Augmented Reality and Education Sciences

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Abstract

The present paper reviews the field of Augmented Reality, starting from the current research and publications of this specialization, starting from the premise that augmenting reality implies an extension of virtual reality. Thus, types of implementations of augmented reality will be presented, emphasizing the HMD type, referring to an application of this kind, made by the author. Based on the application, the observations from a public presentation of it and, taking into account the way in which RA flirts with education, the educational perspectives of and how they can be implemented in the educational system will be presented. Also, in this paper will be presented the limitations of this technology, given that not every educational subject can be presented and taught in an immersive environment.For the implementation of the application under discussion, the technology was used Microsoft HoloLens 1 that combines an untethered device with apps and solutions that help people across your business learn, communicate, and collaborate more effectively.

Keywords: *augmented reality; head mounted display; education; hololensl*

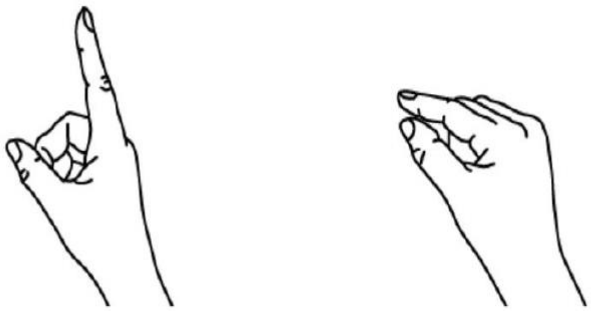
Augmented Reality - definition and technology

If we want to define exactly the field of Augmented Reality (AR), it cannot be said that there is a generally accepted definition that no longer requires further additions. If we were to compare, initially this concept with that of Virtual Reality, which introduces the user to another reality where, for his "functioning" in the physical world, his senses are no longer useful (virtual reality is replaced by the physical one), the augmentation of reality is only a supplement to the physical one (*Kesim and Osarzlam, 2012*). In this sense, it can be stated that the use of Augmented Reality

technology is justified because it extends the user's perception of the real world. (Swensen, 2016). However, in 2001 a definition was given (*Azuma et al*) described by three characteristics: (a) the combination of real and virtual objects in a physical reality, a real environment (b) Augmented Reality applications run interactively, requesting gestures or voice commands from the user; (c) the overlap of real and virtual objects, by their mutual alignment. Thus, it can be stated that AR allows the use of a tangible interface for manipulating objects, either real or virtual (*Singhla et al, 2012*).

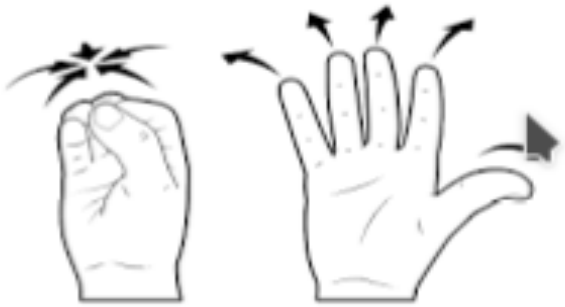
In order to display the digital content superimposed on the physical content, three types of devices were highlighted: (a) mobile, portable devices; (b) stationary units; (c) head-mounted display (*Azuma et al, 2001*). Given that many researchers haveaddressed the influences of mobile devices in education, in this paper we will focus on head-mounted devices (HMDs), even though these, though expensive and considered immature, are rarely used in education(*Nielsen et al, 2016*). One such technology that I interacted with is Microsoft Hololens 1, the first version of the device. According to Microsoft, Hololens is the first device that can be viewed as a holographic computer that displays images in the visible spectrum, in the user's field of view.

As mentioned above, augmented reality is considered an extension of virtual reality, but also an extension of the preception about the real world, running in an interactive environment. In this regard, pressing, buttoning or other similar operations in a 2D environment have been replaced with the user's gaze, gestures and voice, thus ensuring the launch of augmented reality applications, but also running them based on theinput of to the user. Thus, the most important operation for this device, performed by the user, is the look. This is the equivalent of positioning the mouse on a 2D desktop, so virtual objects can "respond" to gestures or voice, when it is detected. Obviously, we are talking about augmented reality applications that have defined certain behaviors at the time of gesture or voice detection. The HoloLens paradigm foresees two fundamental gestures, that of accessing virtual objects (AirTap) but also of returning to the previous menu, or home menu (Bloom). With these gestures you can create and generate a multitude of gestures, respecting the requirements of the application. In the figures below you can see the two basic gestures.



