

# Coronavirus: introduction of the application of augmented reality to help children with disorders to overcome the phobia of contamination facing an indefinite end of the pandemic

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## ABSTRACT

Augmented reality has been increasingly used as a therapeutic tool in psychiatry. In particular, augmented reality exposure therapy (ARET) has been developed from and proposed as an alternative to standard cognitive behavioral therapy (CBT) for the treatment of phobic disorders. Using real-time 3D model and visual displays, the child is immersed in different computer-generated virtual environments designed for different types of phobia. As imaginative or in vivo exposure therapy, ARET consists in a gradual presentation of phobic stimuli. The desensitization through ARET has been found to be efficient in different types of anxiety disorder, and in particular in phobic disorders.

The endeavor of this work is to examine researches done in the field of AR applied to children With Disorders. Thus, we will try to verify whether the use of these techniques makes useful or not an intervention in the case of children with disorder. The work presented aims at a reflection on the introduction of the use of AR in the treatment of these children by means of current researches. We will also observe, throughout this work, the involvement of NICTs such as augmented reality in changing the activities made with these tools on the didactic and methodological level.

**Keywords:** Introducing augmented reality, reflection, phobia, anxiety, phobic disorders

## INTRODUCTION

Since the coronavirus has entered our environment, it is now present in our minds almost at all times and despite everything we do not see it (normal, it measures 0.15 microns or 0.15 thousandths of a mm!).

Gone are now, well at least, when it comes to the visual representation of this enemy.

The current context as particular can be difficult to live for the children with a disorder, in the sense that they have difficulties to define the intensity of the health crisis, and consequently, can feel a feeling diffuse worry at the idea of being contaminated, or even being confined.

What are the measures to be taken to achieve peace of these children in such circumstances? And

what means to adopt in order to reduce their anxiety in an environment that is more or less inconvenient to live?

Children with disorder, who have learning difficulties, can be particularly affected during a prolonged absence from school.

The current situation in Tunisia and elsewhere in the world makes it necessary to put in place an action plan in order to maintain learning, and minimize the inequalities and the negative effects of this “pause” imposed on the school career of students suffering from disorders.

Research in the field of education in crisis situations allows us to identify three axes for planning education during the pandemic:

- Support parents;

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- Identify the needs of children with a disorder towards their teachers;
- Manage the educational resources of children with a disorder.

Our group of researchers at higher institute of specialized education (HISE) can carry out this work. Our fields of expertise are: education in emergency situations, science teaching and didactics.

In this topic, we will present the use of real-time three-dimensional 3D imaging methods and tools in order to overcome the phobia of contamination in the face of an indefinite end of the pandemic. This is why we used these NTICs to help children with disorders.

The equipment used to ensure such a lens includes: a high resolution camera capable of measuring depth, a virtual reality headset connected to a PC, as well as a computer with powerful memory. All of this will allow us to move around at our convenience in the 3D modeled space. You can also enlarge or reduce the chosen avatar on the marker, and understand how the modeled object attaches to the surface. The modeling recreated by these tools will be very interesting for the learning of children with a disorder.

We will use applications based on augmented reality created especially for this research, which will allow us to present all the information necessary for learning in the form of total immersion in 3D (compulsory use of Vuzix-200 glasses), in other words, to present in each scene a direct interaction with the chosen model objects (See example with children during the confinement period, based on an application allowing to observe and interact with the coronavirus as if it were in front of you).

See example with Students of “the unity of well” of the specialized education after the confinement period, based on an application allowing to observe and interact with the Coronavirus (as if it were in front of you).

It is possible to observe the COVID-19 virus before your eyes as if it were within reach.

To do this, simply follow the steps that will be available at higher institute of specialized education, and view the scene with your computers as presented as follows:

### Whatis augmented reality?

On a horizontal axis going from the real environment to a fully virtual world, AR is located on the left side of the axis, as opposed to “augmented virtuality” (AV) which concerns the addition of elements real people (people, textures etc.) in virtual environments. AR and VA are grouped together under the term “mixed reality” (Figure 1).

### How to use augmented reality for mental health?

Augmented reality makes it possible to confront an individual with simulations of realistic situations, to the point of misleading his senses and confronting him with the source of his anxieties. In fact, there is no longer a need for a therapist to accompany the patient in a crowded shopping center or on top of a building, for example. Even situations that are difficult to reproduce in reality, such as an assault or the sensation of flying, can be simulated.

Thus, in-situ coaching, the effectiveness of which is so often touted by physicians, can now be carried out directly within the walls of a practice. Better yet, AR makes it possible to manage the intensity of the simulations and to repeat the confrontation as many times as necessary.

Furthermore, many people may be reluctant to face their fears. Since augmented reality is not real, this reluctance tends to disappear. However, our body and mind behave as they do in reality within these artificial environments, and the lessons learned in AR are transferred to the real world.

