# The brain on VR: Practical and ethical impact of the use of VR in video games

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# Abstract

With the advent of virtual reality, game developers and technology enthusiasts find themselves facing new challenges and new problems to overcome. The brain doesn't react the same way while experiencing virtual reality as it does when in front of a screen. This paper aims to explore the difference between how virtual reality is perceived compared to similar elements on screen to highlight its practical and ethical implications. Virtual reality being a quite recent innovation, content producers have yet to find the full potential, but also the limits, of this technology. If Virtual reality is already use by psychotherapists to treat various kind of phobias as shown in the work of Ivan Alsina, its impact on the brain can be a delicate issue when it comes to the entertainment industry. Michael Madary and Thomas K. Metzinger have recently published the first ethical code for virtual reality with some "tips" to avoid negative repercussions on the brain but this guide is only made of recommendations that game developers can use or ignore. For now almost each and every game studio has its own idea of what can or cannot be shown with virtual reality. With that in mind I would like to deepen my analysis by trying to find common points between the rules game developers impose to themselves, the ethical code of virtual reality and the studies led by various psychologists to draw an ethical line of conduct for virtual reality. The democratization of Virtual Reality, like any innovation, brings its own new questions. The level of immersion brought by this new technology can influence our brains and our perception of the reality in a way that has never been reached before. The lack of screen to determinate the limit between the real and the virtual world can lead us to "feel the game" strongly, resulting in perturbing situations for our brain. Virtual reality can even conduct the user to accept as their own part of their virtual bodies –or avatar- as shown in a study led by French researchers. In the latter, the academics "found that participants responded positively to the possibility of controlling the six-digit hand despite the structural difference, and accepted to some extent the virtual hand and individual digits as their own". If we can implement a part of the body through virtual reality, which impacts can that technology imply? If some researches have been done about the involvement of Virtual Reality in the treatment of psychological disease, how does it influence our brain? Finally, as Virtual Reality is mainly used in the entertainment sector, how do the video game producers perceive –and therefore limit- the potential negative impacts on the players? Through the use of already existing studies and a joined analysis between VR and game design ethics, this research paper aims to provide new insights for a possible ethical game design code of conduct.

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# Contents

*Chapter 1*

# Introduction

"Everywhere we remain unfree and chained to technology, whether we passionately affirm it or deny it. But we are delivered over to it in the worst possible way when we regard it as something neutral; for this conception of it, to which today we particularly like to do homage, makes us utterly blind to the essence of technology"( Heidegger, 1954) .

Neutrality consists in not taking part in moral or value choices. In that sense, being neutral would mean not going one way or another, the decision being made by other forces. But can technology claim such a position? In Gorgias, Plato declares that technology is only a way, independent from the purpose it serves. "So it is not the teachers who are wicked, nor is the art either guilty or wicked on this account, but rather, to my thinking, those who do not use it properly" ( A. Anderson, 1994). This perspective could also be found is Marx's work ( Marx, 1984), notably when he reminds the revolted workers that the machines should not be the target of their anger, but the industrial capitalist society which uses them.

If neutrality seems to be an important part in technology, it would be wrong to assume that it doesn't serve a purpose. Usually a new technique is created to generate efficiency, as Jacques Ellul describes it in his book The Technological society ( ELLUL, 2012): "The technical world, which produces the technical phenomenon, can be described as the quest of the one best means in every field. And this one best means is, in fact, the technical means. It is the aggregate of these means that produces technical civilization." Each way implicitly serves a purpose and the purpose of technology is efficiency. In a world where technology is everywhere, efficiency became the new ultimate goal. In modern society, Men have to be socially, sexually, economically efficient. The fact that the means determine the end can be attested by the way the advent of computer sciences fundamentally changed how we work, consume or communicate. Even if technology is not the only aspect that determines the social, cultural and economic relationships that identify a social period, Debray ( Debray, 1991) establishes that technology is one of the elements that should receive special attention. According to Debray, humanity has been through various stages, all defined by the leading technology of that time: The logosphere appeared with the invention of writing, the graphosphere with the advent of the press and the videosphere with television. Nowadays a new medium is taking the lead: Virtual Reality.

The twenty-first century has been marked by the sign of innovation. If we still can't drive flying car

or spend some family-time in space as the futuristic literature of the nineteenth century predicted, we can't deny that the technology sector has seen a massive development during the past twenty years. From cars that drive themselves to robots more realistic than ever, the world described in Back to the Future or in the Fifth Element doesn't seem so out of reach now that the first prototype of the iconic overboard is being developed by Lexus. If these innovations, all combined, could certainly enlighten us about the state of our society, this paper will reduce the scope and target a technology that would be more relevant in The Matrix than in Space Odyssey: the Virtual Reality. 2016 has been a turning point in both the virtual reality and the video game industry with the release of several VR equipment such as the Oculus rift from Facebook, the HTC Vive by HTC and Valve, the HoloLens by Microsoft or the Morpheus produced by Sony. If these technologies have been in use for several years in the research sector, their release for general consumption brings up new exciting possibilities but also new ethical issues. Innovations influence and are influenced by the socio-cultural context in which they are produced, but VR touches some sensitive notions such as "conscious experience," "selfhood," "authenticity," or "realness."

In his Discourse on Method, Descartes stated that "knowing the force and action of fire, water, air, the stars, the heavens and all other bodies that surround us, just as distinctly as we know the skills of our craftsmen, we might be able, in the same way, to use them for all the purposes for which they are appropriate, and thus render ourselves, as it were, masters and possessors of nature. This is desirable not only for the invention of an infinity of devices that would enable one to enjoy trouble-free the fruits of the earth and all the goods found there, but also principally for the maintenance of health, which unquestionably is the first good and the foundation of all the other goods of this life, for even the mind depends so greatly on the temperament and the disposition of the organs of the body"( Descartes, 1637). Indeed, technology changes the way with which humans interact with their environment, but by bringing new forms of interactions into our social life, virtual reality could not only change the way we perceive and interact with the world, but also modify the relationship we have with our own mind, as stated in the current ethical guide for virtual reality ( Madary and Metzinger, 2016). Innovations not only help humanity control and understand its environment anymore, but gains an introspective power, a tool to understand –and possibly model- human minds, which will lead us to consider Virtual Reality under the angle of modern philosophy of technology, as described by Philip Brey in his text Philosophy of Technology after the Empirical Turn ( Brey, 2010). According to the latter, technology can't be seen as a black or white area and has to be considered objectively by not blindly criticizing one innovation and adore another but by considering the "grey areas" in between. Virtual Reality being able to interact with a particularly sensitive field (the human mind), it has to be considered carefully as it can considerably improve our understanding and control of the human mind, but could as well be devastating. By analyzing the current state of the art in VR and video game ethic, this research paper offers to realize a joined analysis of these two fields in order to extract ethical recommendations for game producers. However, due to a lack of time and length restriction, the ethical guideline provided at the end of this paper can't be considered as definitive and calls for further researches.

## 1.1   methodology

In order to present a coherent ethical code of conduct regarding the use of virtual reality by game developers, this research paper will look at the state of the art concerning ethics in VR and in video games. By compiling the various ethical concerns presented by previous authors in these two fields, this research paper aims to extract pertinent ethical recommendations in VR to apply them to the video game industry and vice-versa.

## 1.2   Chapters breakdown

The first chapter, Virtual Reality, will look into the origins of VR in order to understand the current situation and provide a complete definition of that technology. Based on the previous code of ethical conduct regarding the use of VR published by Madary and Metzinger, we will then define the principal ethical concerns and the solutions offered by the preexisting code of conduct. The second chapter, Ethical consideration regarding video games, gives a state of the art regarding game studies in order to highlight ethical considerations brought up by professionals of the gaming sector. These ethical considerations will then be analyzed in order to provide samples of practical solutions. The third chapter, Joined perspective between VR and video games, aims to provide ethical recommendations about VR and video games by analyzing the previous recommendations and applying them to the other area (video game theory applied to VR and VR theory applied to video games). We will then provide a possible ethical code of conduct regarding the use of VR in the video game industry.

## 1.3   Contribution

The field of ethics in video game is still under-developed. This paper aims to give a state of the art of the ethical concerns in video games in order to extract a certain number of recommendations that could be used by the gaming industry. The code of conduct developed at the end of this paper doesn't claim to be a definitive guide but could be a first step toward further research.

# Virtual Reality

If every medium convey a certain representation of the physical world, immersive VR introduces new and dramatic ways of disrupting our relationship to the natural world. By playing with our perception, virtual reality allow the user to feel the medium in a depth that hasn't been reached before. If virtual reality can be defined under various forms, the main focus of this paper will be on immersive VR, in which subjects use a head-mounted display (HMD) to create the feeling of being within a virtual environment. However, a lot of the points evoked in this essay could probably be applied to augmented reality. By going back from the early stages of VR, this chapter aims to defines the ethical considerations of that field and give an insight of what could be done to prevent unethical use of it.