1. Finger in the ready position 2. Press finger down to tap or click

Figure 1. - https://docs.microsoft.com/en-us/windows/mixed-reality/gestures#air-tap



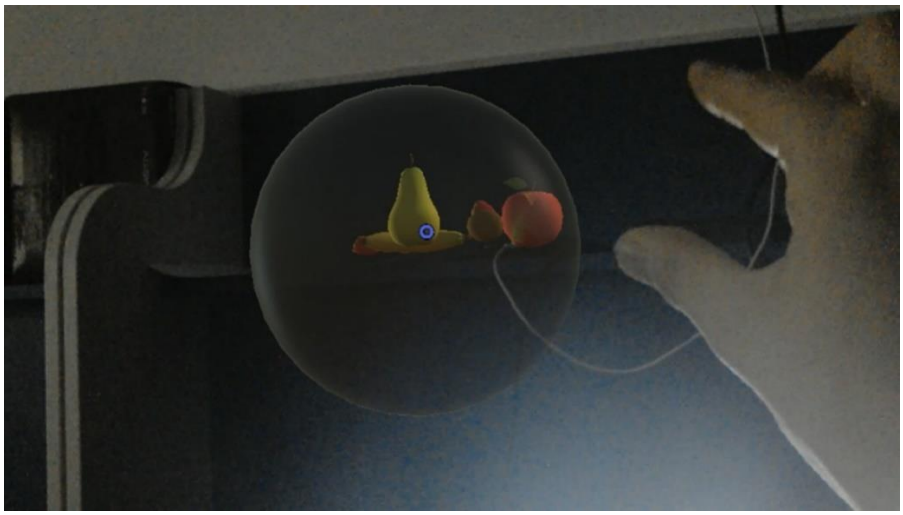
HoloLens Bloom gesture

Figure 2. https://arvrjourney.com/research-mr-content-types-interactions-gestures-interfaces-spacing-it-out-98c7ae752b3e

Educational observations on a personal application of AR

The application I developed is a new approach in terms of viewing, accessing and manipulating digital content in Augmented Reality. The feature of the approach is that the user, introduced to this reality, will be able to follow a completely organized approach to information, in the sense that the classic elements of a 2D Desktop (buttons, menus, toolbar, windows, folders and files, etc.) will be missing. they are completely replaced by elements of semi-transparent geometry (similar to the idea of a folder containing other folders or files inside it) that will contain various

virtual objects, such as fruits, machines or boxes (like files in a folder).Therefore, the information is organized on hierarchical levels, accessing them is possible through recognition of sight and gestures. Thus, it can be stated that AR allows the use of a tangible interface for manipulating objects, either realor virtual (*Singhla et al, 2012*). The figure below shows a screenshot of the application running.



3. Screenshot from the personal running application

Following a public exhibition through which the RA application was presented, a number of user difficulties were identified and identified. The first reaction, most commonly encountered, was that most users were blocked in terms of the definition of the "desktop" concept. For these people, "desktop" meant the display of windows, buttons, menus, etc., and a desktop in Augmented Reality meant transposing these elements into the new reality, this has been implemented for about 20 years. (*Regenbrecht et al, 2001*). Therefore, the users in question could not deduce that the application presented an elementary, immature model of 3D Desktop. However, once they had learned the name of the concept, many of them were still not convinced of how such a holographic interface could look like a desktop of a mobile device that they owned. Thus, HMD Augmented Reality applications are still at the stage of immaturity (*Nielsen et al, 2016*), but if we think of the concept previously defined as belonging to science and, based on the difficulties mentioned, the idea is validated that students perceive science (or, one side of it) as abstract, which makes it difficult to understand. To overcome this impediment, Gilbert stated (*2004*) that some special skills

are needed. In order to improve the visualization and comprehension skills of the visualized content, it is recommended to present a multitude of abstract visual images and allow them to access, manipulate and explore them (*Kozhevnikov et al,2007*).

Another observation regarding the difficulties of the users, considering the adaptation to the new concept or even the requirement for this software implemented for the industry, was that the current hardware device for which the application was programmed, is expensive for anordinary user, the device being purchased in within a research laboratory. However, as time goes by, devices will also improve, prices will decrease, and augmented reality applications will also improve, adapting to human needs and solving them. Thus, if we think about the first difficulty, it can be stated that the latter will have a natural solution, as time goes by.

Conclusion and educational perspectives

As it is easy to see in educational systems, one of the negative aspects of these is the lack ofmotivation among the students, perhaps because, over time, the familiarity with the teaching methods and techniques of teaching-learninghas intervened. To this problem, AR comes up with the solution of the idea again. The idea has always attracted the attention of students. In other words, augmented reality, immersive virtual environments can contribute to increasing the motivation of the students, bringing an additional possibility of increasing the performance in the instructional-educational process (*Pantelidis, 1995, Roussos et al, 1999, Winn,1993*). On the other hand, itshould not be neglected that the technology used, the application that will be developed, must meet the educational needs, be consistent with the objectives of the learning process and, last but not least, be adapted to the target audience (*Kaufmann, 2002*). It is useless an application that presents, for example, the sections of the human body, to children in the primary learning cycle, how, in the same way, the presentation of an application designed to help students learn, say, the alphabet, the high school students will have no impact positive. Moreover, the direct and immediate consequence will be the appearance of disinterest in the students, that is exactly the problem from which we started.

It should also be mentioned that educational goals are not without importance. In this way, not every educational subject, not every teaching lesson can be taught using this medium. From here

comes the role of the modern teacher to prove his creativity and originality in adapting his scientific content to be taught, to the new technology, in this new educational environment. Current research, however, has shown that Augmented Reality has been applied at an experimental level in schools over the past 20 years, obviously receiving the classical methods and procedures of teaching and learning (*Lee, 2002*). Probably, given the fact that the field is immature, governmentsprovide very low financial support (*Shelton, 2002*), so that the costs of technology, its introduction into schools, are difficult to cover.

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