

## 5. Veränderung des Behandlungsalltags durch neue Medien: Virtual Reality und Serious Games

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### 1. Introduction

Mixed realities (MR) and serious games (SG) constitute two branches of the technological advancements that are transforming the field of mental health, including the clinical psychology and psychotherapy realm. Although there are a number of reasons to support the incorporation of these technologies into psychological interventions, its dissemination is still very limited. This chapter will start by describing the advantages of implementing MR and SG in the clinical practice, including practical examples. Besides, the main reasons to overcome the disarticulation between the ample evidence and the scant implementation will be outlined. Finally, the challenges for the near future will be presented.

Under the concept of MR are included virtual reality (VR) and augmented reality (AR), constituting a continuum from reality to virtuality in which the computer mediation determines the difference between the latter and the former. From the 90's on a significant amount of research has yielded evidence on the efficacy of MR, particularly VR, for several clinical conditions such anxiety disorders (Opris et al., 2012), posttraumatic stress disorder (Gonçalves, Pedrozo, Coutinho, Figueira, & Ventura, 2012), eating disorders (Gutiérrez-Maldonado, Ferrer-García, Dakanalis, & Riva, 2017),

psychosis and schizophrenia (Freeman, 2008; Veling, Moritz, & van der Gaag, 2014) and other conditions such as addictions, pain, obsessive compulsive disorder or autism (Valmaggia, Latif, Kempton, & Rus-Calafell, 2016).

In relation to SG, in the last decades game-based learning has raised the attention of many researches in the psychological field thanks to its advantages, like augmenting the intrinsic motivation of patients and increasing the possibility of customized interventions). Although there is little empirical support, a recent meta-analytical work has shown the efficacy of SG. This meta-analysis included primary studies in different psychological disorders, namely depression, post-traumatic stress disorder, autism spectrum disorder and alcohol use disorder (Lau, Smit, Fleming, & Riper, 2017).

However, the implementation of MR and SG in the clinical practice is still very limited. This phenomenon can be attributed to two main groups of reasons: on the one hand practical reasons, such as the costs of the devices required for a massive application, producing that only well-funded clinical settings have been able to afford these treatments (Lindner et al., 2017). On the other hand, the very well documented research and practice gap which also has its consequences in the technological realm. Mohr, Weingardt, Reddy and Schueller (2017) have recently provided interesting ideas why this gap exists, such as the fact that, there are developments of technological tools that do not consider from the initial steps how they will be applied into clinical contexts. This is in line with the “shift of paradigm” proposed by Fleming and colleagues (2016) which emphasizes the necessity to promote user-centered approaches fostering, for example, the reduction of time between the technological developments and their implementation.

Undoubtedly, these barriers should be hurdle in order to take advantage of the vast array of potentialities of new technologies. Table 1 presents the main advantages.

Table 1. Advantages of Virtual Reality and Serious Games.

ADVANTAGES	SCOPE
Ecology	Assessment and interventions
Control	Assessment and interventions
Personalization	Assessment and interventions

Dissemination	Assessment and interventions
Engagement & Adherence	Assessment and interventions
Efficacy	Interventions
Accuracy	Assessment

Namely, the integration of VR and SG and its implementation in the regular practice of psychological disorders could entail numerous advantages: More ecological, controlled and personalized assessments and interventions; a greater dissemination of evidence based treatments; an increase of the rates of engagement and adherence to the treatments; an increase of the acceptability of psychological treatments; and as a consequence of the aforementioned points, it can be expected an improvement in the effectiveness rates.

### 1.1. Ecological interventions and personalized treatments

The treatment of psychological disorders and human suffering places its core question on how to facilitate change. Every process of change constitutes a very daunting task, even in healthy individuals. Although traditional face-to-face treatments have proven to be effective for many psychological disorders (Nathan & Gorman, 2015), it is also true that a vast array of problems are indisputable such as the disarticulation between science and practice (Boswell, 2015), the scarce dissemination of evidence based practice (McHugh & Barlow, 2010), the existence of irrelevant research for practice purposes (Castonguay, Barkham, Lutz, & McAleavey, 2013); the high rates of drop-out (Swift & Greenberg, 2014); or the measurement obstacles due to the use of self-report questionnaires (Schwarz, 2007). Many of these barriers are the consequence of the difficulty to reproduce the real setting in non-representative environments, like a clinic. The use of technologies could instead be able to collect symptoms and reactions in real-time and in real-life situations, thus resulting in more ecological assessments and further improving the quality of clinical interventions (Stone, 1994). Likewise, many patients suffer from either the lack of personalized treatments due to the application of stiff protocols by the therapists or on the contrary of the lack of scientifically based treatments. Hence, VR can provide not only with more realistic environments (Riva, Baños, Botella, Mantovani, & Gaggioli, 2016) but also with multiple contexts and stimuli, that is what has proven to be the key issue for tackling a number of clinical

conditions, particularly anxiety disorders (Craske et al., 2014; Shiban et al., 2015). This could enable targeting patient's concerns about the real situations in a personalized way without losing scientific rigor. By doing so, a more accurate assessment and a greater translation of the therapeutic gains in the real life could be achieved (Morina et al., 2015).