## 2.1 Early history of "VR"

The term "virtual reality" is now more than 20 years old. Yet, if it made its way toward our day-to-day vocabulary, the contour of its definition sometime appears to be blurry, if not nonexistent. Used to describe video-games, simulations (such as the one used by the NASA to train the astronauts) or even a movie with particularly impressive special effects, virtual reality appear to be a suitcase-term that regroups a large number of fields.

When the term "virtual Reality" was first used by Jaron Lanier ( Kevin Kelly and Stacks, 1989) in 1986 to describe the new immersive equipment produced by his company VPL Research, the field of study was already quite advanced. Virtual reality has been present under different forms since, aware of the importance of the perception, artists and scientist started to play with our senses to give us access to new universes, unavailable in the real world. "The most important sense for the perception of the outside world is that of sight. Through it we believe that we contemplate the objects themselves, as we believe we touch them by the sense of feel. The sight and touch appear to us to be the senses that testify in the most certain manner of the existence of other beings"( Ahrens, 1838).During the Antiquity already, artists painted trompe-l'oeil, showing that, by playing with the perspective, our sense of sight –and therefore, our brain- could be fooled. In 1824, the mathematician Peter Roget defined the idea of the persistence of vision, allowing the invention of the stereoscope by Charles Wheatstone (Fig 2.1) a few years later, in 1832. The stereoscope used a pair of mirrors at 45 degree angles to the user's eyes, each reflecting a picture located off to the side. It demonstrated the importance of binocular depth

perception by showing that, when two pictures simulating left-eye and right-eye views of the same object are presented so that each eye sees only the image designed for it, the brain will fuse the two and accept them as a view of one solid three-dimensional object ( Brewster, 1856).
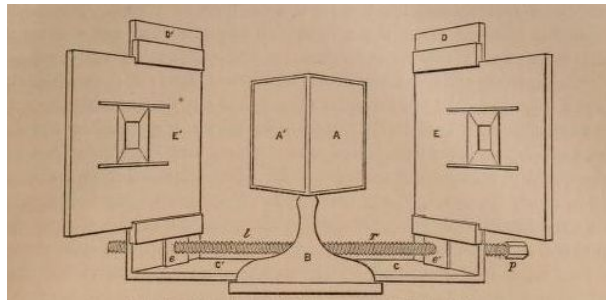


Figure 2.1: wheatstone's stereoscope. (front view)

This breakthrough in the world of image led to what can be considered the ancestor of virtual reality as we know it: the Link Trainer. Developed in the 30', the Link Trainer was used as a flight simulator to train the pilots of the American army, followed by the Sensorama (Fig 2.2) in 1962. The Sensorama, invented by Morton Heilig ( L, 1962), allowed the user to cycle around Brooklyn through a simulation thanks to a wide screen display for stereoscopic vision, surround sound reproductions, a vibrating seat, and a fan coupled to an odor diffuser.



Figure 2.2: An advertisement for the Sensorama.

In 1965, Ivan Sutherland ( Sutherland, 1965) pushes the relation between man and machine one step further and creates the first Helmet-Mounted Display (HMD). The latter is considered by its creator as a

"window on the virtual" and uses two monochromatic cathodic tubes but doesn't provide a stereoscopic view yet as the two images on screen are the same. The helmet was so heavy it had to be suspended to the ceiling, which got it the nickname "the sword of Damocles"( Bouvier, 2009). The stereoscopic HMD arrived a few year later, in 1970, with some improvement made by Daniel Vickers on Sutherland's helmet. In Vickers's version, the user had one screen per eye and the brain had to recompose the image to mentally form a stereoscopic view. Vickers also equipped his helmet with a head position and orientation tracker, so that the point of view was updated after each movement.

Scientists and engineers didn't stop at the sense of sight when it came to the development of new technologies for virtual reality. In 1971, Frederick Brook from the University of Carolina released the first prototype of a force feedback interface (the GROPE-1 project)( Brooks, Ouh-Young, Batter, and Jerome Kilpatrick, 1990). Brooks sought to enhance perception and comprehension of the interaction of a drug molecule with its receptor site on a protein by creating a window into the virtual world of molecular docking forces. He combined wire-frame imagery to represent molecules and physical forces with "haptic" (tactile) feedback mediated through special hand-grip devices to arrange the virtual molecules into a minimum binding energy configuration. Later, other similar system emerged, such as the ICA-ACROE laboratory system in France and the LEPES that, with a nanomanipulator, allows the user to feel the contact of objects of nanometric scale observed using an Atomic force microscope.

The early 80's and its digital explosion was a cornerstone for the development of virtual reality. With the democratization of the personal computers produced by Apple and IBM, computer science slowly made its way into the public life, bringing new perspective for the preexisting VR technologies. In 1985 the NASA launched the first HMD coupled with data-gloves to train the future astronauts. In 1986, the space agency started to test virtual interaction techniques of flight, scaling and rotation with the same installation. A whole new market was open and, following the supply and demand scheme, digital technologies became cheaper, faster and smaller. This evolution can notably been seen as this paper is written with the recent release of several VR headsets such as the Oculus Rift, the HTC Vive and their equivalent on the market. Yet, if virtual reality is reaching a new era, its definition isn't as clear as we might think. By combining the various definitions given by researchers through the years, we will try to define virtual reality in a more global way.

## 2.2 Definition of virtual reality

Ellis, in 1991, defined virtual reality, or virtual environment, as "interactive, virtual image displays enhanced by special processing and by non-visual display modalities, such as auditory and haptic, to convince users that they are immersed in a synthetic space" ( Ellis, 1991). Virtual reality isn't only about the technology anymore, it has to be immersive and interactive. The subject isn't simply a spectator as he would be in front of classical media such as television or cinema, but an actor of the world he's witnessing.

In 1992, Aukstakalnis and Blatner defined virtual reality as "a way for humans to visualize, manipulate and interact with computers and extremely complex data" ( Aukstakalnis and Blatner, 1992). This definition brings important notions to define what can be considered virtual reality: visualization, manipulation and interaction. These notions can often be retrieved in academical papers regarding virtual

reality, but it leaves aside an important part of the subject evoked by Ellis, especially when it comes to ethics: the immersion factor. The latter is however brought back in another definition of virtual reality, realized by Gigante and colleagues. In their article Virtual reality: definition, history and application, virtual reality is defined as follow: "the illusion of participation in a synthetic environment rather than external observation of such environment. VR relies on three-dimensional (3D), stereoscopic, head-tracked displays, hand/body tracking and binoral sound. VR is an immersive, multisensory experience" ( al., 2014).

For Burdea et Coiffet, virtual reality is about the triptych Immersion, Interaction & Imagination (Fig 2.3) ( Burdea and Coiffet, 1993). If the first two "i" -Immersion and Interaction- are globally considered as a sine qua non condition to consider an object as virtual reality by the scientific community, the third "i", Imagination, is still subject to discussion. Authors such as Fuchs, for example, consider that imagination contribute to immersion, but should not be evoked as mandatory or necessary. To that triptych, Von Schweber ( Schweber, 1995) and Slater & al.( Slater and Usoh, 1994) added a final touch: the credibility of the simulation. For them, virtual reality can only be consider as such if the subject believes in what he sees, hears or touches. This part is particularly relevant to study the question of ethics in virtual reality because, as we will explore in the next part, the sense of actually "being there" is what will impact the subject's psyche.
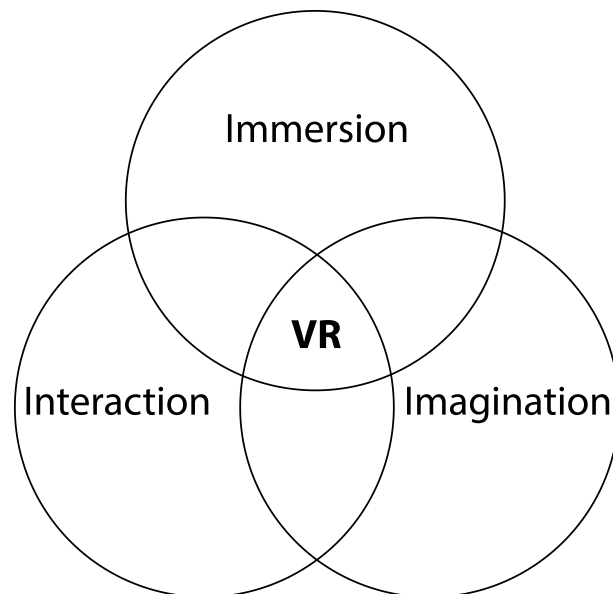


Figure 2.3: Virtual reality as seen by Burdea and Coiffet

By combining the various definitions previously evoked, we will, for the purpose of this paper, define virtual reality as a credible virtual multisensory environment in which the subject can interact through an avatar to foster a sense of immersion.

