## 1. Introduction

The idea of implementing a Desktop3D in Augmented Reality is almost 20 years old, when Regenbrecht, Baratoff and Wagner [1] wanted to implement a tangible 3D desktop environment. At that time, the implementation mode assumed that the 2D standard was simply integrated into Augmented Reality, so that the 3D Desktop was practically a "display" of the 2D desktop, becoming tangible. Two years later, desktop-like systems developed for Virtual or Augmented Reality were already implemented by Muder, Jansen, Rhijn [2]. Also, from the premise that the last 30 years have been dominated by the world of 2D desktops, Verdi, Nurmi and Hollerer [3] have also left, obviously, at that time the implementation was also in a way of designing only 2D digital content. , in the augmented reality. In other words, subsequently, the term "software visualization" referred to the same thing and then attempted an approach [4] 3D for the visualization of digital content, starting from the premise that the visualization in 2D space was (is now) supersaturated, feeling the need to evolve to the next dimension, Augmented Reality being stopped in this situation.

## 2. Application Concept

In this paper we will present the 3D Desktop as a multitude of augmented realities represented by a series of semi transparent spheres, which contain within them diversified content, such as fruits, cars or boxes. In this way, the support application does not introduce the user into Augmented Reality to see a standard, transposed 2D desktop (menus, lists, buttons, etc.) but only visual components that are totally different from a regular Desktop. The size of the spheres, but also the distance from the sphere to the earth reflects the size of the digital content.

The basic idea is that a sphere represents a directory from the standard 2D desktop, as we know it, and the fact that it contains objects means that that directory is one that contains, in turn, other directories or files. Thus, the size of the memory occupied by a directory is given by the sum of the size of each element inside. In this sense, the size of the sphere will be influenced by the amount of memory occupied by the elements inside. Thus, the fact that a larger sphere is attracted to more ground, means that the 3D director occupies a large space in memory. Given that the augmented reality is intended to be superimposed on the physical one, it is important that the built system respects and implements laws of the physical world, such as gravity, and the human mind already considers an axiom that any body in the physical world that has weight, is attracted to the ground. The idea is, therefore, to convert the digital information that we also know from the 2D world into properties of the physical world. So, returning to our app, the visualization system will contain a series of 3D directories located in augmented, virtual space, superimposed over the physical space. We call this first view the level 0 hierarchy of digital content.

In terms of data manipulation, the digital content must be interactive and accessible for users. Once these have been accessed, virtually the visualization system will display the contents of the respective sphere, that is, access to level 1 of the digital content, the next level in the hierarchy. It is important to keep in mind that the sphere, visualized at level 0, will contain only one object, representing that that virtual directory includes only objects of that type. In this sense, once accessed level 1, more information will be visible, ie more objects of the respective type, their number directly influencing the size of the sphere. Finally, the system must necessarily support a way to return to the previous level, this happening at the access of any file in the content of the sphere.

At this point, if we think of a standard 2D desktop, it is defined by a series of operations that define it, the first and most important being its visualization. Secondly, accessing the information hierarchy defines the system, otherwise it would be just a directory containing a series of files. If we consider these two stages as defining for such a concept, we can say that the support application for this paper constitutes a prototype for an interactive 3D desktop, consisting of several augmented realities that overlap over the same physical reality.

## 3. Implementation Details

In order to implement the concept described above, we used Microsoft HoloLens technology, which is "the first fully self-contained holographic computer running Windows 10” [5]. This involves a design stage and a programming, definition and modeling stage of the previously designed scenes. For the design stage, the Unity3D gaming engine was used, and the augmentation of the realities was achieved with the help of the C # programming language, Visual Studio as IDE. The interaction with the objects from the implemented reality scene "is built on gaze to target and gesture or voice to act upon whatever element has been targeted" [6]. In this sense, accessing the next level of hierarchy of digital content is achieved primarily by locating the object to be accessed. The application implemented the first form of input, Gaze. According to official documentation, "they gaze at you where the user is looking in the world and lets you determine their intent" [7] as in the real world, when you want to interact with an object, you first look at it. The support application for the present work has implemented this by modifying the cursor appearance when the user has the target positioned on an object.

Once an object has been located, identified, it can be accessed by performing Air Tap technology gesture. This is "a tapping gesture with the hand held upright, similar to a mouse click or select" [8]. Most of the time, users perceive this gesture and associate it with the "click" event from a standard 2D desktop. An important aspect to note about this gesture is that it must be executed so that it is visible to the HoloLens camera, so that the device can recognize this gesture. Thus, the object can be targeted, the gesture executed correctly, but the camera does not surprise this gesture, and therefore the expected effect will not happen. On the other hand, it is as possible that the object is targeted, the camera suppresses the gesture, but it is executed incorrectly. On this topic, Microsoft states that "Users need to be trained in this area of recognition both for success of action and for their own comfort (many users will initially assume that the gesture frame must be within their view through HoloLens, and hold their arms up uncomfortably in order to interact)” [9]. In the picture below you can see the gesture in which the user is ready to execute the gesture, as well as the moment when he has successfully performed it.