## 1.2. Dissemination of treatments

One of the most challenging issues to overcome in the clinical psychology field is the great amount of untreated people suffering from psychological disorders. In this regard, dissemination strategies, such as new models of applications, are indispensable (Kazdin & Blase, 2011). As aforementioned, the integration of VR, SG and any available delivery technologies (e.g. principally smartphones) can enable a greater dissemination of evidence based treatments. Currently 2.32 billion people in the world are using smartphones (The Statistical Portal, 2017) and thus it is imperative to take advantage of this by facilitating the access of people suffering from psychological disorders to a wider range of possible interventions.

In this sense, if SG were routinely incorporated into the clinical practice, an increase in the adherence rates and engagement of the patients would be expectable. Meta-analytic studies in SG and gamification have proven their utility to enhance the therapeutic engagement (Looyestyn et al., 2017), motivation (Wouters, van Nimwegen, van Oostendrop, & van der Spek, 2013) and adherence to psychological treatments (Brown et al., 2016). However, there is only one study in which engagement was hypothesized to be a stronger predictor of outcome (well-being), while the rest of the studies principally aim at establishing the efficacy or effectiveness of gamification or serious game strategy (Brown et al., 2016).

With regard to VR, it has been shown the greater acceptability it has in comparison to traditional treatments, principally in the realm of specific phobias. The principal reason relies on the non-invasive way exposure is perceived when implemented through a virtual environment instead of the real stimuli (García-Palacios, Botella, Hoffman, & Fabregat, 2007).

It is rather logical to hypothesize that more engagement and greater acceptability is directly associated with higher levels of motivation and as an extension a higher motivation to change, all of which impact on the dissemination of the treatments.

### 1.3. Virtual reality to improve assessment

VR has traditionally been conceptualized as a powerful intervention tool. Nonetheless, it can be equally important for the assessment. An illustrative example is in the realm of personality: VR offers indeed the possibility to create prototypical and ecological situations for the assessment of personality traits (Cipresso & Riva, 2016). Nevertheless, until now assessment has been in a second order place in comparison to treatment. As stated by Freeman et al. (2017), almost all of the 46 available studies including some kind of assessment in VR were with the main purpose of validating a VR environment for further treatment use. The disorders in which a greater emphasis was placed with regard to assessment are psychosis and substance use disorder.

Additionally, assessment in VR could be benefited from further measurements. For instance, the field of wearable medical devices has rapidly increased in the last decades: technologically advances biosensors included in wrist sensors are becoming important tools for the psychological field, offering clinicians the possibility to monitor with a high rate of precision the psychophysiological indices of patients in real-time and real-life situations. At a developing research level, highly complex computational models (Cipresso, Bessi, Colombo, Pedroli, & Riva, 2017) as well as experimental studies with clinical population are being carried out (Dechant, Trimpl, Wolff, Mühlberger, & Shibani, 2017). In this sense, VR can be of great help in the improvement of less biased assessment (as self-reports), for example through the incorporation of biosensors that can gauge physiological responses.

## 2. How to overcome the identified gaps?

All the aforementioned potentialities can only have a real impact if the research findings can be translated into the clinical practice. Hence, three objectives should be targeted: a) Decrease of costs of hardware and software; b) Incorporation of other research designs, topics and methodologies; c) Integration of diverse technological developments.

### 2.1. Reducing costs

Fortunately, this has drastically changed in the last lustrum. The significant decrease of costs in the technology production is permitting a proliferation of MR in a number of areas, including AR in sports events (e.g. Wimbledon App) or massive smartphone's games (e.g. PokemonGo) or the use of VR for different commercial purposes (e.g. real

estate agencies, tourism or car dealerships among many others). In this regard, the integration of goal directed games (SG) with VR constitutes a promising tool for the massive dissemination of these kind of technological advancements in the clinical psychology. There are concrete examples that will surely help in reducing the costs and therefore increasing the dissemination, such as the latest PlayStation 4 which includes a VR system.