## 2.3   Embodiment and ethical concerns

As most species, humans have to adapt to their environment. When we meet new people, or simply by changing our routine, we keep redefining our behavior depending on where we are and with whom.

We are constantly changing or behavior to fit the situation in which we find ourselves, influenced by external factors we don't even notice. Adapting is the foundation of evolution, it is basic instinct, but by putting subjects in unprecedented situations, virtual reality can distort the way we react to change. Virtual reality introduce a new type of environment, somewhere between real and digital, in which our way of thinking might not apply. these changes in the way we interact with our world can have far-reaching consequences, as Madary and Metzinger evoked in their Ethical code of conduct: "It is not excluded that extended interactions with VR environments may lead to more fundamental changes, not only on a psychological, but also on a biological level" ( Madary and Metzinger, 2016).

### 2.3.1    Context sensitivity

Proving that human is a context-sensitive specie have been done by multiple behavioral researches. We are constantly influenced by external forces, whether we are conscious of it or not. We learn to interact with the world by first mimicking the acts of our parents, we put a foot in front of the other to walk like we are taught to, we speak the language of the country we were born in and we act as it is expected from us when possible. Our role in society is internalized, and we act in accordance to what we think is expected of us.

For example, we all have a certain idea of what an inmate or a guard should act like. The hierarchy between these two entities seems quite clear: the guards are hierarchically higher than the inmates and can, therefore, use their power to "control" them. But what if guards and prisoners were only played by neutral people? Would that hierarchy be relevant if everything was simulated? The Stanford Prison Experiment, in which normal subjects played roles as either prison guards or inmates showed that, simulation or not, the way the subjects behave is linked to the environment in which they evolve. As they were playing one side or the other, participants began to show pathological behavioral traits ( Haney, Banks, and Zimbardo, 1973).

The same conclusion apply to the question of authority. We are raised to believe that we have to follow the rules given by those in power. If these rules are usually built for the greater good (the law for example), authority can be abusive, or in contradiction with our moral values. When confronted to a situation where the authority in command is contradicting our moral system, we tend to follow the principle that the person in charge has to be obeyed, as shown in the Milgram's obedience experiment (Fig 2.4), in which subjects obeyed orders that they believed to cause serious pain and be immoral ( Milgram, 1974).

Executing the order given by the person in charge, even if it seems wrong to us, can be considered as normal. The authority knows, the mass executes. We are raised to listen to the higher authority, but we also experiment (often very young) that to blend in is an effective way of being accepted by our surroundings. Asch's conformity experiments, for example, showed that subjects gave obviously incorrect answers to questions after hearing confederates all give the same incorrect answers ( Asch, 1951). Following the same concept of social pressure, a more recent study has shown that the amount of money placed in a collection box for drinks in a university break room was measured under a condition in which the image of a pair of eyes was posted above the collection box. With the eyes "watching", coffee drinkers placed three times as much money in the box compared to the control condition with no eyes ( Bateson, Nettle, and Roberts, 2006).
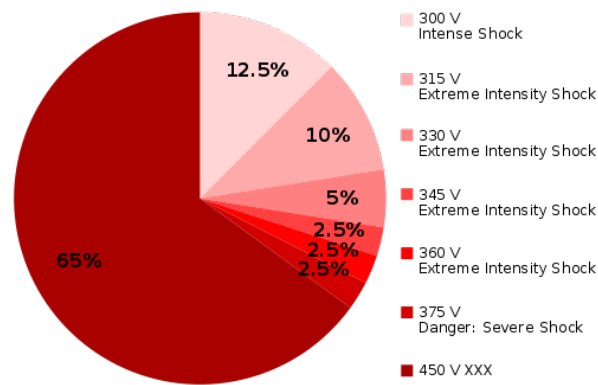
Figure 2.4: The percentage of participants reaching the various levels of voltage during the Milgram experiment

Social is an important -if not the main- part of our environment. "Man is a sociable animal" as Aristotle said, and, as a sociable specie, a huge part of our behavior is defined by the people around us. For Heeter and Metzinger, social is a vital part of virtual reality as it greatly improve our sense of presence. Sociability is what gives meaning to our actions. Is it still a victory if nobody's here to see it? As in reality, being recognized in the virtual world as a real being by one's pairs is determinant in the feeling of being there ( Heeter, 1992; T. Metzinger, 2004).

### 2.3.2  Placticity of the human mind

We have seen that virtual reality can influence our behavior by simulating various social situations. However, the plasticity of the mind, as called in the Ethical code of conduct, is not limited to behavioral traits: the mind is plastic to such a degree that it can misrepresent its own embodiment. When we dream, for example ( Windt, 2015) our brain builds its own representation of ourselves, but what we could consider as an effect of unconsciousness can also happen when we are awake and aware of our environment. Such phenomena (misrepresentation of the body by the brain) can notably happen after a trauma. For example, it is not rare to find amputated people still feeling their missing body part. This feeling has been notably described by Brugger and al. as the phantom limb experience ( Brugger et al., 2000). More radical representations such as out-of-body experiences ( T. Metzinger, 2009), and Body Integrity Identity Disorder ( Ananthaswamy, 2015) could also be a proof of the power of the human mind regarding its own embodiment.

Virtual reality is, so far, the only technology capable of modifying the functioning of the brain itself. This misrepresentation of the body by the brain, as interesting as it is, can sometime include a shift in what has been termed the phenomenal "unit of identification" in consciousness research ( Thomas K Metzinger, 2013).

### 2.3.3  UI-Manipulation

The Unit of Identification -or UI- has be defined by Metzinger in 2004 as "the form of experiential content that gives rise to autophenomenological reports of the type "I am this!", phenomenal unit of identification, determinate representational content, which in turn constitutes the system's phenomenal self-model" ( T. Metzinger, 2004) We could define UI more simply as the way we define ourselves.

This way we perceive ourselves is determined by two main criteria: The minimal UI, constituted by pure spatiotemporal self-location ( Blanke and Metzinger, 2009) and allows us to know where and when we are, and a maximal UI, "likely constituted by the most general phenomenal property available, namely, the integrated nature of phenomenality per se" ( Thomas K Metzinger, 2013).

Virtual reality is able to reach that Unit of Identification, which can confuse the brain about its own embodiment. Such confusion has been tested during the Rubber Hand Illusion experience in which the illusion of embodiment has been created by having subjects look at a visually realistic rubber hand in a biologically realistic position ( Botvinick and Cohen, 1998; Tsakiris and Haggard, 2005). The experiments showed that when the rubber hand was stroked at the same time as the subject's hand (which was hidden), the subjects started to experience the rubber hand as their own.

In the same vein, the six finger experiment realized by Hoyet and al. and based on the rubber hand illusion used virtual reality headset to induce the embodiment of a sixth finger in the subject hand ( Ludovic, Ferran, Corentin, and Anatole, 2016). The research has shown that "participants responded positively to the possibility of controlling the six-digit hand despite the structural difference, and accepted the six digit virtual hand and individual digits as their own to some extent" (Fig 2.5). If the rubber hand or the sixth finger experiment can create a partial illusion of embodiment, the same basic idea can be used to create the full-body illusion, on a global level.
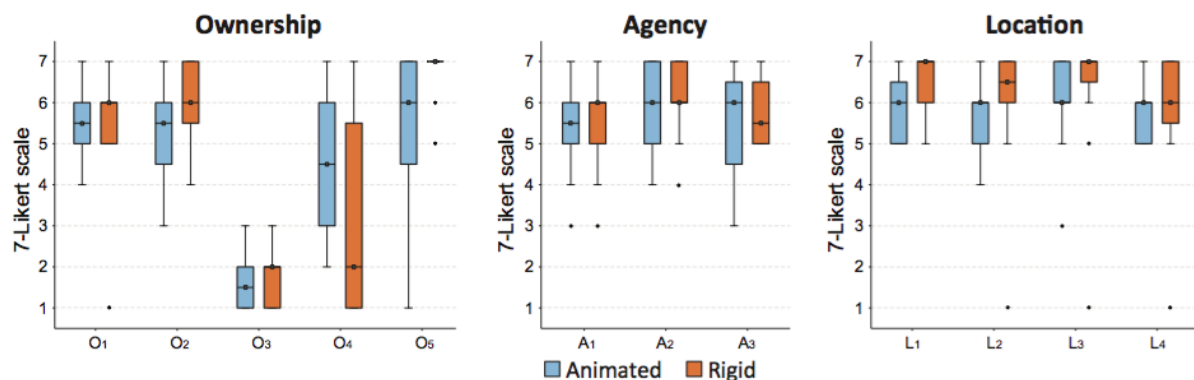


Figure 2.5: Ownership, agency and location rating during the 6 fingers experiment

Lenggenhager and al. have found out that, when being stroke on the back while seeing an avatar simultaneously stroked on the back, the subjects felt as if the body that they saw in front of them was their own ( Lenggenhager, Tadi, Metzinger, and Blanke, 2007). Tactile feedback is not the only way to form an illusion of embodiment, Maselli and Slater have found that a virtual arm with a realistic appearance co-located with the subject's actual arm was enough to induce the illusion of ownership of the virtual arm ( Maselli and Slater, 2013). In addition to visual and tactile signals as the one evoked previously, recent work suggests that manipulations of interoceptive signals, such as heartbeat, can also influence our experience of embodiment ( Aspell et al., 2013).

