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Interreality: A New Paradigm for E-health

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Abstract. “Interreality” is a personalized immersive e-therapy whose main novelty is a hybrid, closed-loop empowering experience bridging physical and virtual worlds. The main feature of interreality is a twofold link between the virtual and the real world: (a) behavior in the physical world influences the experience in the virtual one; (b) behavior in the virtual world influences the experience in the real one. This is achieved through: (1) 3D Shared Virtual Worlds: role-playing experiences in which one or more users interact with one another within a 3D world; (2) Bio and Activity Sensors (From the Real to the Virtual World): They are used to track the emotional/health/activity status of the user and to influence his/her experience in the virtual world (aspect, activity and access); (3) Mobile Internet Appliances (From the Virtual to the Real One): In interreality, the social and individual user activity in the virtual world has a direct link with the users’ life through a mobile phone/digital assistant. The different technologies that are involved in the interreality vision and its clinical rationale are addressed and discussed.

Keywords: Interreality, Virtual Reality, Biosensors, Mobile Internet Appliances

Introduction

The aim of the present paper is to introduce and discuss “interreality” \cite{1, 2}, a personalized immersive e-therapy whose main novelty is the creation of a hybrid, closed-loop, empowering experience bridging both the physical and virtual worlds. The main feature of interreality is a twofold link between the virtual and the real world:

- **Behavior in the physical world influences the experience in the virtual world.** For example:
  - If my emotional regulation during the day was poor, some new experiences in the virtual world will be unlocked to address this issue.
  - If my emotional regulation was okay, the virtual experience will focus on a different issue.

- **Behavior in the virtual world influences the experience in the real world.** For example:
  - If I participate in the virtual support group I can SMS during the day with the other participants.
  - If my coping skills in the virtual world were poor, the decision support system will increase the chance of possible warnings in real life and will provide additional homework assignments.

In the next pages, we will present the different technologies that are involved in the interreality vision and will justify its clinical rationale.
1. The Technology

The bridge between the real and the virtual world is achieved using the following technologies (see Figure 1):

- **3D Individual and/or Shared Virtual Worlds (3DWs):** immersive (in the health care center) or non-immersive (at home) role-playing experiences in which one or more users interact with one another within a 3D world. A 3DW enables its users to interact with each other through motional avatars, providing an advanced level of a social network service combined with general aspects of fully immersive 3D virtual spaces. Residents can explore, meet other users, socialize, and participate in individual and group activities.

![Figure 1: The technology used in the Interreality approach](image-url)
• **Personal Biomonitoring System (From the Real World to the Virtual World):** typically 3DWs are closed worlds and do not reflect in any way the real activity and status of the users. In Interreality, instead, bio and activity sensors (Personal Biomonitoring System – PBS) are used to track the emotional/health status of the user and to influence his/her experience in the virtual world (aspect, activity and access). The link between the real and virtual worlds will be both in real-time - allowing the development of advanced dynamic biofeedback settings - or not, to ensure health tracking also in situations where an Internet connection is not immediately available.

• **Mobile Internet Appliances (From the Virtual to the Real One):** In interreality, the social and individual user activity in the virtual world has a direct link with the users’ life through a mobile phone/digital assistant [3].
  - **Follow-up (warnings and/or feedbacks):** it is possible to assess/improve the outcome of the virtual experience through the PDA/Phone, eventually also using the info coming from the bio and activity sensors.
  - **Training/Homework:** thanks to the advanced graphic/communication capabilities now available on PDAs/Smarthphone, they can be used as training/simulation devices to facilitate the real-world transfer of the knowledge acquired in the virtual world.
  - **Community:** the social links created in the virtual world can be continued in the real world even without revealing the real identity of the user.

