Introduction

The consequences of alcohol dependence in terms of excessive mortality and morbidity associated to alcohol-related diseases are currently a burden to society [1]. Previous research has revealed a pattern of cognitive deficits that may arise from alcohol dependence syndrome (ADS). Neurobiological studies suggest that ADS is associated with brain dysfunction, probably due to alterations in gene expression, neural connectivity and neurotoxicity [2], specifically in the prefrontal regions [3]. These changes in neuroanatomy and neurochemistry impose a certain pattern of cognitive impairment in alcoholics. Evidence from neuroimaging and neuropsychological studies suggests a decrease in specific cognitive abilities [4, 5, 6], particularly those associated

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[1] Corresponding Author: pedro.gamito@ulusofona.pt.

with the frontal lobes (i.e., executive control, impulsivity and attention). Patients with ADS are characterized by a profile of mild to moderate neuropsychological deficits, particularly in executive functioning and visuospatial abilities [7].

Although these studies highlight the neuropsychological consequences of alcohol dependence, the literature is unclear about the effectiveness of neuropsychological rehabilitation in alcohol patients. Some studies, however, reveal specific functional improvements on patients during alcohol abstinence [8]. Existing treatments for alcohol dependence are designed mainly to help patients maintain alcohol abstinence, but according to several studies, training and the stimulation of cognitive functions that have been compromised by the effects of alcohol can improve the recovery of substance-addicted patients [9, 10, 11]. Serious games (SG) i.e. games that were designed for other purposes than gaming, also seems to be a sound way to achieve this aim. In fact, several SG have already been designed specifically for and applied to stroke and traumatic brain injury rehabilitation [e.g., 12, 13]. However, for addiction-related cognitive impairments, studies are still scarce.

On the other hand, the increasing development of both hardware and software has enabled SG to be played on mobile devices [14]. The feature of mobility would be an added bonus to therapy. It would allow training outside the rehabilitation facilities and the dissemination of these services throughout the rehab community. The current study assesses the effect of cognitive stimulation with mobile SG applications in patients with ADS.

1. Method

1.1. Participants and design

30 participants (25 males and 5 females) diagnosed with ADS, with a mean age of 45.73 years ($SD = 10.77$) and an average of 7.95 years of formal education ($SD = 2.73$), were randomly distributed between three different groups: (a) traditional paper-and-pencil neuropsychological intervention; (b) health mobile neuropsychological intervention; and (c) waiting list of aged and education-matched ADS patients.

1.2. Measures

The neuropsychological assessment was carried out through the Mini Mental Examination Test - MMSE [15], which has been validated for the Portuguese population [16]. The MMSE is a brief cognitive screening test that offers an overall assessment of cognitive performance throughout 30 items grouped into 6 categories - Orientation, Retention, Attention and Calculation, Language and Visual-spatial abilities. The maximum score is 30 points and the current cutoff values for the Portuguese population were estimated according to age and education, specifically for people aged over forty years: (a) 0-2 years of schooling – 22; (b) 3-6 years of schooling – 24; and (c) more than 7 years of schooling – 27.

Cognitive flexibility was assessed through the *Wisconsin Card Sorting Test* - WCST [17], which evaluates cognitive functions in several executive domains, namely the ability to develop and maintain appropriate problem-solving and planning strategies and the ability to use environmental feedback to modify a cognitive response. In the current study we used the short version of the test (WCST-64).

Processing speed and attentional abilities were also evaluated through the Color Trail Test - CTT [18]. The CTT assesses focused and divided attention, sequencing, mental flexibility, visual search and motor functions based on two different trials. The second trial involves alphanumeric information and is more demanding than the first trial, which involves only numbers. Participants are instructed to link a number of stimuli with a pencil without lifting it. The CTT is a modified, colour version of the original Trail Making Test.

The assessment of frontal brain functioning was carried out with the Frontal Assessment Battery – FAB [19]. The FAB assesses conceptualization, mental flexibility, motor programming, sensitivity to interference, inhibitory control and environmental autonomy. The maximum score is 18 points.

1.3. Procedure

The patients were recruited from an institution specialized in ADS treatment in the Lisbon region, Portugal. Each participant was assessed twice, with an interval of at least 30 days between evaluations. The exercises performed in each of these groups were selected in order to develop cognitive abilities related to executive functioning, which is believed to be impaired in patients with ADS. The hardware used to perform the exercises in the health mobile condition consisted of Samsung Galaxy 10.1" tablets. The intervention was carried out throughout 12 sessions (three sessions per week) of 60 minutes each. The mobile cognitive stimulation program consisted of several mobile applications running on Android OS that were developed according to traditional paper-and-pencil rationales. The applications were developed using Unity 2.5 (Unity Technologies^{TM}).

The neuropsychological evaluation was performed in the first session, where the MMSE, FAB, WCST and the CTT were applied to the participants. The following 10 sessions were used for cognitive stimulation (i.e., traditional paper-and-pencil cognitive stimulation vs. health mobile cognitive stimulation). Each session started with a brief training period, in which participants were able to acquire interaction skills with the touchscreen devices. Participants' responses were registered using the device input from the touchscreen.

Cognitive stimulation in each session comprised attention, working memory and logical reasoning exercises. The level of difficulty of each task increased progressively throughout the cognitive stimulation rationale. In the last session, the same neuropsychological tests used in the first assessment were again applied.

2. Results

A repeated-measures ANOVA was performed with one within-subjects factor (before vs. after intervention) and one between-subjects factor (traditional vs. mobile vs. controls) for MMSE, WCST, CTT and FAB variables. The ANOVA revealed an improvement in cognitive functioning between the two assessments for the MMSE total score ($F(1, 27) = 16.034$; MSE = 1.765; $p < 0.001$); hit percentage in the WCST ($F(1, 27) = 8.578$; MSE = 112.852; $p < 0.01$); and the execution time in the CTT ($F(1, 27) = 7.524$; MSE = 1424.582; $p < 0.05$). In addition, a marginally significant interaction effect was observed for the FAB total score ($F(2, 27) = 2.983$; MSE = 1.794; $p = 0.068$), indicating a better improvement for participants who performed

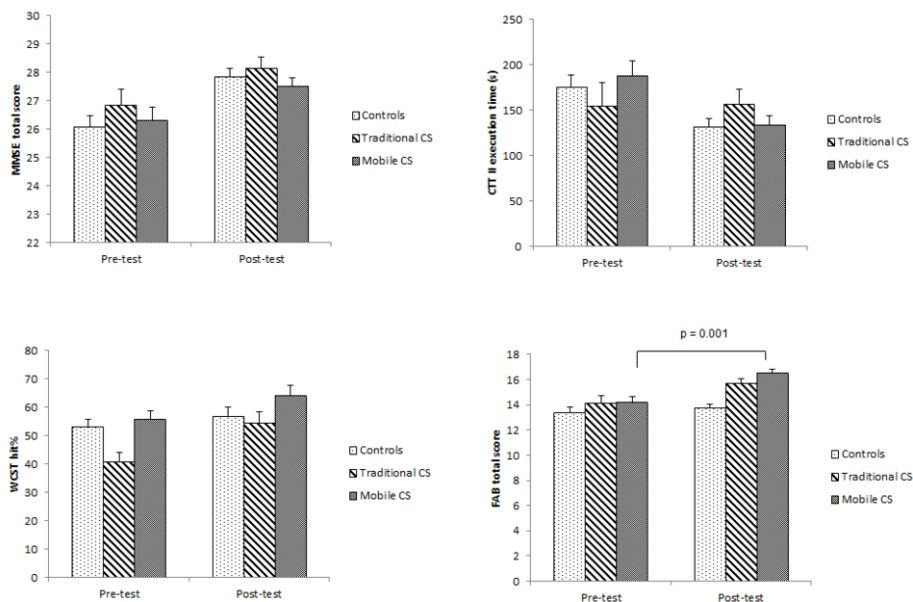cognitive stimulation with mobile technology. Figure 1 depicts the mean scores for each dependent variable.

Figure 1. MMSE; CTT, WCST and FAB pre and post-test results between experimental conditions

3. Discussion

The literature on alcoholism suggests that the pattern of cognitive deficits that result from chronic alcohol use can be reversed during recovery from alcoholism [2]. In light of this, the present study assessed the effect of traditional pen-and-paper vs. mobile rehabilitation procedures vs. control on cognitive improvements in alcoholic inpatients during recovery from alcoholism. We compared three experimental groups (i.e., traditional vs. mobile rehabilitation and WL of ADS patients) to describe specifically the effect of rehabilitation procedures with mobile technology on overall cognitive ability of these patients.

The results of neuropsychological assessment of the participants showed an increase in overall cognitive functions from the pre-test to the post-test evaluation in all groups (including ADS controls), supporting the idea that neural reorganization may occur during recovery from alcoholism [e.g., 8]. In sum, general cognitive function and, more particularly, mental flexibility, attention and visuospatial abilities appeared to recover during alcohol abstinence, in line with previous research. Importantly, however, the improvement in frontal cognitive functioning of alcoholics was significantly higher in participants in the cognitive stimulation program with mobile technology.

Thus, on the one hand, these data indicate a beneficial role of neuropsychological interventions on ADS patients, suggesting that the paths to improve brain function are not limited to substance abstinence, but can be enhanced with neuropsychological interventions. On the other hand, our results also suggest that gradually training

working memory and attention functions in a systematic manner with mobile technology may be particularly important to improve frontal system functions. This may also be crucial to promote the overall adjustment in these patients.

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Heart Rate Response to Fear Conditioning and Virtual Reality in Subthreshold PTSD

Michael J. ROY[a,1] Michelle E. COSTANZO[a], Tanja JOVANOVIC[b], Suzanne LEAMAN[a], Patricia TAYLOR[a], Seth D. NORRHOLM[c], Albert A. RIZZO[d]

[a] *Uniformed Services University of the Health Sciences, Department of Medicine, Bethesda, MD, USA*
[b] *Emory University School of Medicine, Department of Psychiatry & Behavioral Sciences, Atlanta, GA, USA*
[c] *Mental Health Service, Atlanta Veterans' Affairs Medical Center, Decatur, GA, USA*
[d] *University of Southern California, Exploratory Center for the Interdisciplinary Study of Neuroplasticity and Stroke Rehabilitation, Los Angeles, CA, USA*

Abstract. Posttraumatic stress disorder (PTSD) is a significant health concern for U.S. military service members (SMs) returning from Afghanistan and Iraq. Early intervention to prevent chronic disability requires greater understanding of subthreshold PTSD symptoms, which are associated with impaired physical health, mental health, and risk for delayed onset PTSD. We report a comparison of physiologic responses for recently deployed SMs with high and low subthreshold PTSD symptoms, respectively, to a fear conditioning task and novel virtual reality paradigm (Virtual Iraq). The high symptom group demonstrated elevated heart rate (HR) response during fear conditioning. Virtual reality sequences evoked significant HR responses which predicted variance of the PTSD Checklist-Military Version self-report. Our results support the value of physiologic assessment during fear conditioning and combat-related virtual reality exposure as complementary tools in detecting subthreshold PTSD symptoms in Veterans.

Keywords. Subthreshold Posttraumatic stress disorder, Fear Conditioning, Virtual Reality, Heart Rate

Introduction

Deployment to Afghanistan or Iraq is associated with significantly higher rates of posttraumatic stress disorder (PTSD) than is seen in services members (SMs) who have not been deployed [1]. Since there is often a lag time of several months before returning SMs report significant symptoms, this affords an opportunity for an intervention such as cognitive behavioral therapy to reduce symptoms and prevent progression [2, 3], but the sheer number of deployed service members makes it impractical to intervene for all, and this requires reliable early identification of those at highest risk. The presence of subthreshold symptoms provides a surrogate means of risk stratification, since the presence of subthreshold PTSD alone is associated with significant functional impairment [4, 5], as well as elevated risk for progression to full PTSD [6-8]. The aim of this study is to begin to improve upon the power of such

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[1] Corresponding Author. The views expressed are solely those of the authors and do not necessarily represent those of Uniformed Services University, the Department of Defense, or U.S. government.

screens by examining the correlation between physiologic responses to both a fear conditioning task and combated-related virtual reality scenarios taken from Virtual Iraq with the presence of subthreshold symptoms in a recently deployed population.

Classical fear conditioning provides a model for understanding the development of PTSD. A neutral (conditioned) stimulus is paired with an aversive (unconditioned) stimulus to elicit a fear response. The subject is then primed to display a similar physiological reaction to the conditioned stimulus alone as they initially had to the unconditioned event [9]. Patients with PTSD demonstrate hyperresponsitivity to such fear conditioning paradigms, a pattern believed to be mediated by the amygdala, a brain region that is integral to fear processing. The amygdala has a particularly potent influence on heart rate (HR) [10], acting through the sympathetic nervous system hypothalamic-pituitary-adrenal axis [11].We postulate that combat-related stimuli may prove particularly effective in distinguishing those at greatest risk for combat-related PTSD. Virtual reality (VR) has been employed with some success in PTSD treatment [12-16] but physiologic responses to the VR presentation has not been previously reported as a means of PTSD risk stratification. We therefore report the heart rate response observed during fear conditioning and virtual reality exposures in a cohort of SMs within 2 months after their return from Iraq or Afghanistan. For the purposes of this analysis, we divided the SMs into two groups in accord with their PTSD Checklist-Military Version (PCL-M) score: those with high subthreshold PTSD scores (28-49) and those with low scores (below 28). We anticipated that the high symptom group would be characterized by an elevated heart rate response to both forms of physiologic stimulation.

1. Methods

1.1 Participants

The data reported was compiled from 78 SMs (11 women) with a mean age of 29.72 (SD 7.91; range 19-51) who were assessed within two months after return from a deployment to Iraq or Afghanistan. Of an initial cohort of 85 SMs, 4 were excluded because they already met criteria for PTSD (2) or Major Depressive Disorder (2) and 3 were excluded from the analysis due to recording problems with the physiologic data.

1.2 Data Acquisition and Analysis

Data reported was collected during the baseline assessment of a longitudinal study seeking to identify early predictors of PTSD at the National Intrepid Center of Excellence, Walter Reed National Military Medical Center (WRNMMC), Bethesda, Maryland. The study was funded by the Center for Neuroscience and Regenerative Medicine, and the design was approved by institutional review boards at WRNMMC, Uniformed Services University, and the National Institutes of Health.

All participants completed the PCL-M, a validated self-administered screen for PTSD [17]. Physiologic responses were recorded during both fear conditioning and virtual reality tasks. For fear conditioning, participants were presented with a

combination of colored shapes that were paired with a 140 psi airblast to the larynx (danger cue, AX), and a different pattern of colored shapes heralding no ensuing airblast (safety cue, BX). There were 3 blocks with 12 trials (4 AX, 4 BX) in each block [18]. The second psychophysiological assessment featured three 2-minute sequences in a highly realistic Virtual Iraq environment. Two of the sequences represent a perspective from a HUMVEE in a convoy that is confronted with improvised explosive devices (IEDs) and ambushes. The third sequence involves a foot patrol that proceeds through a village marketplace where there are explosions and terrorists firing rocket-propelled grenades (Figure 1).

Figure 1. Sample scene from "Virtual Iraq"

Psychophysiologic data was recorded with Biopac MP150 for Windows (Biopac Systems, Inc., Aero Camino, CA) sampled at 1000 Hz, digitized at 16 bit A/D resolution, and amplified. Using the Biopac Acknowledge software, the ECG signal was band pass filtered at 0.5-35 Hz and converted to heart rate in beats per minute. The data were exported to Microsoft Excel, and HR difference score for each AX and BX condition was calculated by subtracting the mean level for the 2 seconds (s) immediately preceding shape onset from the highest value among those recorded during the 6 s shape presentation interval [19]. During each VR session, mean HR values were computed during the 2 minute viewing period.

Three-way analysis of variance (ANOVA): Group (high symptom, low symptom)*Condition (AX, BX) *Time(early, middle, late) was used to examine group differences during fear conditioning. Post hoc analyses were executed using Tukey's LSD. Linear regression was performed to determine whether the PCL-M scores were predicted by the heart rate response from each period of VR.