Despite the decrease of technological costs and the great diffusion of mobile devices among population, one of the most critical barriers for the application of technologies into the psychological field still remain the need for programming and graphic skills, generally missing among psychologists. A very promissory progress in this regard is the development of platforms such as InstaVR, Neuro3D or VREX (with free and paid versions), which allow for the creation of virtual environments without technical support (Cipresso et al., 2014; Vasser et al., 2017).

## 2.2. New research topics and methodologies

A determinant aspect to consider is the integration of positive elements into technology research. That is, incorporating the scientific principles of well-being into the design of e-experiences that foster positive change (Botella et al., 2012; Riva et al., 2012). Positive Technology is an emergent field within human-computer interaction that principally aims at understanding how evidence-based well-being interventions can be benefited from interactive technologies. In the last years, VR has produced important progresses in a wide range of areas (Baños et al., 2017). Moreover, there are already relevant improvements in the integration of mobile devices and VR both in terms of research studies and guidelines for its further development (Pallavicini et al., 2017). In the specific combination of VR and SG, positive technology is only now bringing forth the first studies, and only at an experimental level (Pallavicini et al., 2017).

Besides, the emerging field of embodiment constitutes also an area full of potentiality to enhance VR in clinical psychology. Both “virtual avatars” and “virtual bodies” are two forms in which this internal reality can be represented in a virtual environment. Although there is still scant applied research, there has already been shown that persons often react to virtual representations similarly as they react to “real” people, and thus individuals can psychologically identify themselves even with virtual representations that do not necessarily reflect their actual appearances (Bailenson, et al., 2005). In this sense, VR can provide the person with new self-representations very easily, by

modifying the appearance of one's avatar. This can be of paramount importance in all disorders where there are body image distortions, such as eating disorders (Riva, 2014) or body dysmorphic disorder (Veale, 2012). Moreover, regarding the use of VR for "embodying" virtual bodies, Riva and colleagues (2016) pointed out two ways to include the body in VR: through "incarnation" (making users' to feel their physical body within a virtual environment), and through "embodiment" (making users' to experience the synthetic avatar as if it were "their own body", that is, as if their physical body was replaced by the virtual one). Although these can be body illusions, they might be very powerful involving physiological and psychological consequences (e.g. Peck, Seinfeld, Aglioti & Slater, 2013). Recently, Falconer et al. (2014, 2016) have demonstrated some examples to decrease self-criticism, anxiety and depressive symptoms, promoting self-compassion through VR. This study suggests that the effects of "virtual" embodiment are of value to patients with different psychological disorders. Nevertheless, it constitutes a field that is in its infancy and much more should be researched, particularly in the clinical application.

Undoubtedly, one of the central aspects to foster the utilization of VR and SG in the clinical practice is the study of the therapeutic process. As stated by Meyerbröker and Emmelkamp (2010), scant research has been conducted on the therapeutic process, such as therapeutic alliance, expectations or particular slopes of change (e.g. sudden gains or early change). This could be of paramount importance in order to delimitate moderators, mediators and mechanisms of change that could explain for whom, how and why change should be promoted. Regarding moderators, it is possible that there may be people whose individual characteristics match better than others with VR treatments. Apart from classical statistical models, implementing novel statistic techniques, such as machine learning techniques, may shed light on this issue (Jordan & Mitchell, 2015).

Another aspect is the necessity of conducting more qualitative studies, which should provide valuable information to facilitate the incorporation of technological developments in the clinical practice. An example is the study conducted by Fornells-Ambrojo, Freeman, Slater and Swapp (2015) on experiences in VR with patients with persecutory delusions. Studying therapists' perspectives and experiences could be informative to delimitate how to overcome barriers and improve their attitudes towards technology in general and VR and SG in particular.

Besides, many disorders were not still researched and in those in which more research has been conducted (principally, anxiety disorders) there is a consensus on the methodological weaknesses that must be overcome. That is, to conduct studies with bigger samples and better controls (Page & Coxon, 2016) and to increment the quality standards of RCT's (McCann et al., 2014). Moreover, once implemented in clinical practice, it would be of paramount importance to study the translation of clinical improvements in naturalistic settings.

### 2.3. Integration as the compass for future research and practice

A unifying approach, not only in terms of articulation of the different available technologies and advancements (VR, SG, Ecological Momentary Assessment, Internet Based Treatments, etcetera), but also from a methodological and theoretical point of view, could provide a stronger support for the implementation, dissemination and further development of these technological advancements within the field of clinical psychology. One conceptual development in line with this is the Behavioral Intervention Technology Model that aims to provide the field with an integrated framework to better articulate the diverse advancements (Mohr, Schueller, Montague, Burns, & Rashidi, 2014).