2. The clinical use of interreality

2.1. The limits of Cognitive Behavioral Therapy

Cognitive Behavioral Therapy (CBT) is a psychotherapeutic approach that aims to influence dysfunctional emotions, behaviors, and cognitions through a goal-oriented, systematic procedure [4]. CBT has been proven to cure or significantly improve several psychological disorders such as depression, anxiety, and eating disorders [4]. CBT is significantly more effective, on average, than without treatment or other psychological therapies, and is at least as effective as medication. The American Psychiatric Association (APA) recommends CBT programs as the treatment of choice for several mental disorders, including anxiety disorders, major depression, and eating disorders, among others [5-7].

However, despite these promising findings, there are still limitations on the availability of these treatments, and not all the individuals who suffer from a mental disorder get to benefit from such programs.

Some mental health practitioners find it difficult to apply empirically validated programs, an important set of patients find it difficult or refuse seeking such help, or there are high non-acceptance rates of CBT and some therapeutic strategies are difficult to automate in these programs.

Some researchers think that it is the patient’s relationship with the counselor and their motivation that determines the chances of success as much as the therapy itself. Professor Mick Cooper, an expert in counseling at the University of Strathclyde, said it was "scientifically irresponsible" to imply that CBT was more effective than other therapies [8]. Forms of treatment such as person centered and psychodynamic therapy
could be equally effective and were backed by small but substantial bodies of evidence. CBT may be like putting a sticking plaster on a problem rather than getting to the root of the problem, he said. So, although the efficacy of CBT has been widely demonstrated, there is still room for improvement.

2.2. The advantages offered by Interreality

CBT has undergone a very large number of trials in research contexts. However it has been less efficacious in clinical contexts and it has become obvious that CBT has some failings when applied in general practice. For this reason, the Interreality approach tries to improve three critical limitation of CBT:

- the therapist is less relevant than the specific protocol used;
- the focus of the therapy is more on the top-down model of change than on the bottom-up;
- the protocol is not customized to the specific characteristics of the patient.

By creating a bridge between virtual and real worlds, Interreality allows a full-time closed-loop approach actually missing in current traditional Cognitive Behavioral Therapy (CBT) regimens. In Interreality:

• the assessment is conducted continuously throughout the virtual and real world experiences: Interreality enables tracking of individuals’ psycho-physiological status over time in the context of a realistic task challenge;
• the information is continuously used to improve and update the overall treatment protocol both within and between sessions: Interreality creates a conditioned association between effective performance state and task execution behaviors;
• the patient is the center of the therapy: Interreality uses bio and activity sensors and devices (e.g., PDAs, mobile phones) to track both the behavior and the health status of the user in real time and to provide targeted suggestions and guidelines.

Finally the sense of “presence” [9] allowed by this approach affords the opportunity to deliver behavioral, emotional and physiological self-regulation training in an entertaining and motivating fashion [10]: in Interreality the patients do not receive abstract guidelines but live meaningful experiences in which they can start to explore and act without actually feeling threatened. Nothing the patient fears can “really” happen to them in virtual reality. With such assurance, they can freely explore, experiment, feel, live and experience feelings and/or thoughts. Experience shows us that this allows the patient to “push the envelope” and try harder knowing they have the safety net of the virtual world to “catch them”. This empowerment speeds their progress and growth, and leads to their increased self-efficacy.

3. Conclusions

The clinical use of Interreality is based on a closed-loop concept that involves the use of technology for assessing, adjusting and/or modulating the emotional regulation of the patient, his/her coping skills and appraisal of the environment (both virtual, under the control of a clinicians, and real, facing actual stimuli) based upon a comparison of
that patient’s behavioral and physiological responses with a baseline or performance criterion:

- the assessment is conducted continuously throughout the virtual and real experiences;
- the information is constantly used to improve both the appraisal and the coping skills of the patient;

The advantages offered by this approach to traditional e-therapy are the following:

- an extended sense of presence: Interreality uses hybrid social interaction and dynamics of group sessions to provide each users with targeted – but also anonymous, if required - social support in both physical and virtual world.
- a real-time feedback between physical and virtual worlds: Interreality uses bio and activity sensors and devices (PDAs, Mobile Phones, etc) both to track in real time the behavior and the health status of the user and to provide targeted suggestions and guidelines.

References