2. Results

A significant Group*Condition*Time interaction was evident during the fear conditioning experiment (Figure 2), $F_{(2,52)}=2.998$, $p=0.05$. The high symptom group had significantly greater HR responses in 2 of 3 time periods studied for both the danger (AX) and safety cues. Specifically, those with higher subthreshold symptoms reacted more strongly during the early and late periods in response to the danger cues, and during the mid and late periods in response to safety cues.

Linear regression revealed that HR across all VR sequences accounted for a significant amount of the variance in PCL-M scores $F_{(3,74)}=3.7$, $p=0.016$, $R_2=.139$.
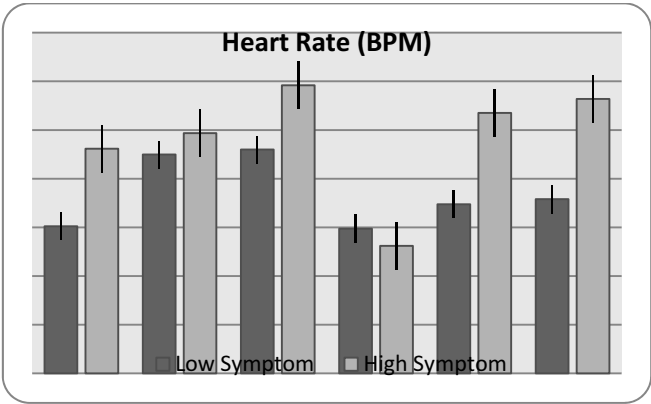
Figure 2. Significant Group*Condition*Time interaction during fear conditioning. Average HR responses during the early, middle and late time phases of fear conditioning are displayed, with standard error margins.

3. Discussion

Early detection of those at highest risk for PTSD may facilitate greater success in treatment intervention. Specifically, those with subthreshold PTSD symptoms represent an important population given the significant functional impairment and associated risk for delayed onset PTSD. Our results provide converging evidence of the utility of physiological measures in detecting symptoms in SMs who have recently returned from deployment.

The fear conditioning task identified significantly higher HR responses to both danger and safety cues for the high symptom group relative to the low symptom group. This is consistent with the belief that the hyperarousal features of PTSD are manifestations of sensitization and overgeneralization of the fear response [20], possibly mediated by hypoactivity in ventromedial prefrontal cortex, a brain region involved in inhibitory control, [21] along with corresponding hyperactivity in the amygdala [10]. Such a neural response may result in resistance to emotion regulation such that emotional attention is maintained at a higher level [22], which could be advantageous in situations such as deployment where threat detection is of importance. However, maintained elevation of such an increased response to emotional stimuli post-deployment could be quite counterproductive, and has in fact been documented in anxiety disorders [22] . Our findings suggest that similar patterns are evident even in those with subthreshold symptoms, consistent with prior reports that such subthreshold are associated with significant functional impairment. Our results further support efforts to intervene in those with subthreshold symptoms, and it is intuitive that such approaches should be conducted as early as possible, since delay will inevitably result in higher rates of full-blown PTSD, which can be expected to be more difficult to treat. Most notably, low intensity treatment may be effective in those with subthreshold PTSD, even though it does not necessarily successfully treat fully developed PTSD [23].

Virtual reality has proven to be a valuable option for treating behavioral disorders, including PTSD [12-16]. Our results significantly expand the scope of potential applications of VR by demonstrating that measurement of a single physiologic response explains approximately 14% of the variance in PCL-M self-report. This novel

technology warrants further study in this regard to better define and validate its potential as a method for risk stratification in PTSD and other anxiety disorders.

Identification of PTSD symptoms upon return from deployment could facilitate early intervention to prevent disability. We believe that an approach that combines multiple physiologic tasks and measures is likely to prove particularly adept in the risk stratification of SMs and other populations. This can in turn engender early psychoeducation and other cognitive behavioral efforts to markedly reduce PTSD symptoms, progression to full-blown disorders, and associated functional impairment.

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What Do Audiences Do When They Sit and Listen?

Ana-Despina TUDOR[1], Sandra POESCHL and Nicola DOERING
Ilmenau University of Technology

Abstract. Speech anxiety (SA) training may help subjects improve their skills on keeping audiences interested in the speech and on managing calm or restless audiences. Attention and lack of attention during speeches are displayed through several nonverbal cues. Such and other nonverbal behaviors can also spread throughout a group and engage whole audiences. The current study is an inquiry into the nonverbal markers of attention and lack of attention during lectures (e.g. note taking, eye gaze towards the speaker, conduct with electronic devices such as mobile phones or laptops). Additionally, the study tries to identify nonverbal behaviors that are diffused and their spatial and time diffusion characteristics. 37 university students at the Ilmenau University of Technology have been observed during a 40-minutes lecture. A quantitative content analysis is conducted to identify patterns of behaviors depicting attention and inattention. Afterwards a qualitative content analysis is carried out to identify contagious behaviors and their spreading characteristics. The findings are used to design virtual audiences (VA) whose members react to each other or display observable audience responses (OAR) and will be implemented into training scenarios for training university students against SA.

Keywords. Attention, inattention, nonverbal behaviors, design, virtual audiences

Introduction

The skill of giving a speech to an audience, either for academic or business purposes requires dedicated training and practice and university programs have long been including public speaking training in the curriculum [1]. Dealing with speech anxiety has been proved to be successful also in virtual reality (VR), with several applications addressing the issue and helping lower anxiety levels of phobic subjects [2]. Such applications simulate real life situations where speakers face various types of audiences (e.g. positive or negative) in various contexts (e.g. job interviews, presentations, etc.) [3]. The main component of the simulation is the virtual audience which performs the responses a real audience is likely to give in that certain context. Based on the importance this component has for the success of speech anxiety treatment, it is sensible to concentrate on the virtual audience separately and look at several improvement possibilities.

One lead for improving virtual audiences is to diversify the catalogue of behaviors listeners display by analyzing audience behaviors in a natural setting. The current research proposes the implementation of several behaviors that students display during a lecture, either separately (attention and inattention) or in groups (OAR). Despite the

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[1] Corresponding Author E-mail: ana-despina.tudor@tu-ilmenau.de

specificity of the researched group, it is believed that these behaviors are general enough to be applicable to a wide variety of audience types and training contexts.

1. Attention, Inattention and Observable Audience Response

One of the first studies that has dealt with speech anxiety in immersive and nonimmersive VR also introduced the concept of interest manifested by the audience towards the speaker [4]. Virtual humans were designed to display positive and negative nonverbal behaviors that could also be identified as markers of interest and inattention, such as dozing off, leaving the room, or chatting with a neighbor.

In the field of education, student interest or attention has been a heavily researched concept in relation to learning performance and has been usually measured with retention questionnaires [5]. Also, it has been regarded mainly from the perspective of the audience member. From the perspective of the speaker, the perceived attention of the students has been measured through rating scales [6] in an endeavor to understand how attention varies within normal limits. Other ways to identify attention used audience observations [5]. Although it's necessary to connect actual *felt* attention with observed attention, there are several nonverbal cues that have been used to mark the presence of generic listener responses and convey attentiveness, such as gaze towards a speaker, smiles, and nods [6]. In the context of academia, another cue used to identify attention was note taking [5].

In opposition to the attention towards a speaker are those behaviors that convey boredom, such as texting, doodling, talking to the person nearby, or daydreaming [8]. Talking to a person nearby can also constitute a distraction or an outside event for the recipient who performs a shift of attention from the speaker towards the distracting event. Whereas attention towards a professor can be considered top-down and voluntary, the focus on an occurring outside event is bottom-up and involuntary [9].

Apart from displaying attention or inattention towards a performer, individuals in an audience exhibit nonverbal reactions towards fellow audience members as well. Coined as intra-audience effects or observable audience response [10], these behaviors can include actions such as clapping, leaving the room, ignoring the performer, etc. Moreover, once they occur, they are copied by others and become contagious [11]. It is expected to discover such nonverbal markers of intra-audience effects also in the specific case of the observed student audience in the current study. Since both the literature on education [5] and SA training [12] emphasize the role of the performer in managing the attention levels of audiences, virtual audiences can be improved by training the attention-triggering and OAR management skills of subjects.

2. Methodology

A non-participant observation was conducted. 37 students at Ilmenau University of Technology were filmed during a 40-minutes lecture. Results are provided for 33 of them in a 20 minutes time span – eight minutes at the beginning and end of the lecture and four in the middle. A codebook was developed and included 79 codes that detailed the broad categories of eye gaze behaviors, facial expressions (smiles and laughter), body postures and movements, etiquette (a list was created based on [13]), technical devices, role of audience member, and conversation. To deal with the enormous number of generated

data, a data mining script was developed in Matlab. Further on, a qualitative analysis revealed behaviors that can be ascribed to OAR as well as their spreading characteristics.

3. Results

The findings of the study are meant to be applicable to the design of virtual audiences used in public speaking training and speech anxiety treatment VR applications. The used codebook allowed for the detailed description of the occurring behaviors, such as eye gaze direction, body posture and hand movements, direction of conversation (e.g. talking to a neighbor to the right/left/front/back), moving objects around, fidgeting, etc. However, the simple identification of such behaviors serves only partially the purpose of VA design. Body movements occurring in real life may manifest simultaneously, are fluid and continuous – preceded and followed by other movements. In order to be able to capture these characteristics, the analysis had to consider two distinct types of occurrences on a timeline: (a) horizontal or parallel – behaviors that co-occur and (b) sequential – behaviors that precede one another. Both these types of occurrences were called patterns.

3.1. Parallel behaviors

In this category various codes that occur simultaneously on a timeline (in minutes and seconds) across different categories were identified. Due to the nature of the codes (some were mutually exclusive) only four different behaviors per pattern were detected.

The patterns were grouped based on the researched elements – attention and inattention, and their pivoting points were the gaze behaviors and note taking. All patterns that included eye gazing towards the front and taking notes were counted as attentive behaviors, independent of the facial expressions, body postures, hand movements, and object manipulations. Table 1 reveals two aspects: (a) the number of identified patterns of attention is rather small in comparison to the frequency of their total occurrence and (b) the number of identified patterns of inattention is rather big in comparison to the frequency of their total occurrence.

A potential explanation for the first point is that only two distinct behaviors were selected from literature as mostly representative for attention (eye gaze and note taking). This low variety may prove advantageous for virtual human design, by proposing a minimum behavior design necessary to depict naturally occurring behaviors during a lecture (gazing towards the speaker and taking notes). Examples of attention patterns were: neutral facial expression, gaze towards front, arms on the desk/grooming oneself; neutral facial expression, gaze towards the desk, taking notes.

Table 1. Types and frequencies of occurring behaviors patterns marking attention and inattention

	Attention	**Inattention**	**Total**
Parallel patterns	14 patterns	47 patterns	61 patterns
	527 (frequency)	252 (frequency)	779 (frequency)
Sequential patterns	10 patterns	4 patterns	14 patterns
	1050 (frequency)	196 (frequency)	1246 (frequency)

Inattentive behaviors occurred in 47 different ways, combining behaviors that involve changes of posture and gaze, and object manipulation. Examples of inattention patterns were: gazing to left/right, talking to the left/right neighbor; gazing towards

left/right, playing with objects on the desk. In comparison to the attentive behaviors, inattentive gaze behavior co-occurred with conversation situations and movements of fellow neighbors (coded as distraction factors) and therefore proved to be heavily marked by interaction. In the qualitative content analysis part, a closer look at the interaction aspect revealed that head turns towards a neighbor or object manipulations trigger a response also in the shape of a head turn or gaze orientation towards the source of movement and away from the speaker. This finding confirmed the existence of involuntary shift of attention in the observed lecture, as described in literature.

3.2. Sequential behaviors

The purpose of the sequential (vertical) search for patterns was to see whether certain behaviors occur in an orderly fashion on a timeline. The argument behind this reasoning is that shifts from one behavior to another should be made smoothly for virtual humans, in order to maintain naturalness. The search was done based on sequential strings of eye behaviors.

The findings show that patterns that contain eye gaze towards the front are most numerous (1050 occurrences in 20 minutes). This means that even if a person is looking to the right or to the left, their gaze will always linger in the frontal position (i.e. look at the speaker). A clear marker of attention was revealed via the pattern of looking towards the speaker and then looking down in order to take notes, and then up again to the speaker. Patterns of inattention contained gazing towards neighbors alternating with gaze towards a mobile phone or laptop on the desk.

3.3. Observable audience response

Due to the format of the observed situation, it was not expected to see intense OAR behaviors such as leaving the room or showing excitement en masse. However, at a more discrete level, both behavior mimicry and spreading occurred. A qualitative content analysis revealed that when a student initiated a conversation, fellow neighbors on both sides became distracted from the speaker and joined in. A conversation triggered people on as far as two seats away to lean towards the conversation partners and listen to the discussion, even if not actively participating. Such events were observed only within groups of minimum three occupied seats and didn't spread across empty ones. They did spread though between rows, both from front to back and back to front. Another particularity of contagious behaviors is that they didn't engage people sitting solitarily or in dyads (one or two people surrounded by empty seats).

4. Discussion

The analysis of a student audience proved to retrieve valuable data on what types of nonverbal behaviors co-occur while students sit in a lecture and that attention and inattention can be displayed with the help of several behavior combinations (patterns). These results should help vary behaviors in the design of virtual audiences for public speaking training and speech anxiety treatment. Apart from this, findings also revealed that certain persons within a group act as behavior initiators whereas others around them act as followers. In the design of a VA this could prove helpful by selectively

assigning behaviors to virtual humans based on predefined roles – as initiators or as followers of distractions and OAR.

The findings also showed what behaviors occur sequentially, such as eye gazing towards the front followed by eye gazing towards the desk in order to take notes, and back again to the speaker. This element could be implemented for virtual humans, by designing strings of sequential attentive or inattentive behaviors.

The exclusive reliance on the visual observation is one limitation of the study, since no professional sound recording was performed during the lecture and only the visual disturbing factors were coded. Additionally, the study focused exclusively on observed attention markers and didn't control for actually *felt* attention. Also, the existing relations among students seated next to each other were not inquired in order to account for the intense conversations during the lecture. Future research could approach this aspect and look at potential relations between nonverbal attention and inattention markers and degrees of emotional closeness between students.

Lastly, further research will focus on the intensity of displayed behaviors and will look at whether the variation in intensity across different cues leads to changes in *perception* of attention or inattention displayed by audience members.

Acknowledgements

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The Effect of Military Motion-Assisted Memory Desensitization and Reprocessing Treatment On The Symptoms Of Combat-Related Post Traumatic Stress Disorder: First Preliminary Results

Eric VERMETTEN[a,b,1] , Lydia MEIJER[a,c] , Peter van der WURFF[b] and Agali MERT[b]

[a] *Military Mental Health – Research, Department of Defense, The Netherlands*
[b] *University Medical Center Utrecht, The Netherlands*
[c] *Military Rehabilitation Center Aardenburg, Department of Defense, The Netherlands*

Abstract. Although the symptoms of Post-Traumatic Stress Disorder (PTSD) in the general and military population seem very similar, combat-related PTSD (cr-PTSD) is typically thought to be more severe due to the repeated and prolonged exposure of traumatic events. Therapeutic adherence is reported a problem in military populations compromising treatment efficacy. Therefore, a new potential supplementary treatment is specially designed for patients with cr-PTSD. This intervention is called Military Motion Memory Desensitization and Reprocessing (3MDR). The treatment incorporates key elements of successful treatments as Virtual Reality Exposure (VRE) and Eye Movement Desensitization Reprocessing (EMDR) and adds motion to the condition. We aimed at designing a treatment procedure that preserved dual task processing principle, yet introduced new engagement by performing the desensitization during motion by to walking on a treadmill. Moreover, we aimed at exposure to real high-affect pictures of deployment setting. Subjects walk a repetitive cycle while walking and viewing high affect pictures of deployment scenes. Dual task processing was maintained by an oscillating ball. Aspects of presence are adhered to, to maximize possible positive outcome. METHOD: Two veterans with chronic PTSD, received four weekly sessions of 3MDR therapy. The indicator of effectiveness was difference in CAPS (Clinical Administrated PTSD Scale)-score. The treatment was designed on the Computer Assisted Rehabilitation Environment (CAREN) facility. RESULTS: The 3MDR treatment did further decrease PTSD symptoms. Patients were highly satisfied about the treatment and had no attention to drop out. CONCLUSION: The results of the two cases suggest that the 3MDR treatment is a successful, more additional treatment that goes further into the patients affect where other treatment may stagnate. The presence was highly appreciated. Further research with more patients needs to be performed to obtain more reliable results.

