OPTIMIZING THE PERCEPTION OF REALITY AS A PRECURSOR FOR HUMAN EVOLUTION; AUGMENTING AND MIXING INFORMATION DOMAINS IN A SINGLE STREAM OF COGNITION

CILVĒKA UZTVERES OPTIMIZĀCIJA AUGMENTĒTĀS UN MIKSĒTĀS VIDES REALITĀTĒS

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Abstract: *Human vision is like a set of pictures moving through time. By analyzing individual frames, it is possible to find spaces of lower and higher priority, distant views and closely located objects. Regions of perceivable space are easily modifiable so that one can individually customize what one sees. Head mounted display technology, currently under development, allows for the modification of our vision, thus replacing the visible world with the artistically imagined or overlaying real time data over perceivable space. The future of perception omits distance – allowing contextual data to come through our vision, providing a digitally controlled perception system in a place of our natural one.*

Keywords*: Augmented Reality, Mixed Reality, Virtual Reality, the space of perception*

1. Introduction

According to anthropology, through the study of fossils recovered from the past two epochs – the Pleistocene and Holocene, humans have evolved over some 2.8 million years *[Campbell and Loy 2000]*, slowly evolving from self-reflecting importance and symbolic thinking, to planet size stratigraphy and its resources, developing constructions and engineering marvels, to satisfy the ever growing demands of humanity.

All living creatures are bound to change, they slowly adapt to the environments and conditions imposed on them. Their bodies and minds adjust for an ever-fresh start for future conditions in their development. Even the simplest things like the gurgling sound called speech or language, can lead to an efficient type of cooperation beyond predictability, creating new fields that are based on concepts of information rather than the available physical material, opening up the opportunity for culture.

Humans have evolved, body mass and strength of the muscles no longer being a part for success. Instead it is cooperation and the complex cognition of synchronicity in nature that have acted as building blocks, laying the foundation called humanity, social strata that are beyond an individual's capacity to maintain and nourish, beyond an individual's ability to survive.

However, as distant as we consider ourselves to be from brute nature, as close we still are to simplicity, like vision. Humans see the shape of things, just as animals see them, although there are differences between the species in terms of their adapted vision: it is adjusted and optimized to see the visible forms in nature and nothing beyond it.

The augmentation of reality [adding to the visible] is a logical step in human development. It is a process that involves fusing concepts from information domains (digital and analog) and technology. In its simplest form, it is adding contextual information such as street names on a building for everyone to see, as part of common knowledge. Next, wearable devices made for vision, sound and the tactile sensations as information could become personalized.

Information - both contextual and changeable - projected on top of physical forms, for a particular individual, only as long as is necessary.

The perception of the environment is a complex task that has been evolving for living creatures for the past 3.3 billion years *[Fliegel, et al. 2010]*. Visible physical forms combined with sounds and smells form that space-environment which we recognize as livable. Adding in

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our thoughts and subtle senses, such as telepathy *[Sheldrake and Smart 2000]*, form a daily routine for human beings, which helps preserve the body and the integrity of the mind.

Technology can add to the natural ability to see or hear. By digitizing the senses, it is possible to modify individual aspects of perception system in real time, through a digital filter for our natural ability to hear and see: (visible forms and sounds - to capture,>, to process,>, to add or subtract,>, to replace or modify - to see and perceive.)

Augmentation is a logical step forward and it is a common experience for mobile phone users', as well as anyone wearing a wristwatch. Mixed and layered information domains, visible and not part of the visible – e.g. the exact time in some particular time zone - are composed for perception. The next step is to organize and optimize and recognize the intricacies of the human's ability to perceive. All visible forms and sounds can be computed, sorted and prioritized. An important step is to organize an effective form of perception, as this lays the foundation of any decision that we make.

2. Virtual Reality, Augmented Reality and Mixed Reality

Virtual reality (**VR**) is the complete experience of being in a virtual space. Visible and perceivable forms are artificially synthesized and change according to the movements of the head. Such environments can stimulate our imagination by allowing us to walk in a fairytale land, or study a virtual model of the International Space Station, to prepare oneself for a spacewalk *(fig.1.)*.