### 2.3.4  Lasting effect of VR immersion

If virtual reality can influence our behavior and the way one perceive himself, the psychological influence it has on the subjects goes even deeper. Virtual reality is quite new to the general audience, but academics have studied it for close to twenty years, and their studies show that virtual reality can have long-lasting psychological impact, making it more delicate to apprehend that the already existing medias.

In the virtual pit experiment realized by Meehan, Insko and Whitton in 2002, subjects were immersed in a virtual environment in which they (or their avatars) were standing at the edge of a pit. The goal, for the subjects, was to drop a bag on a target at the bottom of the pit. Despite the fact that they consciously knew they were actually standing on a wooden platform placed at 1.5" of the ground in a laboratory, the subjects showed signs of stress such as increased heart rate and skin conductance ( Meehan, Insko, Whitton, and Brooks Jr, 2002). The same sense of fear have been observed in various users of "The Walk" for the HTC Vive (Fig 2.6) in which the subject has to walk on a virtual wooden board placed hundreds of meters away from the ground. Presented in various gaming conventions, the videos of the terrified subjects are now invading the web. Another experiment reproducing the famous Milgram obedience experiments in VR found that subjects reacted as if the shocks they administered were real, despite knowing that they were merely virtual ( Slater et al., 2006). If the environment is virtual, the emotional response is real, but feelings aren't the only thing that can be triggered by a simulation.



Figure 2.6: Screenshot and setup of the VR game "The Walk" for the HTC Vive

We have seen previously that we accorded our behavior in order to fulfill the criteria given by society to be considered "normal". This constant adaptation to social situation has been called the Proteus Effect by Nick Yee and Jeremy Bailenson. This effect occurs when subjects "conform to the behavior that they believe others would expect them to have" based on the appearance of their avatar ( Yee and Bailenson, 2007). They found, for example, that subjects embodied in a taller avatar negotiated more aggressively than subjects in a shorter avatar. The age of the avatar can also impact the behavior of the subject linked to it, as shown by Hershfield and al. Their study revealed that people embodying

older versions of themselves as avatars had a tendency to allocate more money for their retirement after leaving the simulation ( Hershfield et al., 2011). In the same vein, Rosenberg et al. had subjects flying through a virtual city in an helicopter or simply by flying like Superman. They found that subjects given the superpower were more likely to show altruistic behavior afterwards – they were more likely to help an experimenter pick up spilled pens for example ( Rosenberg, Baughman, and Bailenson, 2013). This potential positive impact of virtual reality has also been explored by Peck et al. in an experiment in which they gave subjects an implicit racial bias test at least 3 days before the immersion and then immediately after. For the sake of the study, subjects were allocated avatars with either light skin, dark skin, purple skin, or they were immersed in the virtual world with no body. They found that subjects who were embodied in the dark-skinned avatar showed a decrease in implicit racial bias, at least temporarily ( Peck, Seinfeld, Aglioti, and Slater, 2013).

If these changes in the subject's behavior can seem anecdotal, it can have serious implication for the real world, the same way most of the economy of the world is now virtual but still impacts our day-to-day life. These conclusions are, therefore, ethically relevant ( Madary, 2014).

## 2.4 Ethics

The current code of conduct regarding the use of virtual reality can be found in the table presented in "Real Virtuality: A Code of Ethical Conduct. Recommendations for Good Scientific Practice and the Consumers of VR-Technology" by Michael Madary and Thomas K. Metzinger. The table being complete and concise, we will come back to it in more detail in the "VR theory applied to video game" section ( Madary and Metzinger, 2016). Ten principles are raised in the present code of conduct regarding the use of VR, the following section will briefly evoke these principles but the totality of these recommendations can be found in the appendix of this research paper.

The non-maleficence principle advise scientists not to use virtual reality if they foresee potential harm for the subject and calls for further research in order to minimize the risks regarding experiments using VR.

The informed consent section calls for including explicit statement of the risk of VR immersions in the form of consent regarding experiment and advise against experimenting with VR if the subject is incapable of informed consent.

The transparency and media ethics part calls for a collaboration between various scientific fields in order to fully comprehend the potential of VR as well as an honest representation of that medium for the public to counterbalance the false hopes that can arise with new technologies.

Dual use particularly addresses military use of VR and highlight the fact that psychological torture in virtual reality is still torture, and therefore intrinsically unethical. This section also calls for the creation of universal regulations regarding the use of VR for military purposes.

The internet research concerns target the scientific community and ask for actions in order to to avoid the abuse of informed consent with online VR.

The 6th point evokes the limitations of a code of conducts and specifies that the current code of ethical conduct cannot replace ethical thinking and that its implementations have to take the context into consideration.

Long-term immersion in virtual reality calls for further research about the impact of VR on the brain and ask any actor involved in VR to inform the public about the potential danger of long-term immersion in a virtual environment.

The virtualization of social interaction section highlights some of the preoccupations regarding social interactions through telepresence and asks for further researches.

The risky content part emphasize the fact the VR has a greater damage potential than classical media and urges virtual reality objects producer to inform the public about these risks.

The final section, privacy, asks data-collectors to inform the subjects about the new types of data being collected thanks to the use of VR and calls for vigilance regarding advertisements displayed through this medium.

# Ethical considerations regarding Video Games

Despite a massive diffusion among the general public, video games, as an entertainment object, doesn't have the success of television when it comes to academical studies. If some researches about the impact of video games on the user, notably regarding the question of violent games, have been done, these researches don't focus on the object itself. Few has been done to think about video games as others before have thought about novels, cinema or fiction in general. Yet, video games is a complicated field of study that would gain from the interest of the academicians, even just for the simple reason that they now reach billions of users. The complexity brought by the introduction of the interaction factor, the technological -notably in terms of graphics- progress and the fact that millions of gamers are able to interact through always more realistic avatars could also be of interest. Moral and ethical questions about video games have always been present and debated in classical media. These preoccupations often concern the content of the video game itself and the way it represents a certain reality but, unlike classical media, video games present a new form of conveying a message: the embodiment. By regrouping the major ethical concerns brought up by the gaming community, this chapter intends to give possible practical recommendations and ethical line of conduct.

## 3.1   Definition and approach to game ethics

If video games, as the more classical media, can spread representations and ideas through visual and linguistic rhetoric, their interactivity allows them to also convey meaning through procedural and "processual" (term employed by Bonenfant, 2016) rhetoric. Here, the player doesn't only watch or hear the message carried by the medium but the medium make the player ACT (procedural rhetoric) and BE (processual rhetoric) part of the message.

### 3.1.1   Definition

I already used the term "medium" to refer to video games. A medium, by definition, is a way of conveying a message. If classical media such as the television, the radio or the press clearly belong to this category, it might be more difficult to prove that every video game voluntarily contains a message. But

if we replace the term of "message" by "information" - a broader term-, the tension between classical media and video games is reduced. I voluntarily inserted video games into the media category in order to avoid a reduction of video games as a simple entertainment object and to allows us to consider its interest as a transmitter of idea, not only feelings. A video game could therefore be defined as a representative medium which contains a virtual world with which the avatar, controlled by the user, can interact ( Johansson, 2009). The avatar being "the graphic representation adopted by the subjects in a virtual environment" ( Wolfendale, 2007). Male or female, human or animal, visible on screen or not, the avatar is the way through which the user can interact with the game, it is a necessary, but not sufficient, condition to a video game (Fig 3.1).
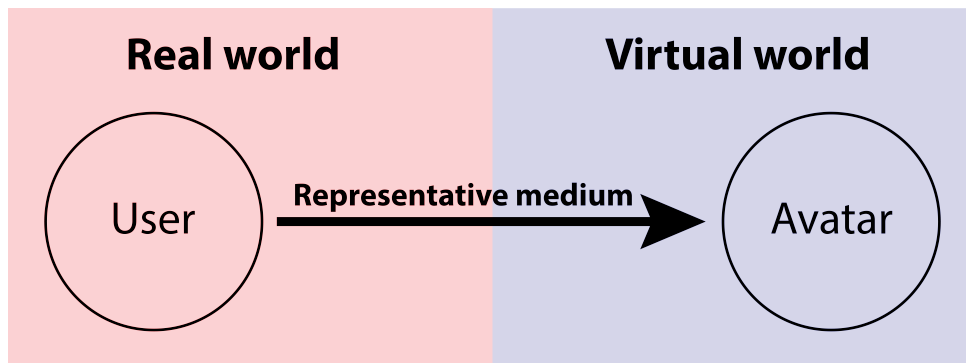