Keywords. EMDR, PTSD, Virtual Reality, Military, 3MDR, CAREN

Introduction

Several exposure-based therapies for treatment of PTSD have proven to be successful. The most common therapies are trauma focused cognitive behavioral therapy (tfCBT) and Eye Movement Desensitisation and Reprocessing (EMDR). Not all patients benefit

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[1] Corresponding Author.

maximally from these treatments, because of non-compliance, drop out, or suboptimal recruitment of 'presence', which we feel is necessary for the therapeutic effect of exposure based treatments. This particularly applies to servicemen with combat related PTSD. PTSD in military personnel is characterized by frequent co-occurrence of other psychiatric problems and physical complaints. Typically military personnel presents with complex PTSD, in part due to a delayed presentation. This requests for additional assessments as well as interventions that are beyond the scope of conventional civilian PTSD.

Exposure can be offered with imagery, graded, prolonged and virtual reality procedures. Typically 6-8 sessions should be sufficient to achieve symptom improvement. EMDR is a form of imaginal exposure accompanied by typical saccadic eye movements. It is conducted by having the patient focus on a disturbing image with high affect or memory while the therapist moves a finger across the patient's visual field. The high affect picture will activate the memory network. Following the finger serves as distractor task that enables desensitization of the disturbing memory. The saccadic eye movements result from the patient's tracking the therapist's finger. It is general thought that EMDR is based on the principle of dual task processing: involvement in a high-affect task (viewing emotional pictures) while performing a distraction task (watching a finger/ball moves in oscillating way, either on a display, in case of a finger from left to right in front of the patients eyes). Since its inception, EMDR has been the focus of much controversy, but the last decade it has resulted in a breakthrough in treatment of PTSD. In some studies prolonged exposure and EMDR did not differ significantly for change from baseline to either posttreatment or follow-up measurement for any quantitative scale. EMDR is typically performed in a sedentary position, as most psychotherapeutic treatments are.

While CBT and EMDR are the most effective treatments currently available for PTSD, and phase orientation is recognized as important factor in therapy, there is still a need to find interventions that are more efficient. Moreover, in our clinical setting we experience relative low therapeutic adherence by young adults. EMDR and other psychotherapeutic interventions are performed in sedentary manner. We designed and employed a EMDR based therapy in a virtual reality environment in which the patient participated by walking on a treadmill, and that was enriched with elements of presence [1].

1. Method

For this study, veterans with combat related PTSD who are therapeutic resistant for more than six months or prone to drop out, will be asked for participation. They were recruited from out the patient clinic of at the Military Mental Health Center. The patients were informed about the psychiatrist's opinion of being treatment resistant or prone to drop out. We included veterans, who had been previously treated for a minimum of six months and show no further progress in decreasing symptoms and patients as well as patients who show a firm tendency to drop out of current therapy.

Treatment was provided in the high-end extended version of the Computer Assisted Rehabilitation Environment, developed by Motek Medical, Amsterdam. This is a setting that is built for real time virtual enhanced training of leg-amputated patients on a treadmill. The CAREN platform used in this study is situated at the Military Rehabilitation Centre Aardenburg in Doorn, the Netherlands. CAREN is a room with a 180 degrees cylindrical screen, in which a platform is situated. This platform contains a

treadmill and is placed on a 6 DoF motion base, resembling that of a flight simulator. The average distance from eye to screen is 2.5 m.

We increased a feeling of personal presence, by enhancing a social richness through the use of personal pictures and use of self-chosen music. Moreover, the method was performed in a walking mode, in tune with the presentation pictures. The expectation was that this approach would enhance compliance in ingoing therapy, and in itself contribute to decrease PTSD symptom severity.

Each patient received a total of six appointments of which four weekly sessions of 3MDR therapy, an intake and a final evaluation appointment. The intake session consisted of an explanation of the treatment and the subject could familiarize with the CAREN device. This was performed with neutral photographs and neutral music. After this familiarization for baseline conditions the questionnaires CAPS, PSS-SR, and ACS are assessed and the informed consent was signed.

The subject brought pictures with high affect from his deployment and these were sorted on affective arousal (SUD-score). At the beginning of the session, the patients familiarized themselves with walking on the treadmill, by walking while music that contained reminders of the deployment was played. Subsequently, a repetitive cycle was started using self-chosen pictures, starting with low SUD scored pictures. We hypothesized that the emotionality of the stimulus would decrease with each cycle. The emotionality was measured with the SUD (Subjective Units of Distress scale) score. The cycle continued until the emotionality of the stimulus is reduced and the SUD score dropped significantly. The therapist was in constant communication with the patient throughout the procedure. Each session lasted 45 minutes.

2. Results

The results from the evaluation form were positive. Both participants scored the overall treatment with 8 out of 10 points, they had no attention to drop-out and felt willingness to go to the treatment. The participants spontaneously reported a feeling of time distortion after 45 minutes into the session, and are able to retrieve new associative memories and affect that they did not feel during the virtual exposure with EMDR. In both patients PTSD symptoms dropped. In one also the attention control, a measure of hypervigilance dropped.

3. Conclusion

In conclusion, the preliminary results of two cases suggest that the 3MDR treatment is a successful, perhaps additional treatment for chronic combat related PTSD. Its effect may lie in presence as well as additional therapeutic factors. This needs to be further explored.

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SECTION VI

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 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

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Evaluating Virtual Reality Mood Induction Procedures with Portable EEG Devices

Alejandro RODRÍGUEZ[a,1] Beatriz REY[a,b] and Mariano ALCAÑIZ[a,b]

[a] *Instituto Interuniversitario de Investigación en Bioingeniería y Tecnología Orientada al Ser Humano, Universitat Politècnica de València, I3BH/LabHuman, Camino de Vera s/n, 46022 Valencia, España Instituto Interuniversitario.*
[b] *Ciber, Fisiopatología de Obesidad y Nutrición, CB06/03 Instituto de Salud Carlos III, Spain.*

Abstract. Virtual Environments (VEs) have been used as mood induction procedures. In this context, it is necessary to have instruments to analyze the emotional state during VE exposure. Objective techniques such as EEG should be evaluated for this purpose. The aim in this work was to study the changes in the brain activity with a portable EEG device during a negative mood induction based on a VE. A virtual park was used to induce a negative mood (sadness) in ten participants. Changes in the brain activity of subjects were compared between two moments (before and after emotional induction). Obtained results were in accordance with previous scientific literature regarding frontal EEG asymmetry, which supports the possibility of using the portable EEG as a reliable instrument to measure emotions in VE.

Keywords. EEG, Emotiv Epoc, Negative Mood Induction, Virtual Environment

Introduction

Virtual Environments (VEs) have been used as mood induction procedures (MIPs) in previous emotional studies. The efficacy of Virtual Reality (VR) as a MIP (VR-MIP) has been tested [1], where the results showed that VR was an excellent MIP because subjects felt more presence than in traditional MIPs during the mood induction experience.

As VEs can be used for mood induction, it is necessary to have tools that allow us to evaluate and assess mood changes of subjects during the VR experience. Currently, assessment instruments are based on subjective questionnaires that ask the subjects about the moods they felt. These questionnaires, although they have proved to be very useful, present some limitations. For example, if the questionnaires are used in combination with a VE, they may only be used before and after the experience, but can never be used during the virtual exposure without interrupting it.

Therefore, it is fundamental to have instruments to analyze emotional states while moods are being induced in subjects through VE [2]. Brain activity measures based on electroencephalogram (EEG) can be a good instrument. EEG allows us to measure the

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[1] Corresponding Author.

fluctuations in brain electrical activity associated with emotions in a non-invasive way; with a temporal resolution of milliseconds

EEG is a technique that would be easily combinable with VR-MIPs since it would not impose restrictions with the virtual stimuli that could be presented in a study. Moreover, new portable EEGs devices that are appearing on the market can be easily combined with VEs. The features of EEG measures allow us to overcome questionnaire limitations, thus complementing the information obtained by means of these instruments.

In our present work, a VE was used to induce negative emotions (sadness) in participants while a portable EEG monitored their brain activities. The main goal was to analyze if a portable EEG device was appropriate to evaluate the frontal asymmetry of the EEG [3] in the context of VE studies.

1. Materials and Methods

Ten healthy participants, 5 men and 5 women, were evaluated in this study, all of them right-handed, within the age of 23-27 years old, and with normal or corrected-to-normal vision. The subjects were university students without any psychological disorder; none of which were experts in the use of the technologies used in this study. The participants signed an informed consent allowing their data to be used in this study.

The EEG signal was monitored by means of an EEG portable device, Emotiv EPOC [4], which had 14 EEG channels using the standard 10/20 layout and 2 reference channels (CMS/DRL), Fig.1.

Figure 1. Emotiv EPOC device and Emotiv EPOC electrodes positioning on standard 10/20 layout.

EEG recordings were analyzed off-line using custom software written in MATLAB. This custom software was based on EEGLAB [5] tools, which was applied to clean the EEG-data and analyze changes in alpha-spectral power.

In the experimental session, the participants had to navigate through a VE designed to induce them into a negative mood (sadness) [2]. This VE consisted of a virtual park, already tested in previous studies, and can be used as an effective mood-induction procedure [1]. This virtual park was shown in a retro-projected screen and participants were able to navigate using a wireless pad (Logitech Rumblepad). Some pictures of the VE and the configuration of the experimental session are shown in Fig. 2.

The protocol of this study can be consulted in [2]. Participants spent approximately one hour in the laboratory and a PANAS questionnaire was completed by each; before

and after the virtual experiment. An analysis of these questionnaires allowed us to divide the subjects into two groups; subjects in whom the mood was successfully induced (sad group) and subjects who were not sad after the exposure (non-sad group).

Figure 2. Subject navigating in the VE and capture of the VE used to induce sadness

The navigation period was preceded and followed by rest periods during which participants had to watch a black screen during two minutes and thirty seconds. Between the two rest periods, the virtual mood-induction procedure started, using the same protocol as previously described [1-2]. Finally, the participants were invited to visualize a film to induce them into a positive mood before finishing the experiment.

Natural log Alpha power and asymmetric coefficient value for F3 and F4 were calculated. The asymmetric coefficient values were calculated through natural log of the ratio F4/F3 [3]. F3 and F4 were used because they are the sensors more often used in scientific literature to analyze the valence of the mood experienced by participants.

A three way ANOVA with repeated measures in two of the factors was applied for Natural log Alpha values. The factors were the moment (initial rest and final rest), the hemisphere (left/right) and the group (sad/non-sad). A two way ANOVA with repeated measure in one of the factors was applied for the asymmetric coefficient values. The factors were the moment (initial rest and final rest) and the group (sad/non-sad).

2. Results

In this section, we present the results of our current study. The PANAS questionnaire showed that a sad mood was induced in six participants (sad group) while in four subjects it was not possible to induce a sad emotion with this VE (non-sad group).

Results showed significant differences between right and left hemispheres ($F(1,8)=12.058$; $p=0.008$), a trend close to significance for the interaction factor between hemisphere, moment and group ($F(1,8)=5.267$; $p=0.051$) in the natural log alpha power.

Pair-wise comparisons only showed significant differences between hemispheres in the sad group after the virtual induction ($p=0.014$).

The mean value and standard deviation of each sensor for different moments and groups can be observed in Table 1.

Table 1. Mean and standard deviation of F3 and F4 sensors.

Group	F3 sensor				F4 sensor			
	before		after		before		after	
	Mean	Std	Mean	Std	Mean	Std	Mean	Std
Sad	3.368	1.244	1.700	1.116	2.045	1.006	3.765	1.372
Non-Sad	1.723	1.257	1.968	0.901	1.646	0.901	2.417	1.127

On the other hand, the asymmetric coefficient showed a trend for the interaction factor between moment and group ($F(1,8)=5.267$; $p=0.051$). Pair-wise comparisons showed significant differences between the moments before and after the virtual induction ($p=0.014$) for the sad group (Table 2).

Table 2. Mean and standard deviation asymmetric coefficient EEG Frontal.

Group	Asymmetric Coef.			
	before		after	
	Mean	Std	Mean	Std
Sad	2.065	1.273	1.137	7.532
Non-Sad	4.485	8.218	5.945	1.078

Figure 3 shows six topographic scalp maps, which give a visual representation about the distribution of averages natural log alpha values around scalp in before induction, after induction and the difference between them.
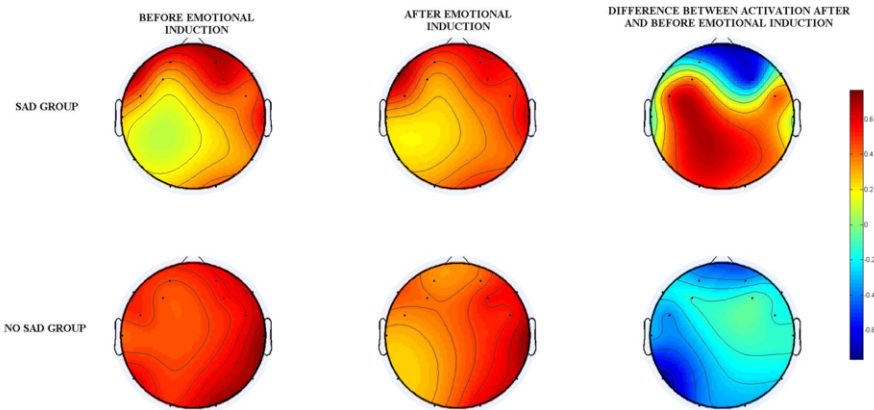
Figure 3. Topographic scalp map of average of natural log alpha values

3. Discussion and Conclusion

The goal of this study was to determine if portable EEG devices would be able to evaluate asymmetric EEG frontal theories in an emotional virtual study.

Statistical results showed greater activation, decrease of alpha power [6], in the right hemisphere after virtual mood induction for the sad group. Furthermore, the asymmetry analysis showed significant differences between the moments before and

after the virtual induction for the sad group. Finally, these results were corroborated with a visual analysis in figure 3, which shows that the activity in the right hemisphere is greater than in the left hemisphere for the group in which the sad emotion was induced to the subjects.

These results showed evidence of the asymmetry in the frontal EEG of the participants after a sad induction, which is coherent with previous results in scientific literature which indicates that the right hemisphere is activated when a subject has been induced a negative mood [3, 6].

This study demonstrates that portable EEG devices can be used as a complementary tool in emotional induction studies with virtual reality, because their flexibility and reliability allow obtaining results about the brain activation of the participants caused by the mood induction with VR-MIPs in a more objective way.

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Measuring Presence During the Navigation In a Virtual Environment Using EEG

Miriam CLEMENTE[a,1], Alejandro RODRÍGUEZ[a], Beatriz REY[a,b] and Mariano ALCAÑIZ [a,b]

[a] *Universidad Politécnica de Valencia, I3BH/LabHuman, Valencia, Spain*
[b] *Ciber, Fisiopatología Obesidad y Nutrición, CB06/03 Instituto de Salud Carlos III, Spain*

Abstract. In the Virtual Reality field, presence refers to the sense of "being there" in the virtual world. Our aim in this work is to evaluate the usefulness of the Emotiv EPOC EEG device to measure the brain activations due to the sense of presence during the navigation in a Virtual Environment (VE), using for the analysis the sLORETA tool. We compare between two experimental conditions: free and automatic navigation through a VE. In this preliminary step, we monitored 9 healthy subjects, obtaining significant differences between the free and automatic navigation conditions in the activity of the right insula for the Theta and Alpha bands. The insula activation is related to stimulus attention and self-awareness processes, directly related with the sense of presence.

Keywords. Presence, Virtual Reality, EEG, sLORETA

Introduction

In the Virtual Reality (VR) field, presence refers to the feeling of being there, inside the VE, while your body is physically located elsewhere [1]. As Kober et al. [2] remarked, the greater the degree of presence the participants feel, the greater the chance they will behave in the VE as they would do in a similar real world setting. One technique that has been proposed and applied for presence measurement is the electroencephalography (EEG), due to the freedom of movement the subject has once the electrodes are placed, especially in comparison with techniques that impose severe restrictions to movements such as fMRI. EEG measures the electric activity in the brain; more specifically, it measures the synaptic potentials in the cerebral cortex. EEG signals show the difference in potential between two electrodes, an active one and a reference one. The time resolution of the technique is of the order of milliseconds, allowing the measure of the fluctuations in the EEG signal due to the tasks developed.