Augmented reality (**AR**) is a logical layer of information that is laid on top of visible environments. These include contextual information like maps, photos, readouts from marked objects in the surrounding area, video calls, localization (GPS) etc. The visibility of the environment is a key function of this technology, while the information layer is somewhat secondary.

Mixed Reality (**MR**) – can capture real time environments to transform them completely or partially. Real objects found in nature, virtual objects, with layers of contextual augmentation can be mixed together, thus creating a futuristic space for us to see. All aspects of perception and vision that are exposed to human consciousness, can be analyzed in real time, adapted, changed, subtracted, or overlaid according to one´s needs and priorities. This ensures the maximum usability of the perception space by excluding information that is of little importance.

Fig. 1. **Virtual Reality Laboratory, NASA** (NASA (b))

Augmented and virtual reality technology devices have been in development since the 1960s (HMD – Head Mounted Displays):

[Morton Heilig (Heilig 1960; Heilig 1962), Comeau and Bryan (Headsight System, 1961), Ivan Sutherland - The Ultimate Display (Sutherland 1965; Sutherland 1968), British Aerospace and U.S.AirForce and Naval Research, ARPA (DARPA - Defense Advanced Research Projects Agency), Andrew Lippman (Aspen Movie Map, 1978), Michael Naimark and Scott Fishe, etc. [Sherman and Craig 2002, p.49]]

But, it is only recently that the technological aspect of these devices have advanced, gaining momentum for the mass-market consumer products. This was due to advancements in the mobile phone industry and greater monetary investment. Small sized high-resolution displays, high performance microprocessors, motion sensors, the size and power form factor, as well as the large number of enthusiastic people attracted to software development and content creation, are responsible for boosting virtuality, augmentation and mixed reality development. Today the consumer market is now saturated with approximately 60 different HDM devices and the numbers are rising.

[Oculus Rift, Sony Project Morpheus, Open Source Virtual Reality (Razer), Samsung Galaxy, Homido Virtual Reality headset, VīsusVR, SteamVR (HTC Vive), Google Glass, Sony "SmartEyeglass", Microsoft "HoloLens", Virtual Realities, Sensics, Cinoptics, Vuzix, Virtual Reality Laboratory (NASA), specific devices for medical applications HMS-3000MT (Sony), science and engineering, military defense, etc.]

High definition displays or two separate synchronized displays, one for each eye, adjusted according to individual pupil distance (IPD – interpupillary distance) and optics give focus for the eyes and a wide viewing angle (FOV) 90-110. Technology can be combined with real time video cameras, local small size projectors, while optical systems can be replaced with transparent multilayer LCD screens such as the Pinlight Display *[Maimone, et al. 2014]*. Motion sensors synchronize the movement of the head with virtual objects (stationary spherical movements, as well as movements in space). Processing power is used to compute the information flow with sufficient resolution and frequency, and some form of information manipulation i.e. approval, input, movement, search (hand movement, eye-lid movement, voice commands, haptic interfaces etc.,)

Software is also important, making use of ever-increasing microprocessor power to compute is gradually replacing the need for sophisticated physical devices, such as the use of photography and real time footage to reconstruct environments and objects recognition. If one can reconstruct the environment and know the distance to objects in space, as well as maintain perspective and to compensate human head micro and macro movements – it is possible to add information layers or replace real life objects in the environment, without causing discomfort or nausea to the senses.

3. Evolution of Sight

Evolution in nature forces all biological forms to gradually adapt to a constantly changing environment. It is a rather slow process and no additional joints or extended versions of vision will surprise us until the day our ancestors call. The opposite is true when speaking of today's digital development or digital evolution - "*Moore's Law (1965)"*, which has been so rapid that it can hardly be predicted where each ensuing success will open up previously unforeseen possibilities. Therefore combining biological and the digital world is a logical step in evolution *(footnote 1.)* and has been in the works for than half a century, beginning with the creation of the first computer. Today, small scale, high frequency, local and cloud based devices are available for our personal convenience and daily routines.