As Table 1 illustrates, there are few studies integrating VR and SG which have been applied to clinical populations. Among these studies, only one incorporated an additional technology (mobile device; Botella et al., 2011). In the same line as VR literature, almost all studies are focused on phobias. Hence, these developments are necessary to be applied to other clinical populations as well. Besides, it must be mentioned that some other studies that are focused on non-clinical population and therefore centered on the prevention of obesity and emotion regulation respectively (Baños, Cebolla, Oliver, Alcañiz, & Botella, 2013; Vara et al., 2016).

Although it does not comprise SG components and it is not applied to a clinical population, the Interstress project is a paradigmatic example of complex integration of VR, mobile devices and biofeedback which should be taken as a reference to continue the progress in terms of assessment and intervention (Gaggioli et al., 2014).

MR

SG

MD BF Design

CP

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Botella et al. 2011	AR	Interacting with spiders while matching the pieces of a puzzle	Yes	No	SC	Cockroach phobia
Levy et al., 2016	VR	Interacting with stimuli by moving hands	No	No	Open study	Fear of falling
Merry et al. 2012	VR	Interactive fantasy game to deliver CBT	No	No	RCT	Depression
Miloff et al. 2016	VR	Interacting with spiders progressively	No	No	RCT	Cockroach phobia
Walshe et al. 2003	VR	Driving through a city environment	No	No	Open study	Fear of flying
Wrzesien et al. 2015	VR/AR	Interacting with cockroach	No	No	SC	Small animal phobia

*Figure 1.* Examples of research integration mixed realities, serious games and other technologies.

MR: mixed realities; SG: serious games; MD: mobile devices; PT: positive technology; BF: biofeedback; CP: clinical population; AR: augmented reality; SC: single case; WSD: within-subject design; RCT: randomized control trial;

### 3. Implementing VR and SG in the clinical practice

Although VR entails the numerous problems aforementioned described for the dissemination in the clinical practice, there are some examples of its implementation in regular practices that deserve to be described. The Psychological Assistance Service at Universitat Jaume I is an example of successful implementation of VR and SG in the routine clinical practice. Specifically, EMMA system is regularly used for all kind of traumatic and post-traumatic elaborations, in particular with adjustment disorders and post-traumatic stress disorders (to see the project in detail see Baños et al., 2009<sup>1</sup>). While it may be true that the infrastructure may be difficult to afford, once installed it does not need any different maintenance in comparison to other computers and it enables a powerful elicitation of emotions through an easy interaction of the patient with the system. More, after developing a SG integrated to a AR mobile device for

<sup>1</sup> Besides, in this website the technology is explained in detail <http://www.labpsitec.uji.es/eng/investigacion/rv001.php>

cockroach phobias (Botella et al., 2011), patients are able to practice exposure to the feared stimuli in different contexts, both before the VR treatment with the therapist and after the session, with the aim of reinforcing what had been learned.

Regarding the rehabilitation field, an illuminating example of the use of cutting-edge technologies in clinical practice is the “Cave” developed at Istituto Auxologico Italiano (Milan), a virtual room designed for Virtual Immersive Telepresence. Thanks to the 3D stereoscopy view linked to a positional tracking system, the "Cave" can measure distances and volumes giving users the sensation of being actually in the scene projected on the screens and reproducing visual, tactile and auditory stimuli. This technology permits that typical treatment scenarios for cognitive (like executive functions and memory) and psychological disorders (like phobias) can be simulated, offering patients innovative therapeutic interventions.

#### 4. Conclusion

VR is already a well-supported tool that has proven to be very useful for a wide range of psychological disorders. In the same vein, SG is increasing its role in the mental health realm and some scholars, indeed, claim that SG will be a central part of the future of psychotherapy (Fovet, Micoulaud-franchi, & Jardri, 2017). Nevertheless, huge efforts shall be made in order to implement the research progresses into the clinical practice. At a theoretical level, the aforementioned described integration is essential, not only to take advantage of the diverse utilities that each technology may entail, but also to better grasp the specific applications for the wide range of settings and disorders. At a practical level, it is indispensable to articulate the interconnection between research and practice by accomplishing a greater incorporation of these tools in the regular treatment of the patients. Finally, at an empirical level, it is essential to conduct effectiveness research studies on process and outcome,

#### Take home messages

- VR and SG can transform the field of clinical psychology
- A major articulation between research and practice is essential
- Some examples already show the potentiality of VR and SG for the clinical practice

## Acknowledgements

This work was supported by the Marie Skłodowska-Curie Innovative Training Network funded by European Commission H2020.

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