Figure 3.1: A visual representation of the definition of video game

To that definition, Sicart adds a massive insight by defining the notion of play. For him "play is the experience of a game by a player, and play is a creative, appropriative process of understanding and engaging in a dialectic relationship with the game system and with other players". Games only exist if they are played, the ethics of the game are therefore intrinsic of the ethics of the player. "Games structure play, facilitate it by means of rules. This is not to say that rules determine play : they focus it, they frame it, but they are still subject to the very act of play. Play, again, is an act of appropriation of the game by players" ( Sicart, 2011). This idea that a game can only be defined by the way it is actually perceived and modified by the user rather than by the supposed use of it goes along with the concept of performativity defined by John Austin( AUSTIN, 1962). For the author, performative utterances are sentences which are not only describing a given reality, but also changing the social reality they are describing. For example, "I do" as uttered in the course of the marriage ceremony is a performative utterance. In that sense, language models reality and produces the world in which the individuals recognize themselves.

Another criteria to create a game is to define if there is a winning condition, and how the latter can be reached. For Barr, Noble and Biddle this ultimate goal (to win the game) implies a value system, imposed to the player by defining the conditions (the "good way") in which the game has to be played and objectives can be reached. "If a value is thought of as reflecting a preference for some particular form of conduct, then the user-interface of a video game, which mediates all conduct in the game world, is heavily implicated both in the construction and expression of these value systems" ( Barr, Noble, and Biddle, 2007). James J. Gibson and his Ecological Approach to Visual Perception argues that a game can't be defined independently from the player as the subject and his environment can't be dissociated. The subject can interact with the environment within the procedurally encoded moral system. In that

sense, a game can reward aggressiveness, patience, theft, etc. according to the rules defined within the moral system ( Gibson, 2014). This idea of moral path has already been evoked by Murray, when he wrote that the path taken to achieve a goal could be programmed and impose a certain way of playing to the user ( Randolph, Murray, and Lanham, 1998).

Barr and al. also argued that "actions are performed with conscious goals in mind and are what a subject is actively concerned with. An activity is comprised of a collection or chain of actions which only make sense in the context of that activity"( Barr et al., 2007). Unlike other medias, video games implement a series of predetermined actions into the player. These actions can then create unconscious and spontaneous reflexes when facing the situations present in the game.

### 3.1.2  Procedural rhetoric

Proceduralists defend the idea that a game can be defined by the sum of its rules and that the meaning of these rules gives the meaning of the game. Sicart argues against procedural rhetoric as, for him, game-play and player can't be studied apart. For him, the player doesn't only adapt to the existing rules of the game but model them ( Sicart, 2011).

If rhetoric is the art of convincing, it is also a form of organization for the discourse determined by the emitter. When visual or discursive rhetoric defines how to say what has to be said or how and what to show, procedural rhetoric determines what is to be done by a predetermined process to be followed. Yet, if the authors have the possibility to control the message, the way it will be perceived by the player is not guaranteed.

Bogost is the first one to have studied the game sector under a procedural approach. Here, procedural rhetoric implies persuasion in order to change opinions and actions. Rhetoric permits to manipulate the users to make them agree with the message, but as the essence of video games is interactivity, the player can always keep a critical distance from the moral values presented by the game ( Bogost, 2008).

The process developed by the game producers becomes meaningful only when played by the user. The player doesn't have to be fully conscious of the meaning of the action, he simply has to consider the objective as important enough to perform it. If the action is repetitive, it can lead to a spontaneous reaction without any moral consideration from the user, as explained by Barr & al and developed later in this paper ( Barr et al., 2007).

### 3.1.3  "Processual" rhetoric

Performing various actions is at the core of processual rhetoric but, if it shares this notion with procedural rhetoric, it differs in the way these actions are comprehended.

Procedural rhetoric, as seen previously, is the art of pushing the player to perform certain actions by convincing him that the goal is worth the effort and can be reached by performing the right actions in the right order. The procedure can then be defined as the way one has to act in order to reach a given objective. For Bogost, "The difference between process and procedure offer instructive shorthand for some of the differences between process philosophy and object-oriented ontology. Most succinctly, pro-

cess entails flow, while procedure entails operation; process is concerned with events, while procedure is concerned with logic, process is concerned with outward becoming, procedure is concerned with inward essence"( Bogost, 2010). The fundamental difference between procedural and processual rhetoric is the way procedure is perceived. In the procedural approach, the goals, the actions and the players are defined before the game actually started, the processual approach, however, add some dynamic to the previous theory by implementing the notion of flow.

When talking about the meaning of "becoming" for Deleuze and Guattari, Zourabichvili wrote: ""To become", it is no doubt first of all to change: to no longer behave or feel things in the same way; No longer make the same assessments. No doubt there is no change in identity: The memory remains, charged with all that one has lived; The body ages without metamorphosis. But "to become" means that the most familiar things in life have changed their meaning, or that we no longer maintain the same relations with the customary elements of our existence: the whole is replayed differently" ( Zourabichvili, 1997). When procedural rhetoric is based on actions and behaviour, processual rhetoric is based on actions and identity. The processual approach introduce the identity within the actions. If procedure is defined by the possible (the various possible actions), process is associated to virtual, a future composed by a series of perpetually changing mental states.

Here the game doesn't simply make the player do, but be. The player can then adopt, or not, the value system presented by the game to discover, integrate, or express new aspects of his personality.

## 3.2   Ethical concerns in video games

When it comes to ethics, game designers are facing a dilemma between what they consider as ethical, and what is asked from them from a consumer point of view. If some players use video game as an escape from reality, if it helps them channel their energy, and, in some cases, their aggressiveness, why not give them what they ask for? The gaming industry as we know it being quite recent, games ethics have not been subject to many studies, leaving the game developers with as many code of conducts as there are game studios. Each studio has its own rules, and each game developer has his own opinion about ethics. In an interview for Gamasutra, a video game industry news website, some of the developers expressed their concerns about ethic ( Takahashi, 2004).

### 3.2.1   A blurred line for game developers

When interviewed by Takahashi for Gamasutra, Jason Della Rocca, Program director of the International Game Developer Association (IGDA) pretty much summed up the current situation of video game ethics: "Discussing ethics and morals is a tricky subject, as the terms are very vague and slippery, Each person's definition of what is ethical changes." But if it is complicated to put ethical considerations in the process of building a game, it doesn't prevent game studios from having moral responsibility. "We as an industry do have a moral responsibility," says Peter Molyneux, CEO of Lionhead Studios and creator of hits from Black and White to Fable. "Anyone who does something for a mass market has a responsibility. You tread carefully on the lessons that you teach. That line that 'if a game is fun, it is okay'-that sounds trivial. If it is obvious this is an artificial world and you can't do these things in real

life, then that is more acceptable. But if it parades itself as a real world, you have to be careful about that."

For Lorne Lanning, president of Oddworld Inhabitants in San Luis Obispo in California, being careful about the representation of violence in a realistic world is not that simple."If designers just create 'fun' games, but the buying trends are heading toward more realistic and violent games, then the designers that refuse to move along will likely be left behind, it is also true that it is easier to create viable game mechanics out of violence than from socially oriented ideas. Socially oriented ideas and cooperative play that doesn't end in violence are extremely challenging to achieve."

"Some games are supposed to be fun," says John Whitmore, director of design at 2015 Studios in Tulsa, Okla., and co-creator of the Vietnam war game Men of Valor. "Some are trying to be more artistic. If you have the pretension of trying to be more artistic, you have to think about the ethical decisions that you make. it is hard to call a game like Grand Theft Auto high art. Some fantastic movies are racy. But porn doesn't quite make it to the Academy Awards."

Doug Gentile, director of research for the National Center for Media and the Family and a psychology professor at Iowa State University, argues that, if the first amendment grants a certain freedom to game creators, "designers often wash their hands of their responsibilities in seeing that the ratings are enforced. They leave it to publishers, who market the games to children." Gentile then adds that games have a number of effects, some disputed, some clear, and that developers should pay attention to them. He notes, for instance, that the research does not show that games have a cathartic effect on people, making them less inclined to violence.