Until now, several studies have been made combining VR with EEG to measure the sense of presence experienced by the subjects. For example, Baumgartner et al. [3] evaluated the cerebral activity related to the sense of presence using a multichannel EEG, applying the low-resolution brain electromagnetic tomography (LORETA) method to study the cortical structures that produce the neurophysiologic activation.

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[1] Corresponding Author.

They compared activations between children and adolescents while viewing a video of a rolling coaster, and found activation in the parietal areas of the brain.

More recently, other studies were developed in interactive environments where the navigation through the virtual environments was allowed, in order to increase the sense of "being there". Kober et al. [2] analyzed spatial presence in an interactive virtual world, comparing two systems for the presentation of the virtual stimuli: one based on a high-immersive VR wall (3D) and another based on a low-immersive 2D desktop screen. The 3D screen system showed a greater presence sense associated with an increase in the Alpha band for the parietal TRPD ("Task-related power decrease"), related to the parietal activations. The lower presence experience in the 2D screen was accompanied by a strong functional connectivity between the frontal and parietal areas of the brain, pointing out that the communication between those areas is crucial for the experience of presence.

In another study, Kober and Neuper [4] studied the Event-Related brain Potentials (ERP) of the EEG signal, which were elicited by tones that were not related with the VR experience and were used in the experimental design to obtain an objective indicator of the experience of presence in the virtual environment. They found a correlation between the increase in the presence experience and the decrease in the late negative slow wave amplitudes, related to the central stimulus processing and the allocation of the attentional resources. According to this conclusion, an increase in presence is related to a greater pay of attention to the virtual environment, which leads to a decrease in the attention paid to the irrelevant stimulus of the VR (decrease in the ERP components due to the tones).

In these previous studies, the influence of user-controlled navigation on the presence experience and on the associated brain activations was not directly evaluated. In order to evaluate this issue, for our present study, the goal will be to compare brain activity due to presence between two experimental conditions: the view of a video of an automatic navigation and a free navigation through the VE. We expect that the sense of presence will be greater in the navigation condition than in the video condition, and that there will be differences in brain activation in areas related to presence, which will be generated by the changes in the presence experience between conditions. Moreover, for this study we will use a wireless portable EEG device, which will allow a quicker placement of the sensors and a higher degree of movement in the subject.

1. Material and Methods

1.1. Subjects

For a preliminary study, 10 healthy subjects (6 men, 4 women) were evaluated, all of them right-handed and with ages between 22-29 years old. All of them provided signed consent for allowing their data being used in this study. One subject (a woman) had to be excluded due to movement during the scan. The experiments were conducted in a laboratory inside the LabHuman institute. The EEG signal was monitored by means of a multichannel wireless portable EEG device (Emotiv EPOC) [5], which has 14 data-collecting electrodes and 2 reference ones. The handset transmits wirelessly the EEG data to the computer. For showing the VR environments, a desktop screen was used.

1.2. Presence Questionnaire

After the EEG session, subjects had to answer the questions of a SUS questionnaire [6] to evaluate the level of presence that they felt during each task (one questionnaire for each experimental condition). The questionnaire consisted in six 7-point Likert type questions that had to be answered depending on the strength of the "being there" sensation experienced, where 1 corresponded to not feeling there at all and 7 to the highest sense of being there (as experienced in the real world).

1.3. Environments

The virtual environments were programmed using GameStudio software (Conitec Datensysteme GmbH, Germany), which allowed us to develop 3D objects and virtual worlds with which we could interact and navigate. Our virtual environment (VE) consisted of an everyday, clean bedroom (with a bed, a closet, and a desk with some books on it) where participants could navigate freely.

To allow us to identify the specific areas of the brain that were activated for each task, we divided the paradigm into two conditions developed with the same virtual environment: in the first, a video of an automatic navigation through the room is observed; in the second, the participant can navigate freely in the VE.

Each condition was repeated six times. To learn about the tasks that had to be performed inside the scanner room, subjects underwent a prior training session. In order to prevent differences in activation caused by the motor task, subjects were instructed to move the joystick continuously during the video task in the same way as they did during the navigation period.

1.4. Data Analysis

For the questionnaires, we carried out a non-parametric Wilcoxon Signed-Rank test to compare SUS responses for the questions 1-6 and for the SUS mean, between the free and automatic navigation conditions.

The preprocessing of the signals was made by means of the EEGLAB program [7]. All recorded EEG epochs were checked for artifacts. First of all, data were digitally filtered using a linear FIR band pass filter (0.5-45 Hz). Then, the electrooculographic (EOG) artifacts were removed applying Blind Source Separation (BSS), using a window length of 10s, with 5s between windows. The electromyographic (EMG) artifacts were removed using also the BSS method.

For the analysis of the activated brain areas, the sLORETA (standardized low-resolution electromagnetic tomography) tool was used [8-11]. The whole brain was analyzed using voxel-wise LOG t-tests for examining the navigation vs. video conditions in the six frequency bands.

2. Results

A Wilcoxon Signed-Rank Test was conducted to compare between the six questions and the SUS mean results corresponding to the video and to the free navigation. A

statistically significant increment was found in the navigation scores with respect to the video scores for all the six questions and the SUS mean results (p<0.05).

Table 1. SUS responses to questionnaires for each task (mean score and standard error of the mean) and results of the Wilcoxon Test for each question and the mean score

	Video	Navigation	Z	P
SUS question 1: feeling of "being there"	3.11±0.31	4.89±0.39	2.714	0.007
SUS question 2: feeling that the room is real	3.00±0.33	4.78±0.40	2.724	0.006
SUS question 3: how real do you remember the room?	2.67±0.24	4.11±0.39	2.565	0.010
SUS question 4: feeling of being inside the room or observing it	2.89±0.51	4.78±0.49	2.588	0.010
SUS question 5: memory of the room as similar to being in other places	2.89±0.39	3.78±0.49	2.271	0.023
SUS question 6: did you think you were really in the room?	3.22±0.28	4.78±0.47	2.392	0.017
SUS mean	2.96±0.24	4.52±0.35	2.668	0.008

For the EEG data, the comparison between the Navigation and Video conditions using voxel-wise log t-test for all frequency bands revealed significant differences in the Alpha-band (8-12 Hz) and Theta-band (4-7 Hz), for p<0.05. Alpha and Theta band power was decreased in the Navigation condition in the right Insula (BA 13), indicating increased activity in this region during the free navigation task. There has been also found a trend (p<0.1) to increased activity in the Prefrontal Gyrus (BA 43) for the Alpha-band.
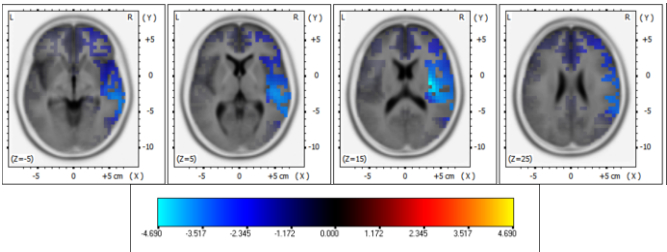
Figure 1. Capture of sLORETA activation in the Insula.

3. Discussion

As aforementioned, we have found activation in the insula. This area is related to emotion and regulation of the body's homeostasis, which includes among other functions self-awareness or the sense of agency and body ownership [12]. The sense of body ownership is the property which allows you to discriminate your own body and perceptions; forming the "body schema" which guides your behavior [13]. Recent works [14] have found evidence that the right insula may be activated by a combination of attentional and response control demands, playing a role in the processing of sensory stimuli that are relevant to the current goals. While navigating in a VE, you make decisions all the time, based on the evaluation of the sensory stimuli that guides our behavior in the VE. Our results suggest that the insula may play a key role in guiding behavior in the virtual environment based on the presented stimuli and the sense of presence. Moreover, according to Sjölie [15], attention and behavior are essential to develop the sense of presence, increasing the precision in the predictions about the

environment and the synchronization with it, and avoiding prediction errors from sources outside the VE.

Regarding the questionnaire results, they confirmed that a higher level of presence was induced during the free navigation than during the automatic navigation. Specifically, the Wilcoxon Test showed significant differences between the experimental conditions for all the questions and the SUS mean with higher presence values for the navigation condition.

Finally, we would like to emphasize that our results are consistent with those obtained in previous researches, which validates the possibility of using the Emotiv EPOC EEG portable device for this kind of studies.

Acknowledgements

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Neurocognition, Presence and Acceptance Of a VR Programme For Psychotic Patients: A Correlational Study

Mar RUS-CALAFELL[a,b,1] José GUTIÉRREZ-MALDONADO[a], Joan RIBAS-SABATÉ[b]

[a] Department of Personality, Assessment and Psychological Treatments, University of Barcelona, Spain
[b] Department of Psychiatry and Mental Health, Igualada General Hospital, Spain

Abstract. Patients with psychosis exhibit a wide range of cognitive deficits which are associated with poor functioning and poor outcomes in psychosocial interventions. Recently, virtual reality (VR) has been demonstrated to be a useful tool for treatment and rehabilitation of these patients. We have developed and applied an integrated VR programme to improve social skills in people with schizophrenia: the *Soskitrain*. The aim of the present study is to evaluate the relationship between patients' cognitive deficits, their sense of presence and their ratings of the programme's acceptability. Twelve clinically stabilized outpatients with a well-established diagnosis of schizophrenia or schizoaffective disorder underwent neuropsychological assessment prior to treatment, while after the intervention they completed a questionnaire about their sense of presence and the acceptability of the VR programme. Post-treatment results revealed a high sense of presence among patients, as well as good verisimilitude and high acceptance of the virtual environments. In addition, there were significant negative correlations between sense of presence and deficits in both delayed verbal learning and processing speed. The paper discusses the implications of cognitive impairment for the experience and acceptance of VR when treating psychotic patients.

Keywords. Psychosis, virtual reality, cognitive deficits, presence, acceptance.

Introduction

The cognitive deficits and marked emotional symptoms associated with psychotic disorders can hinder treatment progress and often limit the benefits of psychosocial interventions that target functional impairment in this population [1].

Virtual reality (VR) has recently begun to be used in the study and treatment of schizophrenia, with encouraging results as regards symptom assessment, establishing symptom correlates, identifying predictive variables, investigating the differential prediction of symptoms, identifying environmental predictors, in tests of putative casual factors and for treatment/rehabilitation [2]. Moreover, and as noted by Ku et al. [3], technological advances have recently been made in the design of avatars that enable computer-generated entities to simulate both the appearance and behaviour of

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[1] Corresponding author: Mar Rus Calafell, MSc. Faculty of Psychology, University of Barcelona, Passeig de la Vall d'Hebrón, 171, 08035 Barcelona. mruscalafell@ub.edu.

humans. These improvements can maximize the benefits of cyber-interventions since the environments used are more realistic and have a stronger social component, thereby enabling patients to practise the skills with human-like agents (e.g. experiencing the same social discomfort as when they interact with other people). Furthermore, the therapist can observe what the patient is able to do and modify the task parameters, all in real time. It should also be noted that in their meta-analysis on the impact of the inclusion and realism of human-like faces on user experiences in interfaces, Yee et al. [4] concluded that human-like representations with higher realism produced more positive social interactions than did representations with lower realism. All of this can directly affect the phenomenon of generalization, a key objective of psychosocial interventions for psychosis. However, the impact of patients' cognitive impairment on the virtual experience has been less widely explored, and it may be a central issue when using this technology in the treatment of psychosis.

We have developed an integrated VR programme, the *Soskitrain* [5] (Figure 1), to improve the social cognition and performance of patients with schizophrenia spectrum disorders. The purpose of this programme is 1) to broaden the treatment options for those patients who refuse to participate in group therapy (since the therapist can deliver the intervention in one-to-one sessions), and 2) to use an ecologically valid tool (the VR system) to train social skills and improve the generalization of learned responses in the patient's daily life. In addition to these benefits we were also interested both in the acceptability of the system and the impact of the patient's cognitive impairment on the virtual experience. Consequently, the aim of the present study is to evaluate the relationship between patients' cognitive deficits, their sense of presence and their ratings of the VR programme's acceptability.

1. Methods

Twelve clinically stabilized outpatients (M_{age}=36.5; SD=6.08) with a diagnosis of either schizophrenia or schizoaffective disorder and who were being treated at a mental health centre in Igualada (Catalonia, Spain) completed a social skills training (SST) intervention using the *Soskitrain*. This intervention was based on the manualized protocol of the brief SST programme developed by Rus-Calafell et al. [6]. The VR programme consists of seven activities in which the therapist can modulate the patient's behaviour using cognitive-behavioural techniques. Specifically, it uses a random presentation of virtual faces, interactions and characters to offer participants a wide range of experiential options and to provide novelty during each session. Special attention was paid to the creation of facial expressions and morphing of all the characters so as to ensure that the different interactions were realistic. The programme also allows users to practise social interactions with virtual avatars, and encourages progressive learning of the social skills repertoire. To practise with the programme, participants used a laptop with a 15.6-inch monitor and stereoscopic view, and they were required to use 3D glasses and headphones. This hardware was selected for its ergonomic design and for the fact that it makes it easy for the experimenter to control the virtual reality environment and, consequently, the participant's exposure.

The therapeutic intervention consisted of sixteen, one-on-one sessions, conducted twice weekly over eight weeks. Each session lasted approximately 60 min and was divided into two parts: the first 30 min to discuss the content of the SST intervention and the remainder to practise with the VR programme.

Prior to the intervention, patients were administered the following neurocognitive tests:

- Screen for Cognitive Impairment in Psychiatry (SCIP)-Spanish version [7]. The SCIP is designed to detect cognitive deficits in several psychotic and affective disorders. It includes a working memory test (WMT), a verbal learning test-immediate (VLT-I), a verbal fluency test (VFT), a verbal learning test-delayed (VLT-II) and a processing speed test (PST). It provides the assessor with a specific score for each of these cognitive domains, as well as a total score.
- Continuous Performance Test (CPT II version 5 for Windows®, [8]: This is a computer-based attention-vigilance task which provides information about inattentiveness, impulsivity or difficulties maintaining vigilance.

As part of the final treatment session, patients also completed a questionnaire regarding their experience with the VR programme:

- SUS questionnaire [9]. The original version of this instrument assesses three factors: sense of being there, extent to which the virtual environment (VE) becomes more 'real or present' than reality, and locality (i.e. the extent to which the VE is thought of as a place visited). For the present study, an additional item about acceptance/aversiveness of the VR system was included. The ratings used a Likert scale ranging from 1 (minimum) 7 10 (maximum).

To investigate the relationship between cognitive variables and the patient's sense of presence and acceptance of the VR system, a series of Spearman rho correlations were computed.

Figure 1. Examples of *Soskitrain* scenarios.

2. Results

A descriptive analysis of the SUS questionnaire revealed that patients gave high ratings for sense of being there, the extent to which the VE was more 'real or present' than reality, and locality (the extent to which the VE is thought of as a place visited) (Table 1).

Table 1. Means and standard deviations for sense of presence and acceptance.

SUS	M	SD
Sense of being there	5.33	0.88
Real or present	4.25	0.96
Place visited	6.16	0.57
Acceptance	6.5	0.53

In addition, the correlation analysis showed a negative association between the sense of being there and both delayed verbal learning and processing speed (Table 2). Neither years of illness nor attentional ability were related to the sense of presence. Acceptance of the VR system was not related to any of the cognitive variables.