## METHODS

Augmented reality would be especially useful as a tool of intervention to help children with disorders to overcome, the phobia of contamination facing an indefinite end of the pandemic. This technique offers an opportunity that is especially advantageous for this population [1]. The advantage of this method is that augmented reality opens a marvelous way of creating a safe and contactable virtual environment close to the real environment, can sometimes is disconcerting for children with disorders because it is difficult to grasp. Since augmented reality allows one to be placed in a non-real

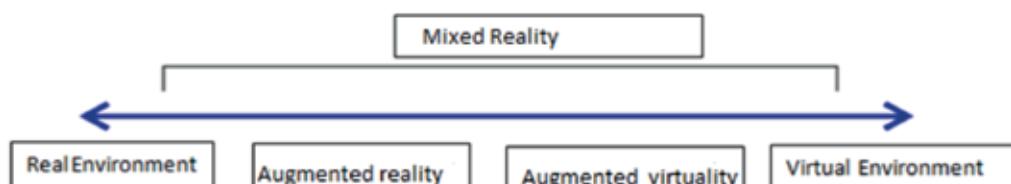


FIGURE 1. The continuum real/virtual

but effectively controlled environment, the person with an invasive disorder and phobia of contamination of the coronavirus can therefore exercise without being afraid of the consequences that would likely happen in a real situation. Sensory hypersensitivity is, found with children with disorders may feel invaded by certain stimuli of the real environment. Moreover, the created daily environment can simply be adjusted to each person according to his/her needs [2]. So the creation of well-defined specific intervention programs for each population is possible [3]. Given that children with disorders and the phobia of contamination of the pandemic have different specificities, some patients may speak, while others do not. Augmented reality offers a way to create a daily environment based on the weaknesses of the child and regarding his/her interests in order to improve the quality of his participation in the exercise [4].

It is simple with augmented reality to gradually increase the level of complexity and to modify contexts of learning [5]. Children with disorders usually have complexities in mental representations, as well as in the creativity [6]. So, in many cases it is not easy to imagine a realized scene. Augmented reality makes it possible to palliate this complexity by realizing for them 3D avatars or an imaginary scene representing the real world. However, many researchers warn users of this intervention because of its artificial nature. According to this latest method, augmented reality may be too safe for someone with disorders. Such person can become dependent on this new universe because it is more accessible and

would be likely to flee interactions with the created daily environment. Currently, augmented reality is only used in clinical settings with surveillance; so, the dangers of abuse and dependence would be fairly controlled. In addition, it is advisable to combine VR and/or AR interventions with more “classic” processes such as social scenarios or role plays. In any case, the potential gains of augmented reality for people with disorders and phobia of contamination appear to be very important as potential risks. With intervention techniques, augmented reality appears to be a practical modality for this population by demonstrating benefit. This method analyzing the use of augmented reality with this type of population was to establish whether children with disorders and phobia of contamination could tolerate an immersive virtual universe and provide solutions for this population.

### Result with 3d modeling

#### Use of augmented reality for child with disorders

A mental disorder, which can also be referred to as a psychiatric disorder or even a mental disorder, refers to a set of conditions and disorders of very

different origins leading to difficulties in the life of a child, suffering and disorders behavior. Mental disorders affect all populations, regardless of sex or age. These disorders can be chronic or permanent. This is why our research is based on the application of augmented reality to the problems of children with corona virus phobias [7].

AR is not only useful for therapy, but also for diagnosing mental health. Rather than relying on children's memories or feelings, we can run realistic simulations to test their reactions.

By confronting the user with their deepest phobias, it is possible to help them overcome their fear. The applications that we have made allow you to experience dealing with different phobias from home. Currently, augmented reality treatments require the presence of a qualified therapist. In the near future, the therapies could be delivered by a virtual therapist. Thus, access to psychotherapy could be much cheaper and open to as many people as possible.

In addition, therapists should set clear and realistic goals, and tailor those goals for each child with a phobic or disorder. This role of therapists is particularly important for children with a disorder and their parents, with whom it is important to communicate regularly and to conduct frequent assessments of their situation.

Therapists also need to strategically reduce their expectations of all children with a disorder and identify a few specific things that they want them to focus on, while making sure that the expectations are clear on both sides.

It is also possible to plan tasks to allow children with a disorder to work at their own pace, on their own or according to their areas of interest. We can therefore provide them with several exercises, which will allow the child to make his choice.

#### The foundations of Augmented Reality Exposure Therapy

Although the first augmented reality platform was developed in the last few years, at the Higher Institute of Specialized Education (HISE) the first tests of using AR for psychotherapeutic purposes were set up. This involved treating a child with the phobia of COVID-19 through exposure to virtual environments [8]. During this first experience, the original idea was to use RA (head-mounted display, PC, position marker) as part of the treatment principles of cognitive-behavioral therapy (CBT) which is the reference treatment for anxiety disorders [9]. In CBTs, the so-called standard exposure phase in vivo requires the patient to be exposed progressively, repeatedly and in a hierarchical manner to the avatars of corona virus that cause anxiety in order to obtain a habituation effect and decrease in fear as well as avoidance behavior until the phenomenon

of extinction of this phenomenon. Subsequently, with regard to AR, the phases of in vivo exposure to real photogenic situations or objects can be replaced by homologous situations in computer-generated images. It is therefore a question of substituting reality with stimuli artificially created and controlled in a real environment. This therapeutic procedure is referred to as AR Exposure Therapy (ARET). It aims, through confrontation, at getting used to conditional stimuli. By this process, it results in the extinction of the anxiety just like the classic treatment of TBI, but in a more flexible and more controllable environment than reality.