The next big step for human development, a priori, is the optimization of our vision – the visible and perceptible in nature. It is, or will be, possible if we choose, to saturate our individual

space of perception by optimizing the visible world, replacing it partially or totally with a synthesis of digital environments. This will be two to three meters in range indoors, but outdoors can extend to 100-200 m for a sense of space and orientation.

The ability to see is how we perceive the world, while natural human vision is not limited to the visible. The world we see is the space of perception, but If we analyze more closely, we have to conclude that the visible information that surrounds us, is not contextual in its nature or consistent with the time.

At work, at home, or in traffic, one sees things in a compulsory manner such as buildings and their features, trees, grass, people, vehicles passing and advertisements; things and objects, the primary existence of which do not provide the perceptual load of an individual. If human beings choose to be engulfed by never changing surroundings, and don't replace portions of their perception with up to date context, that is organized, arranged and geo-locally supplemented, their development will be slow, or, at least, predictable.

Fig. 2 **Mixed Reality environments** (authors´ imagery)

If we were to analyze photographs taken randomly in the street and marked all the things that appear, the existence of which at a given situation and moment of capture may not be important. We would start to screen the sky, buildings and trees, which are at least 100 meters away from the observer, leaving only the important features in the foreground - transport, humans, animals and terrain variation, as well as other close and potentially dangerous objects.

Eventually, we would have to admit that about 50% of the photographs' contents could be replaced with something else. The figure varies between 40 – 50% according to the information load in a picture. Forests, fields and rivers, the sky, are all information domains that can be replaced or safely supplemented, augmented, according to an individual`s mental and psychological comfort. This is because the information that exists in nature, and lies behind the security margins (100 – 200 meters) is more "aesthetic" than essential in principle.

Analyzing photographs automatically allows us to recognize the geometrical margins of objects, to create alpha masks, reconstruct virtual objects, three-dimensional fragments of the surrounding area (SLAM geometry) and to store the data as geo-tagged templates in a cloud database. By knowing the boundaries of an object and its proper perspective, while replacing the environment for HDM cameras, it is easy to supplement environmental objects with information layers, or crop data outside one's perception, thus leaving space for contextually richer

experience. Subsequently, each new path becomes a data batch in a cloud, where repeating patterns of movement are data driven and thus easier to compute and visualize.

In order to create conceptual environment perception, a number of preconditions exist:

People would have to willingly link themselves to technology i.e. the use of mobile devices such as phones with built-in GPS satellite navigation systems and HDM type equipment for mixed and augmented environment perception.

The person living in this environment would wish to avail of technology

The person would be communicative – voluntarily absorbing and engaging in a dense information space

The person would be looking towards the future with interest in order to experience it today.

If we can ensure the contextual nature and dynamics of environments, in other words the flow of information towards the object in nature (information overlay), and replace the "unnecessary" in the space of perception with a meaningful everyday variables, we can build the foundation for a greater involvement in life processes, to create a faster pace for the individual and the collective, thus reduce the response time to social change.

Conclusion

Further disentanglement of human beings from the collective and locking them into their own spheres of personalized information domains can be seen as a negative tendency in society; however, evolution is primarily a process projected away from herd instincts, towards individual experience and personal responsibility. Therefore, physical unavailability and non-communication with fellow human beings does not necessarily mean social isolation. The proof for this is the sweeping popularity of social networks; a person communicates and willingly communicates with stratigraphically similar, rather than physically accessible peers around them, with technology creating this opportunity, which is also an evolution – the niche of possibilities.

[Footnotes]

The word 'evolution' in this article indicates the possible development of perception as a means of human personal growth potential. The word is not used as perceived in natural science – the gradual transformation of the vision system of our species to the point where nothing will be perceivable without silicon microprocessor implantations

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