Vince Desi, CEO of Running With Scissors, the developer that created the controversial games Postal and Postal 2, says, "Games are games and they should be fun to play." He adds, "If a person plays a game and understands it is a game, then that's all it is. We absolutely don't seek anything more or higher than a good time. There's a lot of hypocrisy in our industry. We like to say, 'violence belongs in games and not in the streets.'" He adds that for those who see games as interactive movies with a deep story, that statement doesn't hold.

### 3.2.2   Leave it to the players

Being an ethical game creator is no easy task, but while some studios are working on their ethics, Molyneux puts the ethical choices in the hand of the player. In his game Fable, the player can choose between the good or the evil side depending on his actions (Fig 3.2). If the player can slaughter an entire village or choose to rescue the damsel in distress, the choices are coded and the player can rapidly identify which option will bring the most "evil points" if he decides to follow that path. Once a path is chosen, players often have a tendency to systematically choose the action associated to their choice in order to fully live one of the two endings (Good vs Bad). This quantitative way (for the points) of taking decision completely erases the qualitative aspect of these decisions, and therefore, their ethical implications. By presenting moral choices under a quantitative system (the more bad actions, the closer to the "evil" goal), game creators risk giving the player an automatic way of playing that could interrupt a critical thinking that would have been possible otherwise. With that in mind, ethical choice (at least in

appearance) are not enough to create an ethical game. Molyneux still had to limit the potential unethical behavior within the game, for example by not implementing children or rape into the game. That initiative has been approved and adopted by Jack Emmert, lead designer at Cryptic Studios on City of Heroes, to which he adds: "If you take people, remove them from society, in a world where there are no laws, things will go haywire, that's what an online game is like. There are no punishments in the online world."



Figure 3.2: In Fable, the player can choose between good (white, left choice) or evil (red, right choice)

If these precautions can seem anecdotal, open ending games have been shown to have an impact on the behavior of the players. Yoon and Vargas, for example, had subjects play a video game as either a superhero, a super villain, or a neutral control avatar. After playing the game, subjects were given a tasting task that they were told was unrelated to the gaming experiment. Subjects were given either chocolate or chili sauce to taste, and then told to measure out the amount of food for the subsequent subject to taste. Those who played as heroes poured out more chocolate, while those who played as villains poured out more chili ( Yoon and Vargas, 2014). These observation are ethically relevant in the sense that people who play video games are usually exposed for a long time to this kind of situation, potentially implying a more significant impact.

### 3.2.3  The question of data-mining

During the Game Developer Conference that takes place every year in San Francisco, Miguel Sicart, an associate professor of Computer Games Research at the IT University of Copenhagen, expressed his opinion about ethical issues in the gaming industry, notably regarding the problem of what he calls "data-mining" ( Crossley, 2011). During this edition 2011, the professor declared:"We agree to let companies take data from us and profile us, and I think that's a fantastic tool for developers. But data mining raises moral concerns. The main problematic question is what happens to our data. I don't

know what Steam is doing with my data, I, like millions of others, haven't spent time reading through all the licence agreements. The duty is on the developer to be clear and transparent about what they are doing with such information."

He also evoked the implicit relationship, and therefore ethical implications, between the player and the game company. "Any game is not only an entertainment product, but an implicit contract between the developer and player. Every future game developer should know how they are going to relate to these people, these human beings, and not just see them as customers." For him, the ethical choices implemented in the game should be taken with care, as they impact the players values."Players thus create values in games," he said."Developers should think about what the good values can be transmitted to players. The defining moral principal of life is to be the nicest, best person you can be."

But for Sicart, game ethics don't stop at what is presented in the game : "The key moral issues in game development are workplace ethics; crunch and team management," he told Develop in an interview following his talk at GDC. "Those are very problematic issues in game development that affects a lot of people. A lot of game developers eventually get married and work in other, less demanding industries."

Sicart believes a 'culture of crunch' means the development workforce will remain young. "If you look at most software development practices, the issue of overtime is considered either in a professional code, or day-to-day workplace ethics," he said. "I'm not saying the conclusion to this issue is no crunch at all, but crunch has ethical implications. It harms people and therefore it harms the profession. Crunch may or may not have a negative impact on the quality of a game, but it affects developers' mental health, family life and social relations. You have a burn rate in game development, and that's a long-term issue." He then added "Look around; this is a very young, passion-driven industry, but the good old guys just leave. There should be hundreds of them at an event like the Game Developers Conference, but look, there's hardly any. And these are wise people who leave the industry."

For him, that shift in the workforce within the game industry is problematic, as it prevent what he calls "the institutional memory"."The better we treat our workplace, in terms of ethical thinking, the more fulfilling the profession will be, the more long-lasting the profession will be, the more communicable the information will be. Developers will improve and better themselves if they look a bit closer at the job they are doing and the demands placed on them."

### 3.2.4  The question of violence

The question of violence in video game has always been a central debate when it comes to moral or ethical concerns. If the supreme court of USA stated in 2010 that video games were protected by the freedom of speech.( Ferguson, 2013), Switzerland adopted quite the opposite position with the motion Allemann (09.3422) that wants to prohibit violent video games :"[...] recent studies have shown that there is an empirical link between violent behaviour and the consumption of violent video games." the the Swiss legislators, this link could be explained by "the ultra realistic design of video games and the multiple possibilities they offer to exert violence." According to that train of thought, the more realist a violent or immoral game is, the more it will push its player into committing acts that go against the moral, and by extension, the law. Here it is the interactive characteristic of video game that is targeted

("possibilities to exert violence"), and implicitly clears the classical media such as radio or TV. Another proposition, the motion Hochreutener (07.3870) offers to restrict the access of violent video game to the adult population (18+) ( Assemblee federale - parlement Suisse, 2008). The two propositions have been accepted by the Swiss parliament.

The question of violence in video game has often -if not always- been treated through preexisting moral systems. McCormick considers that an argument condemning violent video games can't be based on the assumption that it will increase the aggressiveness of the player in the real world ( McCormick, 2001). For him our society loves entertainment, even if it can lead to people being hurt. Football, for example, could be considered potentially dangerous as it created the hooligans that accompany some of the games. Yet, nobody banned football. Why? For McCormick, this could be simply explained by the fact that if the entertainment is pleasing, our societies are ready to accept a certain -sometime quite high- level of violence. Based on Aristotle ethics and its principle of individual development, McCormick argues against violent video games in the sense that they would reward a bad attitude for human kind rather than helping it develop more virtuous values such as braveness, wisdom or temper.

Waddington thinks that violent video games, if they imply cruelty, go against Kant ethical idea of the duty we have toward ourselves ( Waddington, 2007). Moreover, he claims that the increasing accuracy with which video games represent reality blurs the line between virtuality and reality, creating "a de-valuation of the idea of wrongness". Wonderly consider the problem under Hume's ethics based on the notion of empathy to dictate our moral values. For him, violence in video game leads to a decrease of our empathy, and therefore -empathy being the base of morale- a decrease in our sense of moral ( Wonderly, 2008).

For Will Wright, creator of The Sims franchise at Electronic Arts' Maxis division, violence in video games is not a problem, on the contrary. For him, acting violently in the game world allows the player to act in a way he couldn't in real life. Used as an aggressiveness catalyst, violence in video game could actually have therapeutic values ( Takahashi, 2004). The same theory has been explained in the book Killing Monsters: Why Children Need Fantasy, Super Heroes and Make-Believe Violence. Published by Basic Books in 2002, the author, Gerald Jones develops the potential positive aspects of violence in video games ( Monsters, 2002).

So far, there is no fixed answer when it comes to the question of violence, and each producer has his own opinion about what should, or shouldn't, be presented in video games. "I have a dim view of the use of graphic violence to increase sales of video games," says Daniel James, CEO of San Francisco-based Three Rings, which maintains Yohoho! Puzzle Pirates, an online puzzle game. "Although I am not naive enough to think that violent games lead to violence, I think that exposure to such material is corrosive to mental health, and quite frankly rather dull." Meanwhile, Jay Wilbur, vice president of marketing at Epic Games in Raleigh, N.C., says that "the level of violence in a game should fit the context that the world of the game calls for. Anything more violent or sexual than what the context calls for is gratuitous. In some ways, that suggests the creators of games with horrific plot lines have the most artistic license" ( Takahashi, 2004).

