May AR Manipulate Users Subconsciously?

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ABSTRACT

Asimov's first law states: *A robot may not injure a human being or, through inaction, allow a human being to come to harm.* The increasing capabilities or AR now allow changing reality insofar that the reality may be perceived differently. Situations can be hidden or changed in appearance. This raises the question whether computer systems and AR may have the *right* to alter the reality and – if so – under which circumstances. Some examples are discussed to illustrate the spectrum of application and to build a foundation for further investigation now incorporating aspects of morality.

Keywords

Augmented Reality, Safety, Psychology, Morality, User Manipulation

1. INTRODUCTION

Augmented Reality has the potential to extend the surrounding of the user with computer generated 3D virtual objects. Advance in tracking and display technology allow more stable placement of such superimposed objects, letting them appear like real objects. Realistic computer graphics then can let such objects appear to be real objects. AR thus can not only be used to extend the environment of the user but also to change it. Such modifications to the environment may not necessarily be visible or even known to the user. Objects can be added, removed or moved to another location. A person then interprets situations from a different angle.

The possibility to alter the reality generates questions about morality. Should computer systems be allowed to change reality and, if the answer is positive, to what extent? Issac Asimov stated the three laws of robotics which define a similar context for that question. The first law [2] states that *a robot may not injure a human being or, through inaction, allow a human being to come to harm.* But may a robot, or as in our case, an AR computer system do changes to the reality? A changed reality on the one hand can possibly mitigate negative physical or psychological effects or on the other hand in effect only postpones more traumatic effects? Physical or psychological effects can be mitigated through hiding or changing a possible cause of such an effect. The affected person only sees his topic of concern and can fully focus on this without being physically or mentally captured of the situation aside. The risk of postponed traumas comes through later surveying the same location without the operating system. The user then realizes that he has been manipulated previously. The mental impact of the circumstances and the extent of the previous situation then generates a mental demand potentially larger in effect than a direct exhibition.

To investigate such effects, we propose a two-sided approach. We first want to initiate discussion about this topic to investigate the moral code to follow. We therefore sketch some examples that might be possible in near future. We are second interested in initiating projects that investigate the feeling of presence in augmented environments and the psychological effects of later push-backs to the normal environment.

2. EXAMPLES

This section briefly illustrates some examples showing how reality could be changed and what later negative effects could be.

2.1 Psychological Care for Paramedics

Disasters are events where many people are injured. Paramedics have to quickly check all causalities to determine when and how much treatment everyone needs. Nester and Klinker [4] developed a system to support this process of triage. What makes such situations so psychological demanding is that the whole environment is occupied by several other injured people who are triaged by the other onsite paramedics. Especially the number of injured people and their grade of injury often generate psychological pressure, forcing paramedics to require psychological consulting afterward.

Disaster management systems [3] are already used to reference causalities to paramedics. An AR system could visually (and acoustically) remove all those people not listed on the triage list of each paramedic. The actual psychological situation for each paramedic gets less demanding because the environment look much less densely filled, the paramedic gathers only some injured. The paramedic could better focus on his current task without getting overwhelmed by the whole situation. Later psychological treatment of the paramedic could be less necessary because the paramedic has never been aware of the whole extent of the disaster.

2.2 Compensating Fear of Height

With increasing urbanization and increasing technical development, many jobs have to be executed at great heights. While trained climbers can deal with height, others often suffer from a fear of height. Some jobs are thus complicated

to handle for such people, often even prohibiting them to work in such areas.

AR can make such working environment safer, at least visually. Railings or surrounding floors can be added to the surrounding of the user, generating the feeling of a more safe or less high environment. Here the danger is apparent. The immersive presentation of the safety enhancer can lead the worker to try getting hold at a virtual railing, thus letting him fall down. Suitably placed retaining elements can prohibit the user to even reach to these virtual railings and thus can eliminate the direct danger. The worker thus would think to work in an even or low environment and could fully concentrate on accurate work.

2.3 Indirect Support for Car Drivers

Car drivers, especially inexperienced drivers, can suffer under information overload, thus neglecting safety in traffic. Situations can arise where they are exhibited to too much information or to a visual stimuli, too intensive to get the attention off immediately [5]. Driver focused adaptive assistance systems could determine such situations before they occur and could wipe the irrelevant information from of the field of view. The surrounding of the car would be less densely filled and the driver could more easily capture the information relevant for driving.

Another area of application for automotive systems can use AR to give a reason to do a certain action. When, for instance, a driver assistance system detects a potential hazard like many nails on the road, it could show a car parking at the side of the street. The car driver would swerve around the parking car, thus avoiding damage on the tires or an accident.

3. DISCUSSION

Some examples have been illustrated in different areas of application. While there are many more further areas where AR can change reality, these examples are sufficient to initiate a discussion about the possible risks for the user of such a system. The risks can be categorized into two classes of effects in time. The first class contains direct reactions of the user when the system is turned off or taken off while using it, the second class contains all thoughts that follow after the current task has been executed and the user recognizes that he has been tricked by a computer system.

An immediate discover that the environment of the user is changed can occur through system malfunction or turn off. The user then can suffer under different effects. Information overload can be one effect if the content of the environment has been reduced. The spontaneous increase of input is in no way classified and it takes some time until the user oversees the situation again. During this time, accidents can occur because important information has a high chance to be neglected. Another effect is that the user gets aware about his current environment. In case of the high altitude worker the effect of the realization would be much greater than a normal fear of height and he would be stuck at his place. The mental impact of the spontaneous new situation is therefore expected to be much more immersive than it would be when the user enters it in a normal way.

The second class of situation realization contains getting awareness afterward. Here the AR user performs his task in the changed AR world but after fulfillment realizes the change. For the paramedic this can be described as the full impact of every step he did at one point in time instead of stepwise acquisition. The impact of the situation again is expected to be much more immersive than direct experience.

4. DIRECTIONS FOR INVESTIGATION

We propose two parallel approaches to define guidelines, conventions or rules for this issue. First, interdisciplinary discussion must be initiated to generate awareness about the issues. In parallel, research must be inverted in some areas. There is lot of research investigating the feeling of presence in virtual and augmented environments (e.g. PRESENCCIA [1]). It has also to be investigated how the step back to reality is the be executed. How can a human be taken out of the loop of a virtual or augmented existence without generating misunderstandings or mental effects as the traumas that were mentioned in the examples?

5. CONCLUSION

Increasing technical development of sensors and computer graphics allows developing realistic and immersive AR applications. The real surrounding of a user can be changed in many different ways with the user perceiving these changes. Some examples have been given to illustrate areas of applications that, on the first glance, appear to generate wishful developments. Working environments appear safer and crisis situations are less straining for people helping others. The second glance reveals that a later realization could generate a much more demanding mental situation or that even a higher risk for the user can occur immediately. We hope to encourage different research communities to investigate the question *how and to what extent reality may be changed.*

6. REFERENCES

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