These ARET experiments were motivated by the fact that while the standard exposure of CBTs is recognized as effective, a significant proportion of children with phobic disorders are still reluctant to the idea of exposing themselves to real anxiety-inducing places during of in vivo exposure. Indeed, the majorities of children suffering from phobias seek professional help and benefit from exposure therapy. On the other hand, standard in vivo exposure has a practical drawback due to the inherent unpredictability of reality [10]. These situations present a varied number of real situations that can give us good results on the phenomenon of extinction of fear of COVID-19.

The ARET thus appears to have many advantages:

- The treatment takes place entirely in camera, which confers a degree of confidentiality and the possibility of monitoring the child suffering from a phobic or disorder [11];
- The child is exposed to controlled virtual environments exhibiting great flexibility and a wide variety of stimuli with adjustable situations in their nature and intensity [12];
- Virtual situations are not only gradual but they can be repeated ad infinitum;
- Prevention of any sensitization or any risk that could be incurred in vivo (fall, panic attack of dangerous avatars or during delicate situations such as COVID-19);
- The feeling of confidence useful for progress because of this confidentiality, this security, the presence of the therapist, the feeling of absence of real threat and the relative awareness that the exposure does not happen in reality [13];
- The motivational aspect that is generated by this new technology and its control capacity: several studies have shown a preference for ARET compared to traditional CBT [14].

## DISCUSSION

Augmented Reality Exposure Therapies for Disorders (ARET)

ARET has been used in a number of clinical trials focusing on various anxiety disorders. The clinical protocols for this work are similar in their use of augmented reality. It is about placing in a prolonged and repeated way.

Subjects with anxiety disorders in virtual situations that they avoid or fear because of their anxiety-inducing nature. These augmented reality exposure sessions are generally weekly and include a few sessions, the latter of which may last a few minutes. The measures of the therapeutic effect of this exposure are subjective (questionnaires that include different items to which the subject must answer before and after exposure) and/or objective. The latter are mainly represented by physiological tests and more rarely behavioral tests in situation [10]. Performed together these subjective and objective tests allow, in the presence of significant correlations, to further corroborate the results found.

### *Corona phobia*

Since the first ARET experience mentioned above in 2020, this type of phobia has benefited from a few studies, including controlled trials with a control group (no treatment) or with a group receiving standard exposure treatment. This early research effort on this phobia in particular can be explained by the economic stakes of large medical companies: annual loss for all international medical companies estimated at billions of euros in 2020 due to this phobia alone [13].

Thus, ARET's controlled trials for corona phobia compared to standard in vivo exposure treatment were completed by our research team in 2020 on tens of children with corona phobia. Our research groups received treatment sessions either in augmented reality, or in vivo exposure, which here represents the reference treatment. These studies found superior therapeutic efficacy of ARET compared to the control group and an equivalent effect compared to standard exposure treatment [9,12,13]. These positive changes lasted for a few months and the children did virtual workshops afterwards. This phenomenon supports the idea of transferring therapeutic effects from the virtual world to the real world. Finally, we have successfully performed other trials with variants such as the use of biofeedback (the use of physiological information to obtain a certain voluntary control of these parameters) [14] or exposure to virtual environments and real complementary, especially situations [8]. These virtual/real places, models of exhibitions and real rooms can also be used for other phobias. See example with Students of "the unity of well "of the "specialized education after the confinement period, based on an application allowing to observe and interact with the coronavirus as if it were in front of you).

## CONCLUSION

The technology of Augmented reality allows a learner to be immersed in a virtual or a daily environment close to reality created by a computer and in which he will be fully immersed and interact in real time. The virtual or real environments available to children with a phobic or disorder can represent any experimental situation, realistic or not. The application of this technological solution to psychotherapy and in particular to the principles of cognitive behavioral therapy has made it possible to obtain convincing therapeutic effects under the term therapy by exposure to augmented reality. Indeed, the clinical studies generated covering various mental disorders such as different phobias, demonstrate its experimental clinical efficacy as measured, depending on the work, by self-assessment questionnaires and objective measures (behavioral or physiological). In addition, we have underlined the motivation and the attraction that ARET triggers in children due to the involvement of this new immersive and interactive technology and this in real time which is sometimes similar to 3D cinema. This clear preference is also due to the great degree of control that it affords both children and therapists. However, it should be noted that most clinical trials have been set up with relatively small sample sizes and that some disorders have not yet benefited from experimental studies compared with the standard treatment. It should be added that not all of these same studies carried out long-term follow-up or measured the level of presence (sensation of immersion and interaction) during their treatment protocols. In addition, we can note that there remains a lack of consensus in the material used: each study

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