## 3.2.5   The question of interaction

Most of the games evoked previously are single player games, but they only represent a fraction of the game market. Let's imagine that a single game is published in two versions: one single player and the other one multiplayer. If we assume that killing one of the Non Playable Character (NPC) in the single player game is a morally neutral act, does that action keep its neutrality if the opponent killed was controlled by another player? If an ethical code was to be adopted by all game producers, would the code of conduct be different for multiplayer games? The case of MMORPGs (Massively Multiplayer Online Role Playing Game), which often take place in a persistent worlds with their own time lines appears to present a new kind of ethical considerations. In these games -that often gather millions of players-, users can spend hours, weeks and even years improving and taking care of their avatars in the virtual world. Creating communities, alliances and even virtual economies, the players become gradually more involved in these virtual societies. Based on the case of a virtual rape that happened in the years 2000' in LambdaMoo (Fig 3.3), Wolfendale demonstrated that the users' attachment to their avatar strongly influence how much pain is felt when the avatar is hurt, or even killed ( Wolfendale, 2007). When the avatar controlled by a player is victim of a particularly violent -or shocking- event, the user can also suffer a psychological trauma. Can that -real- pain justify an attempt to regulate, or control, the relationship between players in a MMORPG? Observing the lack of contractual duties, Craft answers affirmatively ( Craft, 2007), whereas Powers simply notes that an authentic moral offence is possible within the virtual communities, but doesn't adjudicate on whether or not regulations would be beneficial ( Powers, 2003).

```
        *   Welcome to LambdaMOO!   *
        **************************

        Running Version 1.8.3+47 of LambdaMOO

PLEASE NOTE:
   LambdaMOO is a new kind of society, where thousands of people voluntarily
come together from all over the world.  What these people say or do may not
always be to your liking; as when visiting any international city, it is wise
to be careful who you associate with and what you say.
   The operators of LambdaMOO have provided the materials for the buildings of
this community, but are not responsible for what is said or done in them.  In
particular, you must assume responsibility if you permit minors or others to
access LambdaMOO through your facilities.  The statements and viewpoints
expressed here are not necessarily those of the wizards, Pavel Curtis,
or Roger Crew, and those parties disclaim any responsibility for them.

NOTICE FOR JOURNALISTS AND RESEARCHERS:
   The citizens of LambdaMOO request that you ask for permission from all
direct participants before quoting any material collected here.

For assistance either now or later, type `help'.
The lag is low; there are 30 connected.
```

Figure 3.3: A screenshot of the opening screen of LambdaMoo, a text-based video game

The case of LambdaMoo isn't isolated. Some extraordinary and potentially harmful situations happened for example in Second Life (another constant MMORPG) in which a player managed to hijack

the game mechanics to push other player's avatars to have sex with each other. In this type of universe, the possibilities are almost infinite, creating unprecedented and potentially damageable situations for the users. In a world where users can be whoever they want, what would happen if the situation discussed earlier involved a minor controlling an adult avatar and an adult controlling an under-aged avatar?

## 3.3   Ethics in video games

### 3.3.1   The developers' points of view

When it comes to ethics, we have seen that each studio -if not each person within the studio- has an idea of what could be called an ethical game creation process.

Regarding the issue of violence in video game, one of the lead designer at Cryptic Studios highlighted the fact that violence, if it can't be completely eradicated, can be contained by the game designers. In the interview realized for the web-zine Gamasutra, Jack Emmert declared that his next project, City of Villains, would allow the players to be the villains... To a certain extent. Indeed, he also plans to limit violent behavior such as mass killing in order to keep the game socially acceptable.

For Ben Sawyer, moderator of the Serious Game message group, games have a huge, yet unexploited, potential to train and help people deal with their daily lives. For him, the gaming industry "needs to grow the pie and create new forms of gaming that emphasize deeper ethical issues we can explore in interesting ways", as he confided in the interview for the gaming website. Creating games to emphasize real life aspect is quite uncommon, but some attempts have been made already. It is notably the case of Kuma Reality Games. The company Kuma released in 2006 a series of online video games simultaneously with "Shootout!" television episodes from The History Channel, allowing audience members to watch the show and then "live" the historical event by playing a 3D game re-creation of the episode."People can say we are taking advantage of a situation where Americans are in peril," declared Keith Halper, CEO of Kuma Reality Games. "That doesn't diminish the value of what we deliver, which is using the power of video games to communicate important facts about the world. We deliver timely information in an informative and emotionally gripping way. The exploitation issue is best served by telling valuable stories."

For Halper, the sense of ethics kicks in when the designers must figure out how to balance the fun of the game with the accuracy of what happened. In the capture of Saddam scenario, they added a suicide charge of insurgents. While it didn't happen, Halper says the event illustrated one of the things that U.S. soldiers might have had to face as they closed in on Saddam. To make sure they get it right, Kuma War's designers have a military advisory board.

### 3.3.2   Evaluating a game from an ethical point of view

An unofficial contract bonds the user to the game company. If someone buys a hoover, he obviously expects the product to do what it was meant for, in that case hoovering. Same goes for video games. The developers are creating games that are supposed to entertain the players and bring them the experience they were looking for, at least to a certain extent. In that sense, banishing violence or certain types

of interaction could be considered an offense to that tacit contract between the game and its buyer. So how can game producers evaluate the ethical level of a game without taking out the immersion or the expectations that players have toward the game? In an article for Gamasutra, Michael Fergusson, CEO and founder of Ayogo -a game company notably know for their use of game psychology and social networks to help patients take control of their treatments- offered some example of questions game developers could -or should- ask themselves before releasing a new product ( Fergusson, 2017).

## How clear is the game about rules?

The general public purchases video games for as many reasons as there are gamers in the world, but one thing the game producer can provide is a clear set of rules and instructions. Recently, the University of Waterloo (Ontario, Canada) Problem Gambling Research department conducted a study where the effects of "unclear" rules were addressed in slot machine play. For their paper, the Ontario student used multiple versions of the same game with payback percentages varying from 85 to 98 percent. The different versions look identical to the player. How does it influence gameplay when the player isn't aware of these rules? ( Harrigan and Dixon, 2010)

If this question is obviously ethically relevant when it comes to gambling machines, the free-to-play system also presents some hidden features that can be problematic according to Greg Costikyan, game designer and science-fiction writer. In an article for Gamasutra ( Costikyan, 2014), he explains that the free-to-play system is based, as various diseases, on the principle of K-factor. In medicine, the K-factor is the number of healthy persons infected by a sick one and if doctors are often trying to reduce the K-factor, game developers look for the opposite. In order to increase the K-factor of a game -meaning the number of players that can be brought into playing the game by an already active user- online free-to-play games can use the social aspect of the internet to push the player to go viral and share his achievements with his friend or invite them on the platform. If this practice is fair, the game designer argues that it can also be problematic when not properly done. "Here's an example of dishonest practice: Most games ask you to invite friends early in the first user experience. Fair enough, as far as that goes: But many also do not allow you to close the pop-up that asks you to invite. There's only a single "invite" button. The user is forced to click it – or quit. This pops a friends-list dialog, and you can close out of that, and return to your game without sending invites; but you have just told your players "We treat you like sheep and try to trick you into sending virals." This is the opposite of respect".

The same observation goes for in-game purchases. According to Costikyan, in-game purchase aren't unethical, they can even be necessary for the sake of the company, but he warns zealous game creators against the effect of what he calls "bait and switch". "If [...] the parameters are tuned so that players literally cannot complete the sequence without paying, then it strikes me as unethical. it is a bait and switch; it is like Lucy pulling the football away from Charlie Brown. You're holding out a reward and giving players the impression that they can get there by grinding, but denying them that opportunity. Players will wise up to this, eventually – and you will lose some who do."

## Is the game beneficial to players?

We have seen in the previous sections that games had an certain amount of possibilities when it come to improving the life of the player. Escaping (temporarily) from the reality, improving the reflexes,

releasing dopamine, calming anger... The video game industry has the potential to help its consumers.

In 2009, Li and al. published a study showing that playing an action video game for 50 hours (spread over ten to twelve weeks) improved visual contrast sensitivity (the ability to distinguish subtle differences in shades of gray) compared to controls ( R. Li, Polat, Makous, and Bavelier, 2009). An equivalent study, published by the same team a couple of years later demonstrated that video games could help cure the "lazy eye" syndrome, or amblyopia. In the experiment, Li and al. made adults with amblyopia (where one of the eye gradually stops functioning) either play video games or other activities such as knitting or watching TV with their good eye covered. The results showed that "playing video games (both action and non-action games) for a short period of time (40–80 h, 2 h/d) using the amblyopic eye results in a substantial improvement in a wide range of fundamental visual functions, from low-level to high-level, including visual acuity (33%), positional acuity (16%), spatial attention (37%), and stereopsis (54%)" ( R. W. Li, Ngo, Nguyen, and Levi, 2011).