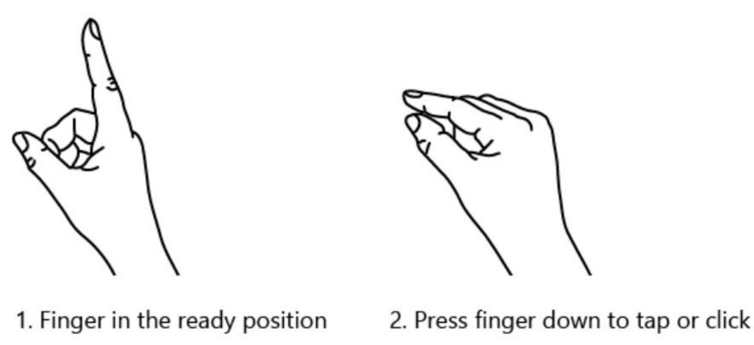


Figure 1. - https://docs.microsoft.com/en-us/windows/mixed-reality/gestures#air-tap

For the implementation of the gestures, it was necessary to insert in the design stage a package that ensures the implementation of event-related procedures, such as "OnInputClicked". Thus, once generated the behavior of the event, the script in which it is described, will be attached to the objects that want to have the respective behavior, the script being part of the objects of the scene. The tools used are those that are part of the MixedReality-Toolkit [10]. The behavior of the OnInputClicked function is shown below.

```
public void OnInputClicked(InputClickedEventData eventData) {
 GameObject[] objects = SceneManager.GetActiveScene().GetRootGameObjects();
 if (this.gameObject.name.Contains("Sphere")) {
  destroyPrefabsByName("Sphere", objects);
  if (this.gameObject.name.Contains("Box")) {
   loadPrefabsByName("Box");
  } else if (this.gameObject.name.Contains("ford")) {
   loadPrefabsByName("ford_GT");
  } else if (this.gameObject.name.Contains("Fruit")) {
   loadPrefabsByName("Fruits");
  }
 } else {
  destroyPrefabsByName(this.gameObject.name, objects);
  SpawnItems.Instance.SpawnManyItems();
 }
}
```

Figure 2. The Behavior of AirTap Gesture

## 4. Observations from a Public Presentation

In a public exhibition within a Shopping Center in Bucharest, an exhibition on the theme of Augmented Reality, the application was tested by a multitude of visitors, aged between 10 and 60 years. The reactions of the users regarding the technology and the concept implemented were different, based on different life experiences, their culture and education, but mainly on their contact with the technology.

As for the application, as we anticipated, it was difficult for users to agree that what they saw would be a desktop. Most expected to actually see a projection of a 2D Desktop, lists, buttons, menus, etc. This speaks clearly to the fact that the move to another kind of desktop will be done gradually, as people will be open to thinking or imagining their digital content in a different way than the classic one.

At first impression, visitors were interested to test the application, but the impediments of lack of experience with technology appeared immediately. Thus, one of the  impediments was that, after learning to properly execute the AirTap gesture, the next level of hierarchy was inaccessible. This was due to the fact that the users focused more on the correctness of the gesture and its positioning in front of the camera, but the target was not achieved (gas). Basically, they did not interact with any object, which, of course, had no effect. Another series of users reacted in the opposite direction: they focused on the object, but either they did not make the correct gesture from the first, or they did it correctly, but not in front of the cameras or in the field of view's cameras. Below, a series of images from the experiment are shown.

Figure 2. Photographs captured during an open exhibition to the public, showing visitors trying out our application for HoloLens.

## 5. Conclusion

According to the authors, this work does not necessarily have direct implications on the concept of "homo technologicus", but it demonstrates and strengthens the idea as technology, as physical tools as well as ideas and practices [11] is the one that transforms "homo sapiens" resulting in "homo technologicus", but in no case is it a plus for "homo sapiens", resulting in "homo technologicus" "[12].

On the one hand, if we consider the fact that in the implementation of the concept, in the running of the application are necessary gestures, a concentration of eyes to target the device, homo technologicus is, in fact, in this way "a symbiotic creature in which biology and technology intimately interact [13] who has a much more complex outlook on life, on what is possible or not, superior "homo sapiens", thus becoming happier [14]. On the other hand, the evolution of homo sapiens toward homo technologicus, or they-who-use-techn [15] is due to the fact that technology he guided the minds, invented himself, expanding our minds and nurturing human intelligence [16]. However, if we think of technology as the science of doing [15], extending the idea of a standardized 2D desktop to another way to look at the respective digital content, it can be said that homo sapiens and homo technologicus are not distinct entities, but rather, homo technologicus being a "virtual extension of the current" [17].

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