Table 2. Correlation between the study variables. *p<0.05; **p<0.01

		1	2	3	4	5	6	7	8	9
1	SUS_1	1								
2	SUS_2	0.743**	1							
3	SUS_3	0.591*	0.734**	1						
4	SUS_4	0.00	0.90	0.00	1					
5	WMT	-0.173	0.257	0.35	-0.255	1				
6	VLT-I	-0.252	0.196	0.242	0.321	0.337	1			
7	VFT	0.056	-0.139	-0.035	-0.401	0.368	-0.488	1		
8	VLT-II	**-0.655***	-0.251	-0.056	0.371	0.306	0.597*	-0.276	1	
9	PST	**-0.534***	-0.250	-0.413	-0.037	0.807**	0.395	0.256	0.529	1
10	CPT_clinical	0.057	0.358	0.243	0.354	0.219	-0.385	0.479	-0.296	-0.111

3. Conclusions

The post-treatment results revealed a high sense of presence among patients, as well as good verisimilitude of the virtual environments (meaning that they were highly familiar and similar to the participants' natural living environment). Ratings of the acceptability

of the VR system were also high. Although some cognitive deficits seem to modulate the sense of presence when using VR, aspects such as the consistency of the environment, interactivity and the realism of representations are not affected by cognitive impairment.

The apparatus used here to present the virtual environment does have some limitations. Despite its stereoscopic system, as well as the inclusion in the environment of all the distal and proximal stimuli and the high degree of control that this enables over the participant's interaction, other important characteristics of VR exposure, such as eye gaze and head tracking, were not present. However, our priority when developing the system was 1) to enable a flowing conversation between the virtual avatar and the patient, 2) to be able to modify and emit the most suitable avatar response depending on the patient's performance, and 3) to reproduce or simulate 'everyday' environments that the patient was familiar with (e.g. a bar or a supermarket). This is an important aspect in terms of the extent to which responses may become generalized to the patient's daily life. It should also be noted that the hardware was selected for its ergonomic design and because it makes it easy for the experimenter to control the virtual reality environment. Consequently, it has the potential to be used in a clinical setting (e.g. the psychologist's office)

The results have important implications for clinicians who use cyber-interventions in people with psychosis, since they highlight the need to take into account certain aspects of cognitive impairment when interpreting the results obtained.

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SECTION VII

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 which are nurtured by artificial intelligence techniques that were 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

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Contactless Bio-behavioral Technologies for Virtual Reality

Pietro CIPRESSO [a,1], Silvia SERINO [a], Andrea GAGGIOLI [a], Giovanni ALBANI [b], Giuseppe RIVA [a,c]

[a] *Applied Technology for Neuro-Psychology Lab, IRCCS Istituto Auxologico Italiano, Via Pellizza da Volpedo 41, 20149 Milano, Italy*
[b] *Department of Neurosciences, Istituto Auxologico Italiano, Piancavallo-Verbania, Italy*
[c] *Psychology Department, Catholic University of Milan, Largo Gemelli, 1, 20123 Milan, Italy*

Abstract. The use of biosensors in human experimental research has become one of the most reliable methods to objectively quantify participants' behavioral, psychological and physiological measures. Modern bio-behavioral technologies can be integrated in Virtual Reality platforms, for a contactless assessment of affective states. This manuscript proposes a paradigm to deeper reach accuracy in assessment and diagnostics of rehabilitation processes.

Keywords. Contactless, Bio-behavioral, Virtual Reality, New Technologies, Cybertherapy, Assessment, Neurorehabilitation

Introduction

Experimental psychology and virtual reality paradigms use methods and techniques involving experimental trials with humans and animals. In particular, the use of biosensors in human experimental research has become one of the most reliable methods to objectively quantify participants' behavioral, psychological and physiological measures during virtual reality immersion.

The most crucial problem to consider with biosensors is the obtrusiveness. The more we want to examine objective behaviors, the more we interfere with the experiment directly conditioning the participants. In many kinds of experimental research, from emotions to affective states, to cognitive assessment, this is a critical aspect that can interfere with possible outcomes and conclusions.

The problem is relevant and well known among researchers in all the related fields, and big steps have been taken in many directions. Firstly, biosensors have been developed to be more precise, and also less obtrusive. Also, there has been a big development of biosensor integration, above all making them wearable, to reduce the discomfort of patches and cables.

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[1] Corresponding Author.

However the problem of these technologies remain exactly the same, i.e. experiments involving human beings are highly conditioned by sensors and direct observation [1].

The observer effect is amplified in bio-behavioral science when the measures regard affective states, emotions, psychiatric disease, stress, and all the aspects of psychological sphere.

Several studies on Virtual Reality make use of methods and techniques involving biosensors for a precise measurement of psychophysiological states. In particular the use of biosensors in human experimental research has became one of the most reliable methods to objectively quantify participants' behavioral, psychological and physiological measures. The most crucial problem to consider with biosensors is their obtrusiveness, above all if this is already high by using a head mounted display. This manuscript aims to deeper understand which contactless technologies can be integrated in Virtual Reality platforms and to provide the Contactless Bio-behavioral research methods to be effectively used for cybertherapy.

1. Bio-Behavioral Research: Scientific Standards

Bio-behavioral states are detected through cardiorespiratory activity, behavioral states, arousal-pleasantness states and attentional-contextual situations, as following explained.

Cardiorespiratory Activity:

Cardiovascular and respiratory activity is monitored to evaluate both voluntary and autonomic effect of respiration on heart rate, analyzing RR and NN interval extracted from electrocardiogram (ECG) and respiration (RSP) signals, and their interaction. According to the guidelines of Task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, typical *Heart Rate Variability (HRV)* temporal and spectral indexes can be extracted to evaluate the autonomic nervous system response [2].

Behavioral Patterns:

Activity-related behaviors suggest a clear aspect of continuous regulatory actions, observable in movement qualities, contours, expressions, and also perceived in vocal tonality. *Gesture and posture* are considered as parts of a wider semiotic system that underlies human communication. In this perspective, nonverbal behaviors could be interpreted to indicate the ''unsaid'' elements representing our internal states [3]. On the other hand, *speech analysis* is used to recognize affective and cognitive states from the user's voice.

Arousal And Pleasantness Patterns:

Arousal-Pleasantness models have been extensively used in psychophysiological research as an objective way to measure affective states. Physiological arousal can be measured through *skin temperature*, *galvanic skin response*, *respiration rate* and *pupil dilation* [4]. Pleasantness can be measured monitoring the activation of *zygomatic major* and *corrugator supercilii* facial muscles [4]. In general the analysis of facial expression through a classification in *Action units* can be useful to detect specific emotion and consequently pleasantness. Eventually pupil dilation can be used to quantify the pleasantness intensity.

Contextual And Attentional Patterns:

Voluntary, but also involuntary eye movement responses reflect internal processing and how such processing is accomplished, yielding insight into the content

of information processing. Cognitive Psychology is composed of plenty of sub-disciplines concerned with different aspects of thinking, such as attention, memory, perception, and coordination. There are many specific paradigms, such as visual searching, prosaccade and antisaccade tasks.

On the other hand, the context to which the attention is shifted is also to be considered, and also the social context dealing with the interaction among subjects.

2. Contactless technologies

The above indicated scientific standards for bio-behavioral research can also be assessed by the means of contactless technology already available to researchers.

Following the available contactless technologies and the relative correlates that can be extracted to assess bio-behavioral states (see also figure 1 and 2).
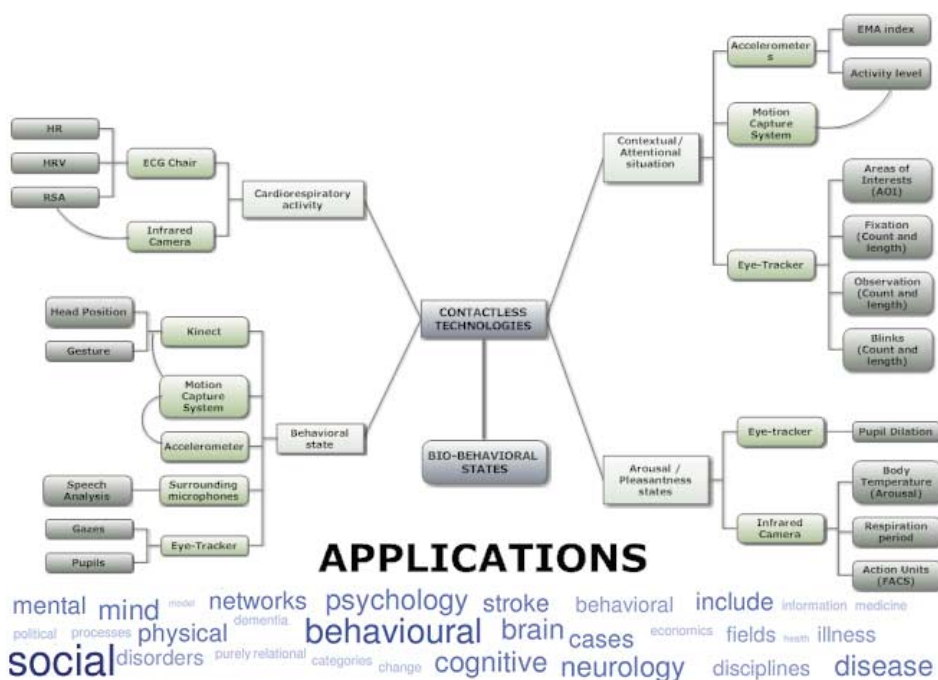
Figure 1. Contactless technologies and the extracted measures for the bio-behavioral states.

Eye-Tracker: A technology to record eye movement data consisting of moment-to-moment measures of the eyes' displacements along the vertical and horizontal axes within the spatial working area of a scene.

Stereo Camera: A low cost, single view depth imaging camera that collects spatiotemporal information of the subject's movements (an example of this is the Microsoft Kinect device).

Motion Capture System from Cameras: A digital video solution to map a body in a virtual digital tridimensional space, to record any activity in a defined environment.

Non-intrusive ECG through a Chair: Capacitive sensors through the back of a chair can be employed for measuring the complete electrocardiogram of a human heart without electric contact with the skin.

Surrounding microphones: A system based on low-cost microphones to be used for speech analysis based on voice detection and noise removing.

Accelerometers: Small devices to measure proper acceleration. Can be inserted in an object and track its movement in an environment. Can also transmit data via Bluetooth or record data locally.

Digital Infrared Thermal Imaging Camera: Is a non-invasive camera to record images and videos (thermograms) and involves no exposure to radiation. Thermograms were initially used to detect body temperature, but a recent study used these cameras to detect respiration, cardiovascular patterns and muscle activations also for the detection of face expressions.

3. Integration into a Virtual Reality Platform

Most of Contactless devices make available the Software Development Kit (SDK) that makes it possible to integrate third-party software into a Virtual Reality Platform [5]. Moreover, recently, the framework of contactless technologies has been widely extended, fostering from the classic clinical assessment to a more active use as input platform. In particular, the paradigm aim at implementing the integration of Contactless Technologies to provide the following advantages: 1) increased accuracy in assessment and diagnostics of ongoing rehabilitation processes; 2) ability to correlate specific mental states with specific activities executed into the environments, through the use of Kinect and eye-tracker for the synchronization of the ocular path within the action performed by the user; 3) ability to study the variables related to attention, perception, and cognition in the framework of simulations representing realistic situations and daily contexts, increasing the ecological validity of gathered data.

4. Conclusion

Behavioral and medical sciences, and in particular psychiatry, can benefit enormously from operating within this methodological paradigm while using Virtual Reality.

At the moment, paradigms in cognitive sciences worked on the obtrusiveness dimension of biosensors, however another perspective, that has not been considered, is the proximity level of biosensors. This paradigm fosters to reach an ambitious achievement: to switch from unobtrusiveness to a totally transparent technology, where a participant doesn't wear any sensors, being these out of the body's subjects, detecting bio-behavioral states at distance.

In a typical experimental situation, participants and in particular patients affected by schizophrenia, autism, psychosis, bipolar disorders, or other mental disorders, reject the idea to wear biosensors or also to be touched, with important consequences on the outcome of these researches, potentially conditioned by the personal discomfort of the participants.
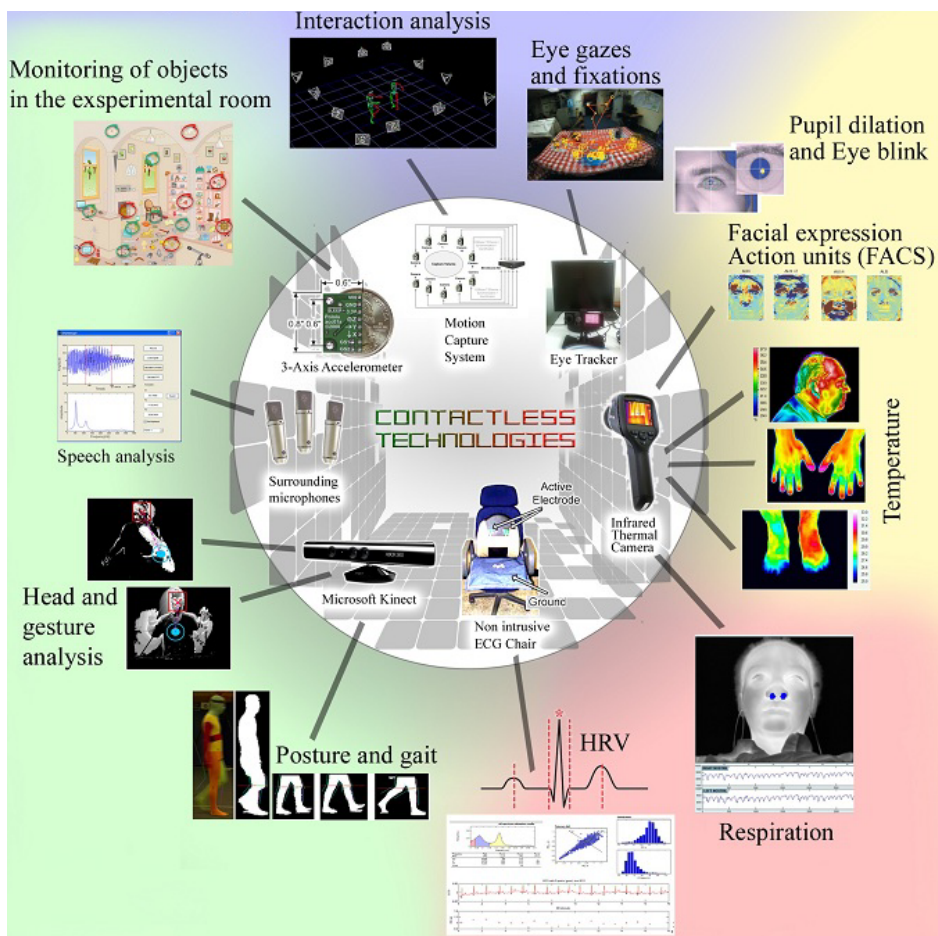
Figure 2. Contactless technologies and the extracted features.

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Evaluation of a Personal Mobile Coaching Service for Health Tracking

Fabiana GATTI [1], Eleonora BRIVIO and Carlo GALIMBERTI
Centro Studi e Ricerche di Psicologia della Comunicazione
Dipartimento di Psicologia
Università Cattolica del Sacro Cuore di Milano

Abstract. Yukendu is a personal mobile coaching service that supports people in reaching good levels of psychological and physical well-being. The aim of this contribution is to describe the peculiarities of Yukendu and its multi-step evaluation process.

Keywords. Coaching, well-being, app, health-tracking, mobile

Introduction

Recently the market started to welcome many services that support and help people reach and maintain an adequate level of physical and psychological well-being thanks to new information communication technologies. The aim of this paper is to present and outline the evaluation process of one of such services. In particular, the first part of the paper will be focused on presenting the Wellness&Wireless Yukendu service, a mobile-supported wellness coaching service; the second part of the paper will present the research that is being carried out to evaluate the service, with two particular research questions: a. evelute the influence of technology on coach-user relationships and its impact on the service effectiveness; b. define guidelines for coaches to manage technology-mediated relationships.

1. Yukendu: a Personal Mobile Wellness Coaching Service

Wellness & Wireless Srl ("W&W") is a company that is about to launch in the Italian market a personal mobile coaching service to help individuals achieving their wellness and health objectives, typically weight-loss and healthier life styles, by inducing lasting changes in behavior.

It is well proven that life style change for an individual is an extremely challenging feat: a recent meta-study showed that diet programs are not a efficient way to lose weight but barely slow down weight gain [1].

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[1] Corresponding Author: Fabiana Gatti, Cantro Studi e Ricerche di Psicologia della Comunicazione, Dipartimento di Psicologia, Università Cattolica del Sacro Cuore di Milano, L.go Gemelli 1, 20123 Milano; email: fabiana.gatti@unicatt.it.

On the other hand, health-coaching programs are a highly effective as a way to lead people toward healthier life styles and therefore prevent or manage chronic conditions. So much so that in the USA Medical Insurances pay Health Management companies in excess of $ 4 B/year for their health coaching services, given their effectiveness in correcting unhealthy life styles and reducing medical costs as a consequence.

The company intends to integrate the successful approach of health coaching with wireless and wearable technologies to make the service pervasive, always available, easy to use and data-driven, to adapt to the most recent life styles trends.

Yukendu is the commercial name of a service to be launched in Q4 2013; it is a wellness service, targeting healthy individuals who desire to change their life styles, control their weight and feel better and more energetic overall. In a second phase Wellness&Wireless will target the health management services to help individuals to prevent and manage chronic conditions such as diabetes, high blood pressure, cardiovascular conditions etc. whose fast increasing prevalence demands innovative preventive strategies in line with the most recent recommendations of the World Health Organisation [2]. Yukendu is then a personal mobile coaching service that works in the following way:

- The user subscribes online to a 1-3-6 month program and gains access to an App for smartphone and to a web portal and will be associated to a Coach
- The Coach (and the relevant IT systems) automatically tracks the user's weight and body fat through a wireless body composition scale that is part of the program
- The user receives through the App/Web a life-style plan, based on the user's biometric parameters and personal preferences, including:
    a) A non-prescriptive dietary recommendation whose objective is to teach the user how to eat better and healthier. The weight and body fat data collected through the scale offer a data-driven closed-loop mechanism that drive, over time, the user to find the most suitable dietary regime with the support of the Coach.
    b) 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. The App supports the user through small video sessions as well as through a wireless heart beat monitor, to adjust the training intensity to the actual user's capabilities.
- Via the App/Web the user can:
    a) see the Coach's agenda and book video/audio appointments.
    b) exchange messages with the Coach on a more informal basis
    c) see the updated dietary and fitness plan
    d) connect the wireless scale and heart beat monitor for measurements and guidance during fitness activities
    e) receive advice and recommendations on food, diet and self awareness

Figure 1. Yukendu app main menu

- The Coach (and the company' workflow management system) monitors the user's behavior and performance (e.g. weight, body fat, fitness sessions, login on the App/Portal) and communicates with the user to ensure all challenges are addressed and the user moves toward a new balance
- The App and the portal act as
    a) an always-available repository of information about the user's life-style plan
    b) a user-coach communication channel through messaging, phone and video capabilities
    c) gateway for wireless personal peripherals such as the body fat scale, the heart beat monitor and other devices in the future.

Forcing new beliefs and new habits into people's mind is an approach deemed to fail since it undermines the existing and hard-to-modify narrative about the self.
W&W's overall approach to life style change is non-prescriptive and focuses on supporting the user in realizing that a new perspective or better a new reality is at reach.
All pillars of the program are inspired by this philosophy:
- Coaching: Yukendu takes a "befriending" approach whereby the coach takes the role of the supporting companion rather than of the "master" in the relationship. The focus is on emotional support rather than on performance and achievements.
- Dietary recommendation: Yukendu does not prescribe specific foods but rather a healthy balance between main nutrients categories, leaving the user free to pick the preferred food. The concepts of calories in-take and consumption are not part of Yukendu's methodology.   The regular measurement of the weight and body fat helps the user realizing what works and what does not in his/her diet, hence uncovering autonomously new possibilities and eventually a new balance
- Fitness: the focus is to bring the user to live an active life whilst disregarding actual performance (e.g. calories burnt or steps taken in days). Yukendu achieves this by offering various and diverse possibilities to exercise and to provide practical and emotional guidance and support for whichever option the user eventually leans toward.

- Mindfulness and self awareness: both the coach and the App help the user in developing stronger self awareness that is key for the user to adopt new beliefs and therefore new behaviors.

2. Methodology

Such complex service requires a multi-step evaluation process that closely takes into consideration each part/actor involved in the service.

1. Designing, monitoring, selecting and training of the coaching staff. One expert in mindfulness and training and two experts in CMC designed a 4 day training which includes basics of Yukendu's nutrition methodology, home-fitness programs, communications skills with a specific focus on anxiety management; from literature [3] [4], the most problematic interactions in a online coaching service were identified and are to be explored and solved through role playing simulations; a 15 day period of on the job training is also part of the coaches' training.
2. The evaluation of the service is set for June-September 2013 and consists in following 2 users and their two coaches during a 7 week program. The data is ecologically produced in the web and app environment and consists in video and audio data of the coaching sessions, the texts exchanged by coaches and users, data log of system use. Verbal data will be analyzed with the conceptual context suggested by Palmquist [5]. Results from this computer-assisted qualitative analysis will be triangulated with log data.

3. Results and conclusion

Through a selection process, 15 potential coaches were identified and set for starting training in May 2013. Coaches will train to manage routine interactions (anxiety management, managing objections, empathic guidance, setting clear boundaries to personal interaction) and prototypical critical users (relational addicts, demotivated users, people suspected to have eating disorders…). From the analyses to be conducted on the beta phase we expect to identify which patterns of mediated interaction between coach and user are most fitting for successful behavioral change using this kind of technology. After the evaluation process the service will go through a final revision and will launch in Q4 2013.

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Cognitive Rehabilitation of Schizophrenia Through Neurovr Training

Filippo LA PAGLIA [a,1], Caterina LA CASCIA[a], Rosalinda RIZZO[a], Lucia SIDELI[a], Antonio FRANCOMANO[a], and Daniele LA BARBERA[a]

[a]*Department of Experimental Biomedicine and Clinical Neuroscience, University of Palermo, Italy*

Abstract. Cognitive difficulties are prevalent in people with diagnosis of schizophrenia and are associated with poor long-term functioning. In particular, memory, selective, divided and sustained attention and executive functions are altered by this disease. We used a Virtual Reality environment (developed via the NeuroVr2.0 software) for the rehabilitation of shifting, sustained attention and action planning functions using tasks reminiscent of daily life tasks. Test and retest showed significant differences in the assessed cognitive dimensions.

Keywords. Virtual Reality, Schizophrenia, Cognitive Rehabilitation, Executive functions.

Introduction

Schizophrenia is a mental disorder characterized by a breakdown of thought processes and by poor emotional responsiveness, such as abnormal expressions of emotion and ways of thinking, mental derangement, regression from reality, strange language or behaviour and delusion or illusions. Cognitive impairment is a core feature of schizophrenia, and is present in the majority of patients, independent of positive symptoms such as delusion and hallucinations, with converging evidence showing that it is strongly related to functioning in areas such as work, social relationships, and independent living [1]. Furthermore, cognitive functioning is a robust predictor of response to psychiatric rehabilitation [2, 3]. Schizophrenia transversally affects all of the neurocognitive functioning domains, in particular the functions related to the "hipofrontality", such as executive functions, processing speed, memory, and attention [4]. We developed - via the NeuroVr 2.0 software - a Virtual Reality (VR) cognitive task, for rehabilitation of shifting, sustained attention and action planning functions (problem solving, planning, working memory, inhibition, mental flexibility, initiation and monitoring of actions). Virtual Reality provides opportunities to enlarge the actual limits of cognitive rehabilitation applications providing valuable scenarios with common elements for the patients, putting them in contact with daily life activities. Immersive virtual environments appear to be the best solution to make lab situations become closer to the natural setting in the subject's perception.
According to other authors [5, 6], we believe that the added value of Virtual reality in cognitive rehabilitation, compared to the traditional approaches, is the customization on user's needs (each virtual environment can be produced in a specific way focusing on

[1]Corresponding Author: Filippo La Paglia, Dipartimento di Biomedicina Sperimentale e Neuroscienze Cliniche, Università di Palermo, Italy. E-mail: filippolapaglia@gmail.com; filippo.lapaglia@unipa.it

the patient's characteristics and demands); the possibility to graduate (each virtual environment can be modified and enriched with more and more difficult and motivating stimuli and tasks); the high level of control (it allows professionals to monitor the level of affordability and complexity of the tasks that can be provided to patients); the ecological validity (a virtual environment allows to stimulate in the subjects emotional and cognitive experiences like in the real life); and the costs reduction (rehabilitation with Virtual Reality can be cheaper than the traditional one, mostly when it comes to the reconstruction of complex scenarios).

1. Methods

1.1 Participants

The study included two clinical samples of patients suffering from schizophrenia disorder diagnosed by DSM IV with no history of neurological disease, recruited at the outpatient Unit of Psychiatry of Palermo Universitary Hospital.

The experimental group consisted of 6 patients (mean age=31 years, std.dev.=14.6) treated with pharmacological therapy and with cognitive training based on virtual reality (once a week). The control group was composed of 6 patients (mean age=35 years, std.dev.=9.9). They received pharmacological therapy, Integrated Psychological Treatment (IPT) (once a week). Moreover these patients used to frequent a community centre to participate in other activities such as music therapy and individual/group activities to improve social skills and autonomy in daily life.

Exclusion criteria were: motor impairment which does not allow subject to perform the virtual procedure; presence of severe difficulties in visual discrimination skills and language comprehension; absence of psychiatric comorbidity.

1.2 Instruments and procedures

Before and after training we assessed the cognitive and executive functions, both in cases and controls, through following tests: the Mini Mental State Examination (MMSE), Frontal Assessment Battery (FAB), the Trial Making Test (TMT), the Tower of London (ToL), the Memory Battery, the Wisconsin Card Sorting Test (WCST), and the Stroop Colour Word Test.

1.3 Interventions

The experimental group was exposed to a virtual attention and executive-function training consisted of hierarchical sequences of tasks (starting from a single-task condition and ending with successive multiple tasks) settled in four different virtual environments, whose characteristics are described below (Figure 1):

1. Park (sustained attention): the subject was asked to catch footballs presented at irregular intervals of time, in order to reduce the expectation effect;
2. Valley (selective attention): the participant was required to identify and pick up a particular type of flower. The increasing difficulty of this task – consisting of four different subtasks – was related to the different characteristics of the target stimulus (first any pink flower, secondly only

white and red poppies, then only yellow daisies) and with the complexity of the background (poor of flower vs. rich of flower valley);

3. Beach (selective and divided attention): the subject had to pick up particular types of bottles (first only glass bottles, then both green glass bottles and red-cap bottles). Moreover, he was alerted to any calls and loudspeaker announcement: when a voice announced the kiosk's opening time, he had to stop his activity, go to the kiosk, and have a meal;

4. Supermarket (executive function): the participant was asked to collect and buy several products from a shopping list. The products were presented in categories including food, hygienic products, frozen food, and on-sale products. Furthermore, while doing his shopping the participant had to follow specific rules, i.e. not to go in the same aisle more than once, not to enter an aisle unless the participant needs to collect something in it [7].

Figure 1: virtual environments:- park, valley, beach, supermarket

The treatment was implemented in 10 weekly individual sessions. Each session lasted 90 minutes. During the training, the patients' performance was registered using two similar observational grids that provided quantitative indicators. In attention training (park, valley and beach) we evaluated:

- time of execution;
- total errors, with a score ranging from 49 (the subject has correctly done the tasks) to 98 (the subject has totally omitted the tasks);
- partial errors whit a scoring range from 7 (no errors) to 14 (more errors).

Items of partial errors are: "pick up all objects"; "sustained attention"; "divided attention"; "maintained sequence of task"; "self-corrections"; "absence of perseveration"; "maintained task".

In executive function training (virtual supermarket) we used a grid to measure [8]:

- time of execution;
- total errors, with a score ranging from 11 (the subject has correctly done the tasks) to 33 (the subject has totally omitted the tasks);
- partial tasks failures, with a score ranging from 8 (no errors) to 16 (great errors);
- inefficiencies, with a score ranging from 8 (great inefficiencies) to 32 (no inefficiencies);

- rule breaks, with a score ranging from 8 (many rule breaks) to 32 (no rule breaks);
- strategies, with a score ranging from 13 (good strategies) to 52 (no strategies);
- interpretation failures.

The control group was exposed to 10 60-minute group sessions of Integrated Psychological Therapy (IPT) [9], 1 time per week. IPT is based on a building-block model that assumes basic neurocognitive functions are necessary prerequisites for higher-order complex social functions. The IPT proceeds through 5 subprograms, arranged in a hierarchical order according to complexity of function. The first 3 subprograms represented the cognitive training component, including abstraction, are conceptual organization, basic perception and communication skills training. These IPT function domains are designated Cognitive Differentiation, Social Perception, and Verbal Communication. The fourth and fifth components represent the behavioural level of social interaction and are similar to skills training approaches used elsewhere.

Statistical analyses

Social and clinical characteristics of the groups were compared using Fisher's exact test and Mann-Whitney test. Wilcoxon test was used to compare pre- and post-training cognitive performances both within the experimental and the control group. All analyses were carried on using SPSS v. 19.

2. Results

At baseline, groups were similar in terms of gender, age, education level, and degree of cognitive impairment. Both VR training and IPT were associated with improved performance in the divided attention task. Furthermore, VR training was related with reduced cognitive deficits and improved planning (Table 1).

Table 1. Results at Wilcoxon test

Test-retest	Experimental (n=6)	Control (n=6)
MMSE	z= -2.020, p= 0.043*	z= -0.210, p= 0,833
ToL	z= -2.032, p= 0.046*	z= -1.841, p= 0.066
FAB	z= -1.826, p= 0.068	z= -1.787, p= 0.074
TMT-B	z= -2.023, p= 0.043*	z= -2.207, p= 0.027*

*Significant p<0.05

After the executive function training (virtual supermarket) the experimental group showed significant improvements in: decreased errors (20.33 ± 2.7 vs.15 ± 2.36; Wilcoxon z test = -2.02, p= .043); reduced time of execution (10.47 ± 3.31 vs. 4.42 ± 1.91; Wilcoxon z test = -2.20, p= .028); increased observance of rules (17.33 ± 3.9 vs. 22.33 ± 34; Wilcoxon z test = -2.21, p= .027). In addition, after the attention training (park, virtual valley and beach), the experimental group showed improvements in: reduced time of execution (54.00 ± 28.71 vs. 25.56 ± 13.26; Wilcoxon z test = -2.20, p= .028); decreased perseverative errors; improvement in sustained attention.

3.   Conclusions

These preliminary data suggest that virtual reality training may improve cognitive functioning in psychotic patients and others in rehabilitative programs.

We think that characteristics of VR training (such as low costs or daily life reproduction) makes it very useful with schizophrenic people. Moreover, 90 minutes sessions do not allow the patient to fatigue or bore. Furthermore, if we compare the two samples we find similar results, but the experimental group is involved in only VR training. The control group spends much more time doing daily activities.

A small sample size is required to carry on with this study to verify our preliminary data.

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Peak Provoked Craving After Smoking Cessation

Irene PERICOT-VALVERDE[a], Olaya GARCÍA-RODRÍGUEZ[a,1], Mar RUS-CALAFELL[b], Sergio FERNÁNDEZ-ARTAMENDI[a], Marta FERRER-GARCÍA[b], José GUTIÉRREZ-MALDONADO[b],

[a]*University of Oviedo, Spain*
[b]*University of Barcelona, Spain*

Abstract. Peak provoked craving (PPC) is an alternative approach to cue-induced craving that focuses on the highest craving level experienced during the exposure to drug-related cues. The main objective of this study was to assess the effect of abstinence on PPC in smokers and to determine whether PPC is altered by continuous abstinence. Results showed reductions on PPC levels only 24 hours after achieving abstinence and craving levels remain significantly lower after 7 days of abstinence.

Keywords. Peak provoked craving, Virtual Reality, smokers, treatment

Introduction

Cue exposure studies have shown that smokers report craving increases during the exposure to cigarette stimuli compared to neutral stimuli under experimental conditions[1]. Such studies define cue-induced craving as the difference between pre- and post-exposure values. However, cue-induced craving has been shown to be moderate[2]. This may be due to high values of pre-exposure craving[3] when subjects are previously deprived (ceiling effect) or to low values of post-exposure craving in the case of satiated smokers (floor effect).

Peak provoked craving (PPC) is an alternative approach when measuring craving[2]. PPC focuses on the strongest craving level experienced during the exposure to substance-related stimuli, without subtracting pre-cue levels. PPC attempts to obtain a valid measure of user's urge for the substance without making a distinction between pre-exposure craving and cue-induced craving.

Despite nicotine deprivation has been strongly related with craving increases[4], few studies have examined the effect of continuous smoking abstinence on craving levels. In the few studies that reported cue-induced craving levels after cessation, no abstinence effect was observed[3]. As the cue-induced approach may underestimate the effect of cue exposure on smokers, PPC could overcome this limitation.

The aims of this study were to analyze the effect of abstinence on PPC in smokers and to determine whether PPC is altered by continuous abstinence.

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[1] Olaya García-Rodríguez. Department of Psychology. University of Oviedo. Plaza Feijoo s/n. 33003. Oviedo, Spain. E-mail: garciaolaya@uniovi.es

1. Method

1.1. Participants

A total of 11 smokers (2 men and 9 women) participated in this study. Inclusion criteria for participation were aging 18 or older, smoking 10 or more cigarettes and be willing to quit. Participants involved in any other smoking cessation treatment and reporting any substance use disorder other than nicotine were excluded.

1.2. Instruments and measures

Sociodemographic characteristics and smoking history were assessed with a semi-structured interview.

The Fagerström test for nicotine dependence[5] (FTND) and the Nicotine dependence syndrome scale[6] (NDSS) were also applied. Carbon monoxide (CO) concentrations in expired air were measured at each session using the Micro-Smokerlyzer (Bedfont Scientific Limited, Rochester, UK). Abstinence criterion was CO ≤ 4 parts per million (ppm).

PPC was determined as the highest craving value reported by the participants during the exposure to a virtual environment. Craving was assessed every 2 minutes with a visual analogical scale (VAS) from 0 to 100 built into the virtual environments. PPC levels were measured before achieving abstinence, after 24 hours of abstinence and after 7 days of abstinence.

Virtual environments reproduce real-world settings where people smokes[7] and they were presented with an eyewear Vuzix iWear VR920 (Vuzix, Rochester, NY, USA) with 3 degree of freedom head tracker using a laptop computer running Microsoft Windows XP. Participants can also interact with the environments and rate self-reported craving levels by using a standard mouse.

1.3. Procedure

In each of the three sessions, participants provided a carbon monoxide sample in order to assess smoking status and they were exposed to Virtual Reality (VR) environments during a maximum of 30 minutes.

1.4. Statistical analysis

Descriptive analyses were performed with sociodemographic and clinical characteristics. A repeated-measures ANOVA (with Tukey's post-hoc comparisons) was conducted to determine whether levels of PPC differ across the three time points.

2. Results

Participants' characteristics at baseline are shown in Table 1.

Table 1. Sociodemographic and clinical characteristics (n=11)

	Mean ± SD/%
Age	36.6 ± 15.6
Females (%)	81.8
Smoking duration (years)	15.4 ± 9.9
Cigarettes per day	14.7 ± 6.1
Nicotine per cigarette (mg)	.75 ± .07
FTND	3.1 ± 2.4
NDSS	55.2 ± 5.5
CO level (ppm)	10.5 ± 7.3

Note: FTND = Fagerström test for nicotine dependence; NDSS = Nicotine dependence syndrome scale; CO = Carbon monoxide; ppm = parts per million.

Figure 1 shows mean PPC level for each assessment: before achieving abstinence (M = 48.2; SD = 28.4), after 24 hours of abstinence (M = 25.1; SD = 23.2) and after 7 days of abstinence (M = 22.3; SD = 20.4. ANOVA results indicated that PCC differed significantly across assessments ($F_{(2, 9)}$ = 4.95, p = 035, partial η^2 =.52).

Figure 1. Peak provoked craving during virtual exposure session
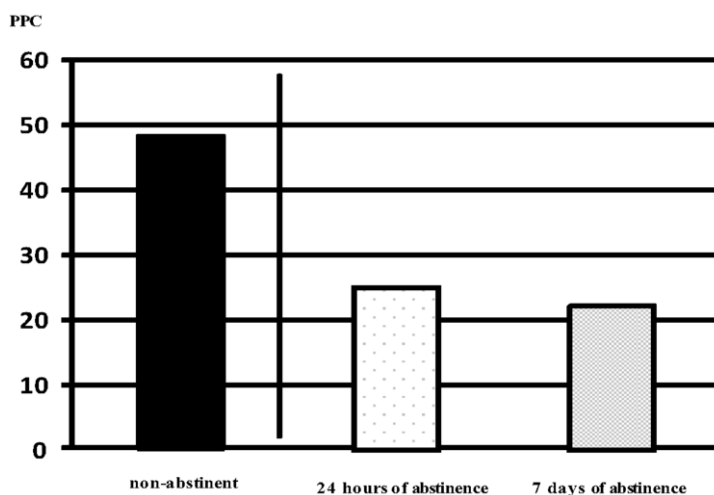
Post-hoc comparisons showed that PPC before achieving abstinence was significantly higher than after 24 hours of abstinence and also after 7 days abstinence. No significant differences were found in PPC between 24 hours- and 7 days-duration of abstinence.

3. Conclusions

The main goal of this study was to assess the effect of smoking abstinence on PPC. The results showed that PPC decreased in abstinent smokers. The effect of continuous abstinence was observed on PCC levels after 24 hours of abstinence, and it was maintained after 7 days abstinence.

Craving use to be conceptualized as a conditioned response (CR) that may be eventually extinguished through repeated presentation of the conditioned stimuli (CS, specific contexts or persons related to tobacco use) without the unconditioned stimuli (US, tobacco use) [8]. Therefore, reductions in PPC may be explained for extinction processes as a result of the exposure to CS without smoking (response prevention) during the quitting and abstinence periods.

Cue-induced paradigm has been widely used in craving research[1,3]. Nevertheless, this approach has limitations to detect changes in craving when pre-exposure levels are influenced by abstinence effects. PPC could be an alternative measure of drug craving[2] as it detects overall effects of nicotine abstinence and cue exposure like the experienced by ex-smokers in everyday situations.

Limitations of the present study need to be mentioned. First, the small sample size may limit the generalization of our results. Second, despite 7 days of abstinence can be considered continuous abstinence, longer periods of abstinence need to be analyzed.

In summary, PPC was attenuated after achieving short- to medium-term abstinence, pointing to extinction processes related with exposure mechanisms. Our findings suggest that PPC is an alternative and complementary approach to assess tobacco craving that may contribute to understand the complexity of smoking craving.

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Designing Virtual Environments to Measure Behavioral Correlates of State-Level Body Satisfaction

Clare K. PURVIS[a,1] Megan JONES, Psy.D.,[b] Jakki BAILEY, M.S.[c], Jeremy
BAILENSON, Ph.D.[c], C. Barr TAYLOR, M.D.[b]

[a] *PGSP-Stanford Consortium at Palo Alto University*
[b] *Department of Psychiatry and Behavioral Sciences, Stanford University*
School of Medicine
[c] *Department of Communications, Stanford University*

Abstract. Virtual reality (VR) offers a unique method for eliciting state-variable fluctuations in body satisfaction and associated behaviors by allowing near-perfect control over environmental factors. Greater variability in momentary body satisfaction is associated with more problematic eating behavior and cognitive styles predictive of eating disorders. The field currently lacks a model for understanding environmental variables and everyday events that tend to influence fluctuations in state body satisfaction. This study proposes a model of state-level body satisfaction and presents a method for measuring changes as they occur. We aim to investigate body comparison, selective attention and body checking behaviors in relation to self-report levels of state body satisfaction. We additionally assess interpersonal correlates of state body satisfaction using VR to measure personal distance between subjects and avatars of varying body sizes. 80 female college students with varying levels of weight and shape concerns will be exposed to five virtual environments designed to elicit varying levels of body dissatisfaction: (a) an empty room; (b) an empty beach; (c) a beach populated with avatars; (d) an empty party scene; (e) a party scene populated with avatars. Self-report body satisfaction was measured immediately following each exposure. A tracking system automatically tracked subjects' head orientation and body translation to measure visual gaze and personal space behavior relative to each virtual human within the environment. Data collection is currently underway and expected to be completed by May 2013. Preliminary data and development of the VR model for state-variable assessment will be presented.

Keywords. Virtual environments, body satisfaction, college women, eating disorders

Introduction

This study aims to investigate virtual reality (VR) environments designed to elicit state-level fluctuations in body satisfaction. We also intend to measure behavioral correlates to of body satisfaction directly in controlled conditions during VR exposure. VR offers a unique method for eliciting state-variable fluctuations in body satisfaction and associated behaviors by allowing near-perfect control over environmental factors. This study proposes a multidimensional model of state body satisfaction based on an

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[1] Corresponding Author: Clare Kennedy Purvis: clare.purvis@stanford.edu.

individual's perceived body exposure (i.e., their appearance) and prompts for social comparisons (i.e., appearance of others). We present a model for measuring changes as they occur using in vivo state measures and behavioral outcomes. Subjects will report momentary levels of body satisfaction immediately following exposure to each virtual environment using the Body Parts Satisfaction Scale [1]. We aim to assess key behaviors associated with body satisfaction: body comparison, body checking and selective visual attention to weight and shape related stimuli. This study also proposes a novel assessment of personal space between subjects and virtual humans of varying body shapes as a correlate of body satisfaction. We hypothesize that subjects' degree of approach and/or avoidance behaviors toward underweight, average weight, and overweight avatars within the virtual space will vary as a function of body satisfaction.

1. Background

1.1. State-level body satisfaction

State body satisfaction refers to an individual's momentary or day-to-day self-perception and feelings about her weight and shape [2]. Greater variability in momentary body satisfaction is associated with more problematic eating behavior and cognitive styles predictive of eating disorders [2]. The field currently lacks a model for understanding environmental variables and everyday events that tend to influence fluctuations in state body satisfaction. Models for understanding variables that predict changes in state body satisfaction have relied on self-report measures or retrospective accounts [2]. This study proposes a model of state-level body satisfaction based upon an individual's level of body exposure and prompts for self-comparison with others of varying body sizes. Using this model, we aim to measure fluctuations in body satisfaction directly as they occur. Recent studies have used VR with promising results to elicit fluctuations in emotional states in response to food-related stimuli [3, 4].

1.2. Behavioral correlates of body satisfaction

Several behaviors have been shown to correlate with body dissatisfaction among young women and are considered key maintaining features of eating disorders: body comparison, selective attention and body checking. "Body comparison" refers to attempts to evaluate one's own appearance by making comparisons to the appearance of another individual or image [5]. Research has shown that women frequently compare their bodies with those of peers as well as media images of thin-ideal bodies, resulting in decreased body satisfaction [6,7,8]. The literature also indicates that women with elevated weight and shape concerns selectively attend to body-related stimuli in the environment [9], but whether young women exhibit variability in the extent of attentional bias as a function of body satisfaction is unclear [10]. Body checking refers to "repeated critical scrutiny of one's body size, shape and weight" [11], often by using mirrors, pinching areas of fat, measuring body parts or engaging in other behaviors intended to evaluate body size. Body checking is considered a characteristic feature of eating disorders and is measured using self-report methods. The capabilities in VR to expose participants to controlled environmental conditions and record body checking behaviors represents a novel assessment method.

1.3. Applications of VR

Researchers have begun investigating VR treatments for disturbances in eating behavior and body image with promising results [12]. Studies have shown that virtual exposure to food-related stimuli elicits similar emotional responses as would be expected in reality among women with eating disorders [12, 13]. However, the field currently lacks a model for understanding and measuring state-level changes in body satisfaction using VR.

2. Methods

2.1. Participants

Eighty female undergraduate students ages 18-30 will be screened and sorted into two groups: at-risk for developing an eating disorder (n=40) or healthy controls. Subjects will participate in the study for course credit.

2.2. Apparatus

Subjects wore a head-mounted display to view the immersive VR environments. Stereoscopic images were rendered at an average frame rage of 60 Hz and the viewer's perspective was continually updated according to the subject's head movements for an immersive experience. The subject's position along x, y and z planes was tracked with an optical tracking system.

2.3. Procedure

The lead researcher and one undergraduate research assistant were present for each trial. Participants were read a description of the study and the researcher assisted the participant in putting on the head-mounted display. When the virtual environment was loaded, the participant saw a virtual room that was modeled exactly on the physical lab room. In the virtual lab room, the participants were prompted to walk to different areas in the room in order to confirm that the equipment was working properly and familiarize the subject to VR. Before entering the first experimental environment, participants completed the Body Parts Satisfaction Scale, a 10-item measure of body satisfaction, by reading the items in the head mounted display and speaking their answers aloud. Answers were audio-recorded by the blinded research assistant.

The participants were exposed to the four virtual experimental conditions randomly to control for ordering effects. All participants were exposed to the lab room, an empty beach, a beach populated with avatars, an empty party scene and a party scene populated with avatars. Populated environments contain three groups of three avatars, with two females and one male per group. The relative body sizes of the female avatars varied between the groups; thin-ideal, average and overweight body sizes respectively. The groups were placed in fixed positions within virtual space, equidistant from the participant.

In environments containing avatars, subjects are first instructed to view all three groups from their starting point and then to approach ("join") each group in the order of

the subject's choosing. Participants are allowed to spend 15- 20 seconds observing each group. After the subject had approached each of the three groups, the researcher prompted the participant to return to the starting point in the center of the room and stand so that she could not see any of the three groups. Remaining in that position, subjects were asked recall five details they remember about any or all of the three groups. The research assistant audio-recorded responses. In environments without avatars, participants were instructed to approach three areas of interest in the environment and observed each area for 15-20 seconds and were also asked to recall five details about the environment. Immediately following each virtual environment, subjects report their levels of state body satisfaction using the Body Parts Satisfaction Scale using the same method described above.

The order in which subjects are exposed to the virtual environments is randomized to control for ordering effects. Similarly, the positioning of the groups of avatars is counterbalanced between- and within-subjects to control for environmental factors that may influence approach behavior. A tracking system will automatically track subjects' head orientation and body translation to measure visual gaze and personal space behavior relative to each virtual human within the environment.

3. Results

Data collection is currently underway and expected to be completed by May 2013. Preliminary data and development of the VR model for state-variable assessment will be presented. We will investigate self-report levels of body satisfaction, body position within virtual space relative to virtual humans, visual attention within the virtual environment and frequency of body checking behaviors during VR. We hypothesize that state body satisfaction will vary as a function of the individual's perceived level of exposure (i.e. her appearance) in VR and the availability of prompts for social comparisons (i.e. others' appearance). We further hypothesize that greater reductions in state body satisfaction will be associated with visual attentional bias for weight and shape related stimuli, reduced approach behavior and increased body checking behavior, especially among subjects whose cognitive and behavioral features at baseline place them at risk for developing eating disorders.
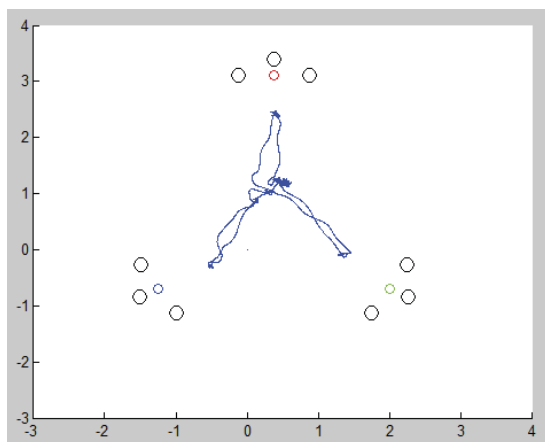
Figure 1. Sample interpersonal distance output. Avatars represented by black circles. Blue line represents the participant's body position on the x, y and z planes captured at a rate of 60 frames per second.

The optical tracking system will measure the interpersonal distance between the subject and each of the three groups of avatars in the virtual environments. We will calculate the minimum distance between the participant and each avatar. A sample visual representation of interpersonal distance data is provided in Figure 1.

4. Conclusions

Existing interventions to improve body satisfaction have limited effects. This study proposes a virtual assessment of body satisfaction focused on state variable fluctuations and interpersonal behavioral correlates. A clearer understanding of momentary changes in environmental predictors of state-level body satisfaction will allow researchers to develop empirically based VR treatments to improve body satisfaction and disordered eating behaviors. The level of environmental control provided by VR allows us to investigate behavioral correlates of body satisfaction in order to better understand the clinical correlates of elevated body dissatisfaction. This understanding may allow researchers to design future clinical interventions that more effectively improve body satisfaction by focusing on behavior change.

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The COST Action On Cyberbullying: Developing an International Network

Peter K. SMITH[a] and Georges STEFFGEN[b, 1]
[a]*Goldsmiths, University of London*
[b]*University of Luxembourg*

Abstract. The COST Action IS0801 on cyberbullying had the aim of a) sharing of developing expertise in knowledge base and measurement techniques across researchers, b) sharing of input from outside the research community; specifically, from legal experts as well as from mobile phone companies and internet service providers c) sharing of already nationally published guidelines, and recommended coping strategies, including positive uses of new technologies, and d) increasing awareness of the issue, as well as of the outcomes of the Action. Besides the conferences and Training schools organised, the Action has fostered or facilitated a considerable number of grant applications, publications as well as other outreach activities, and has established a fruitful international network.

Keywords. Cyberbullying, COST-action, international network

Introduction

Cyberbullying refers to bullying and harassment of others by means of new electronic technologies, primarily mobile phones and the internet. There has been much research and action on traditional forms of bullying in schools, with some success, but cyberbullying has arisen and increased in the last decade. This paper starts with a review of challenges of cyberbullying research. It continues with explaining what a COST Action is, and how an international network of 28 countries took forward aspects of research into cyberbullying [1].

1. Challenges of cyberbullying research

Although cyberbullying research is vigorous and has already achieved a lot, it faces some notable challenges. In particular, definitional and measurement issues need to be more fully resolved. Issues that needs to be addressed more clearly include when the incidence should be regarded as cyberbullying (with repetition) or cyber aggression (a one off act); and the notion of power imbalance. A more standardized approach to measurement in this area is needed [1]. A complication here is that the rapid historical changes in ICTs means that researchers need to continually modify instruments and be aware of new developments. These developments may have an influence on a variety

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[1] Corresponding Author: Georges Steffgen, INSIDE, Campus Walferdange, University of Luxembourg, L 7201 Walferdange; E-mail: georges.steffgen@uni.lu

of aspects such as gender and age differences or distribution processes of the bullying material. The field has also lacked an overall theoretical approach, although this can be said to be true of the field of bullying research generally [2].

However there are also many opportunities in cyberbullying research [3]. One is a broader disciplinary basis of research than is found in traditional bullying, including besides psychology and education, strong input from sociology, media studies, public health, law, and other social sciences; and a greater combination of qualitative and quantitative approaches perhaps following from this disciplinary breadth. There is the potential to make more use of young people themselves, not only as participants in focus groups, but also by involving them as researchers themselves, in the design of the study, and gathering data [4].

The nature of cyberbullying phenomena also inevitably directs us to broader contextual and developmental aspects. Contextually, we know that (even for school-aged children), most cyberbullying is not experienced in school; the perpetration, the witnessing, and the reception of cyberbullying acts will often be in homes, clubs, outside areas. Developmentally, cyberbullying may show more age permeability than traditional bullying; traditional bullying appears to vary substantially between the school setting and the workplace setting; but cyberbullying occurs in cyberspace, whatever age group is taking part. We need to explore and contrast in more detail the motives for cyberbullying, compared to traditional bullying. There also appear to be important national or cultural differences in cyberbullying which call for explanation [5].

If we face the challenges and build on the opportunities that the field offers us, this is an important and exciting program of an international research network that help us minimize the abuse of new technologies and ensure that cyberspace is primarily a happy and satisfying arena for human relationships.

2. International network on cyberbullying

COST stands for Co-operation in the field of Scientific and Technical Research, and a COST Action funds meetings, workshops and seminars, scientific visits, training schools, and dissemination in its particular disciplinary area. COST Actions primarily cover European countries, but a number of other countries have affiliation arrange-ments and possibilities. Many COST Actions are in operation at one time, over a wide range of disciplinary areas; see http://www.cost.eu/about_cost.

COST Action IS0801 started in October 2008 and like most COST Actions, lasted 4 years. Its full title was *Cyberbullying: Coping with negative and enhancing positive uses of new technologies, in relationships in educational settings*. This Action had the aim of sharing expertise on cyberbullying in educational settings, and coping with negative and enhancing positive uses of new technologies. The more detailed objectives were:
- Sharing of developing expertise in knowledge base and measurement techniques across researchers
- Sharing of input from outside the research community; specifically, from legal experts; and from mobile phone companies and internet service providers
- Sharing of already nationally published guidelines, and recommended coping strategies, in different countries, including positive uses of new technologies

in the relationships area; moving towards a common set of guidelines applicable for the European Community.
- Increased awareness of the issue, and of the outcomes of the Action, to likely beneficiaries of the Action.

The Action started with 17 countries at its inaugural meeting in Brussels, and rapidly grew to 28 European countries, by the fourth year of the Action. The European COST countries participating are shown in Table 1. In addition, four institutions in Australia affiliated with COST IS0801, and played a very significant role in the activities. One institution in Ukraine was also affiliated.

Countries which joined could, through their national COST Office, nominate up to two full members and two substitute members to the Management Committee (MC) of the Action. At the inaugural meeting, MC members elected Professor Peter Smith as Chair of the Action, and Professor Georges Steffgen as Vice-Chair. To take forward the aims of the Action, six Working Groups were set up, with a Chair and Deputy for each; these, together with their active membership.

The MC met at approximately six month intervals, to discuss the progress of the Action's aims and objectives. The meetings are shown in Table 1. Each meeting was in a different country, and opportunities were always taken to hold a (usually one-day) conference, with speakers from the COST Action but also local speakers, and a small number of invited speakers from overseas. In addition two Training Schools were held, as well as Short Term Scientific Missions (STSMs) were offered, which enabled researchers to visit an institution in another country for periods varying from one week up to three months.

The website of the Action was developed by Dr Ruth Sittichai, who also helped with much of the administrative work over the four years. The website can be found at http://sites.google.com/site/costis0801/.

On the first (home) page there is information about the Chair, Vice-chair, 28 participant countries, main objectives, aims, and a brief introduction about cyberbullying as well as information about timetable and management. The following pages include information about what COST is; Core Group Members (the Chair and Vice-Chair of the Action, and the Co-ordinators of six Working Groups); and information about Core Group meetings with agendas and minutes. The Management Committee page provides the information about MC members (address, contact details and publications) sorted by country. The Management Committee Meetings page has the agendas and minutes of meetings. The Working Group page has information about the six Working Groups. There is a member's name list with their email address. A workshop and conference page has information on workshops and conferences. The training school page has information on the two training schools; and the STSM (Short-Term Scientific Missions) page provides the reports of STSM that have been concluded. There are also links to related COST actions, Posters, newsletters, presentations at other conferences and the COST Vademecum. Finally, the *Guidelines for preventing cyber-bullying in the school environment* booklet has a link at the bottom, and also a direct link on the home page.

At the end of the four years, the Action was evaluated by COST officials and by Professor Kaj Björkqvist from Åbo Akademi, Finland. The evaluation was very positive; besides the conferences organized, many useful STSMs, and the Training School developed with Australian colleagues followed up by the second Training School in Turku, the Action had fostered or facilitated a considerable number of grant

Table 1. Schedule of main meetings of COST IS0801

Date	Venue	Organiser	Main events
October 2008	Brussels, Belgium	COST Office	Initial MC meeting; organisation of the Action.
April 2009	Lodz, Poland	Dr Jacek Pyzalski	2nd MC meeting; one-day conference *Electronic aggression among youth – the new manifestation of old phenomenon?*
August 2009	Vilnius, Lithuania	Professor Rita Zukauskiene	First Workshop *Cyberbullying: definition and measurement*. Invited speaker from USA (Professor Michele Ybarra). Abutted the European Conference in Developmental Psychology.
October 2009	Sofia, Bulgaria	Dr Katya Mihailova	3rd MC; one-day conference *Social Media for Children: Cyberbullying and Media Literacy.* Invited speaker from Germany (Mr Thomas Jäger).
April 2010	Melbourne, Australia	Professors Phillip Slee, Donna Cross	Training School *From research to policy and practice: Innovation and sustainability in cyberbullying prevention*; a collaborative venture between COST and DIISR, Australia.
May 2010	Antwerp, Belgium	Dr Heidi Vandebosch	4th MC; Second Workshop *Legal issues regarding cyberbullying.* Invited speakers from Belgium (Mr Luc Beirens), Ireland (Mr Paul Durrant) and Australia (Professor Sally Kift). Abutted e-Youth conference.
October 2010	Florence, Italy	Professor Ersilia Menesini	5th MC; 1 day conference *The always-on-generation: risk and benefits of new technologies*.
May 2011	Turku, Finland	Professor Maritta Valimaki	6th MC; Third Workshop *Adolescents and social media: Guidelines and coping strategies for cyberbullying*, combined with 2-day Training School. *Adolescents and social media interventions: methodological issues, and guidance and coping strategies for cyberbullying*. Invited speakers from USA (Professor Sheri Bauman) and ETUCE (Dr Susan Flocken).
November 2011	Dublin, Ireland	Professor Mona O'Moore	7th MC; 1 day International conference *Bullying at school: Sharing best practice in prevention and intervention.*Invited speaker from Norway (Dr Gaute Bjornsen).
June 2012	Paris, France	Professor Catherine Blaya	8th MC; International conference *Cyberbullying*. Invited speakers from USA (Professor Sheri Bauman, Professor Justin Patchin), Canada (Professor Shaheen Shariff), UK (Professor Sonia Livingstone). Many non-academic organisations attended.
October, 2012	Vienna, Austria	Professor Christiane Spiel	9th MC; International conference *Bullying and Cyberbullying: The Interface between Science and Practice*, held jointly with Austrian Ministry for Education, Arts and Cultural Affairs. Invited speaker from Council of Europe (Mr Childerik Schaapveld). Besides COST presentations, a session was devoted to the Austrian national strategies on violence prevention in the public school system.

applications and successes, and many publications and other outreach activities. At least four books and five journal special issues were closely associated with the Action.

3. Conclusions

Some journal reviews of cyberbullying already exist [3, 6, 7], but the area is developing very rapidly, in part as new technologies develop and new fashions (such as particular social network sites) appear. In this paper we briefly highlight some important research challenges.

Finally, the members of the international network will publish a book, which aims to present the major activities, findings and outcomes of COST IS0801 [1]. It is based on the four-year networking collaboration involving 28 European countries, plus Australia, in a sustained program of research, and training activities. This book brings them together in a way which will be interesting for all those researching in, or actively concerned about cyberbullying, and how Information and Communications Technology (ICT) can be abused, but also used positively, in schools.

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Estimation of Usefulness of Positron Emission Tomography (PET) in the Diagnosis of Post-Traumatic Stress Disorders- Preliminary Report

D. WOJTŁOWSKA-WIECHETEK[a,1], R. TWORUS[a], M. DZIUK[b],
A. PETROVIC[a], S. SZYMAŃSKA[a],
M. ZBYSZEWSKI[a] S. ILNICKI[a], P. KRZESIŃSKI[b]
[a] *Department of Psychiatry and Combat Stress, Military Institute of Medicine, Warsaw*
[b] *Department of Dermatology, Military Institute of Medicine, Warsaw*

Abstract. The aim of this study was to evaluate the possibility of using PET both in assessing the susceptibility to stress and in the diagnosis of post-traumatic stress disorders.

Mentally and somatically healthy soldiers were subjected to PET-CT head scan examinations before and after virtual reality stimulation with warfare scenarios. Despite stimulation of peripheral nervous system after 10 minutes, VR exposure in any of the examined soldiers simulation did not cause changes in any brain structure that was visualized in PET.

PET-CT head scan was also performed in patients with typical symptoms of acute PTSD according to the criteria of DSM IV TR. In those patients no changes in any brain structure was found.

Initially it was found that VR exposure techniques like clinically typical acute symptoms of PTSD do not leave changes in CNS, which could be visualized in PET.

The preliminary hypothesis was put forward that exposure to stimuli like symptoms of PTSD must remain long enough to induce permanent damage of brain structure.

Keywords. PTSD, PET-CT, Virtual Reality

Introduction

World literature describing the problem of PTSD refers to PET-CT scan as a method of imaging characteristic changes in CNS.

However PET-CT neuroimaging is quite an expensive examination and can be complicated with side effects of application of radioisotope. Trying to verify these reports we have planned a three-phase study in association with the Nuclear Medicine Department that should help us estimate the usefulness of a PET-CT scan in PTSD diagnosis in every phase.

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[1] Dorota Wojtłowska-Wiechetek, Department of Psychiatry and Combat Stress, Military Institute of Medicine, Szaserow Street 128, 04-141 Warszawa 44, Poland; e-mail:dw.wiechetek@gmail.com

1. Method

We selected a group of 24 healthy soldiers who were qualified to go on a 10th rotation in Afghanistan. Five of them (21%) disagreed on research while another 19 (79%) were hospitalized in the Department of Psychiatry and Combat Stress for 48 hours. On the first day both a psychiatrist and a psychologist examined them and they underwent a psychological test to exclude existing or previous PTSD. We have selected 14 soldiers (74%) who have gone through a basal PET (positron emission tomography) examination to asses basic brain metabolism and exclude any organic changes in CNS.

On the next day we conducted a study consisting of three parts using VR (virtual reality) equipment as a tool to induce stressor stimulus. Initially we measured basic parameters of life for 10 minutes: (HR) heart rate, (BP) blood pressure, (SC) skin conduction, peripheral temperature on the index finger and tidal volume. Then we split the study group in half. Group number 1 was introduced for 5 minutes into the VR environment using a Battlefield Fallujah scenario. Group number 2 was introduced into the same VR scenario but for 10 minutes. During this simulation we also measured life parameters. We noticed that all 14 soldiers (100%) experienced autonomic arousal manifested by an increase in HR, blood pressure and SC, which is a normal response to stress stimuli. For 5 minutes afterwards they were recovering using diaphragm breathing techniques as to calm down autonomic response. 30 minutes after VR stimulation they underwent another PET-CT scan to determine if short-term stress left any metabolic footprint in CNS. After this part of the study we treated soldiers before VR stimulation as a group without stressful events (group 0), soldiers after VR stimulation as a group with short-term stress, and soldiers with a short interval of time between stressful events and without any symptoms of PTSD (group A). Group A was also split in two parts: A1 and A2. A1 underwent 5 minutes of stimulation and A2 was exposed to 10 minutes of stimulation.

After collecting the results we went further and selected a group of patients (14 people) who were hospitalized in the Department of Psychiatry and Combat Stress. The group consisted of civilians and soldiers, all of whom experienced stress related events. (such as a car accident, a mine trap explosion, prolonged gunfire with the enemy, etc.). They met diagnostic criteria for PTSD according to DSM IV and the time from stressful event was from 1 to 8 years (group B)

Four of them have already undegone PET-CT scan examinations and the other 10 are waiting for a PET-CT examination in near future.

2. Results

After analysing the results of groups A1 and A2 we found that neither 5 nor 10 minutes of stimulation had left memory traces in the brain (which can be visualised in PET-CT). After analysing one third of group B we discovered that there also was not any changes in brain metabolism characteristic for diagnosis of PTSD. Concentration of 18 FDG was equally in all brain structures as well as in the amygdala, hippocampus and prefrontal cortex. The images of brain structures were not different from group 0.

Conclusion

The hypothesis we put forward is just an initial hypothesis and may vary because the whole study is still in progress. At the moment we are tempted to say that the PET-CT scan examination using 18FDG is not a proper tool to diagnose PTSD both in early (group A1 and A2) and late (8 years from the stressful event) phase (group B). It also indicates that fMRI which generates less costs and complications might be found as a proper neuroimaging study to explore changes characteristic for PTSD in every phase.
We are also convinced that we should look a little bit closer to stress inoculation. We noticed that after both 5 and 10 minutes of VR stimulation there was no metabolic response in CNS in contrast to PNS which was aroused. It shows that single stimulation regardless of the stimulation time can be useful only in learning how to control autonomous responses such as an increase of HR and BP by using diaphragmatic breathing. However, this may not be useful in desensitization. This will require further studies.

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