But video games can also be used to train and improve spatial attention as demonstrated by Green & Bavelier in 2012. During their studies, they found that action video gaming improved performance on the ability to quickly locate a target in a visually busy environment, this capacity is especially relevant for driving situations ( Green and Bavelier, 2012). In the same vein, another study showed that action games improved the ability of children and adults to keep track of a set of moving objects that were visually identical to other moving objects in the visual field ( Trick, Jaspers-Fayer, and Sethi, 2005).

From a behavioral point of view, Dye and al. concluded that action games improved self-control, i.e. "the ability to refrain from responding to non-target stimuli, in a situation in which most stimuli called for a response but an occasional stimulus called for no response" ( Dye, Green, and Bavelier, 2009). Chiappi and colleagues found that 50 hours of experience on an action video game significantly improved performance on a test called the Multi-Attribute Task Battery, which is modeled after skills required in piloting aircraft. It involves using a joystick to keep a target centered on a screen, monitoring fuel levels, responding to lights on an instrument panel, and listening and responding to radio communication. High scores on this test correlate well with real-world piloting performance ( Chiappe, Conger, Liao, Caldwell, and Vu, 2013). A number of researchers also demonstrated that experience with action video games improved people's abilities to switch rapidly and without error between tasks that have conflicting demands (( A. F. Anderson, Bavelier, and Green, 2010;  Green and Bavelier, 2012; Colzato, van den Wildenberg, and Hommel, 2014). Another experiment, with elderly participants, showed that video game play results in improvement in cognitive flexibility, attention, working memory, and abstract reasoning ( Basak, Boot, Voss, and Kramer, 2008). One study found that such play led not just to cognitive improvements, but also to better self-concepts and enhanced qualities of life in elderly participants ( Torres, 2011).

Finally, if we have seen previously that Ben Sawyer regretted that the potential of the video games to train people was unexploited, a recent study revealed that young, inexperienced surgeons who were also avid video gamers outperformed the most experienced surgeons in their field ( Rosser et al., 2007). In an experiment, novice surgeons who were provided with experience with video games improved their performance in laparoscopic surgery compared with a control group of surgeons who did not have that experience ( Schlickum, Hedman, Enochsson, Kjellin, and Felländer-Tsai, 2009).

Video games have the potential to help the player improving his physiological (for example visual acuity, quicker reflexes, etc) and mental abilities. If a game is principally meant to be "fun" rather than educational, it doesn't mean it can't help the player improve themselves. By wondering "is my game beneficial to the player?" in a broad way (meaning not only transmitting moral values or creating a "socially acceptable" game environment), game designers could greatly improve their consumers lives. But beyond increasing the well-being of their player, game creators have an already existing issue: the addiction problem.

## What are the consequences if the game turns into an addiction?

If single-player video games supposedly have a beginning, a middle and a defined ending, some ever-lasting video games can be problematic when played by users with an addictive personality. Games like Dofus, World of Warcraft or even FarmVille can lead to deviant uses of the game, in the sense that, without an end, some player with a tendency to get addicted to video games could lose the sense of reality and get emotionally and financially over-involved in the game world.

To illustrate that problem, a CNET article used the example of a player who confessed that since beginning to play FarmVille last August, she's reached an unusually high level 111 in the game (40 levels beyond where the game offers incentives in the form of newly unlocked features). The players confessed that she spent about 2000$ (approximately 100$ per month) on in-game purchases and that she she used to play for several hours almost every day ( Lowensohn, 2014). If this example of an addiction to video games seems quite harmless because the player still managed to keep her social life and bank account in order, the article also gives the example of a father who missed his son's 5th birthday because he was doing a guild raid. Again, this can appear anecdotal, even funny for some, but what would happen if these behaviors were pushed to the extreme?

To counter this tendency to addiction, there is not much the games designers can do without harming the game. If a game is addictive it usually means that it is good from an economic point of view. But if the creator of the game can't be considered responsible for the behavior of his customers, he can control -to an extent- the long lasting impact of the addiction. On that Matter, Greg Costikyan offers a simple, yet underused, solution : let the player fix his limits before starting the game. "The third time within a month that someone makes a real money purchase, pop a dialog saying, "We appreciate your business, and are very glad you want to spend more on our game. But you've already spend $XXX this month. Are you sure you want to spend another $XX?" Likely with a checkbox saying "I'm fabulously wealthy, don't bother me with this again."" ( Costikyan, 2014)

*Chapter 4*

# Joined perspective between VR and video games

Ethical concerns regarding virtual reality and video games appear to be quite similar. Embodiment for VR, immersion for games, the line between one and another is so thin that some might think of the two entities as a whole. Yet virtual reality brings a whole new share of psychological impacts to the video games industry, and vice-versa. In the previous chapters, we have detailed some ethical concerns regarding both parties; this chapter will try to apply some of the solutions evoked by the various authors in a practical ethical code of conduct applicable to the use of VR in the video game industry.

## 4.1 VR Theory applied to video games

Madary and Metzinger have recently published an ethical code of conduct for the use of VR. If this paper principally addresses the ethical concerns when it come to the academical use of VR, some of their recommendations could still apply to the video game industry. In this section, we will try to extract these recommendations in order to apply them to the gaming world. This section will explore the principles of : - Non-maleficence - Transparency and media ethics - Long-term immersion - Risky contents - Freedom and autonomy

### 4.1.1 Non-maleficence

The first (and probably one of the most important) recommendation when it comes to the use of VR in research, as evoked by Madary and Metzinger, is the principle of non-maleficence. In their code of conduct, the two academicians advise researchers not to use VR if they foresee consequences that would lead to involuntary suffering or serious/lasting harm for the subject. We could argue here that this principle could be applied to game developers who, even if they can't possibly foresee each and every use that can be done of their games, might be able to limit the potential negative impact of their product. This principle would be notably pertinent for the release of horror game adaptations in VR. If the horror genre seems to be particularly attractive for the consumers of virtual reality, proper user-testing in order to determine the psychological impact of the game should be realized. This recommendation could also be relevant regarding the "Dual-Use" section of the ethical code of conduct destined to regulate military

use of VR, notably for psychological torture.

### 4.1.2 Transparency and media ethics

In the Code of Conduct for the ethical use of VR, the author recommend the experimenters to provide " an explicit statement to the effect that immersive VR can have lasting behavioral influences on subjects, and that some of these risks may be presently unknown" in an informed consent statement. This recommendation, as it is, can't be applied to game creators. How could a game company require informed consent from millions of user around the world? Adding that much paper work to the already complicated process of releasing a game would be impossible -not to mention the hassle for the users simply trying to have a fun experience. However, displaying a warning before the beginning of the simulation, as done at the beginning of certain movies, could be a first step. As the "contract" between a game producer and its customers is sealed during the purchase of a game, a notification could also be displayed before validating the acquisition of the game such as "this game presents sensitive content that can have potential psychological impact. Do you wish to proceed?". The latter option appears to be the best as it informs the user BEFORE the payment is done. However, we recommend to keep the notification as simple as possible in order to avoid behaviors where the user agrees without reading, as it commonly happens with Terms & Conditions.

### 4.1.3 Long-term immersion

Long-term immersion needs to be examined by further researches advised Madary & Metzinger, but the game creator should be aware that being immersed in a virtual environment over a long period of time can have lasting impact on the player mind. In order to limit the potential negative impact, game creators could implement a way for the user to monitor the time spent in the virtual world. Following researches on smartphone addiction, Mobifolio developed an app (called BreakFree) allowing the user to see how much time they spent on their phone everyday. The same principle could be applied to the use of HMD, where the user could set up a time limit before starting a game session, a notification could then pop-up on the screen to alert the user that the limit he set has been exceeded. In order not to take the immersion out of the game, these notifications could be implemented only for the voluntary customers. If not mandatory, this system should still be presented clearly to any VR user (for example when purchasing a VR game).

### 4.1.4 Risky content

The Risky-content section of the code of ethical conduct regarding the use of VR states that "compared to the viewing of traditional movies containing graphic violence or pornography, the impact of full immersion settings and the associated risk of users suffering psychological trauma will steadily increase as VR technology advances." As explained in the previous sections (Transparency and media ethics), informing the user about the potential effects should be mandatory, if only to prevent future legal disputes, but special considerations should also be done about the embodiment power of virtual reality. On that matter, Madary and Metzinger declare that "Avatar ownership will be an important issue for regulatory agencies to consider. There are strong reasons to place restrictions on the way in which avatars can be used, such as protecting the interests and privacy of individuals who strongly identify with their own

particular avatar on social networks." The last part being quite complicated to implement from a commercial point of view, we recommend extensive user testing before the release of a potentially harmful game. We also recommend, when possible, to avoid visual representation of the avatar being hurt or killed when using virtual reality, either by not representing the body (as it is often currently done in VR games) or by cutting to a black screen right before instant-death experiences.

### 4.1.5   Freedom and autonomy

When it come to the consumption of goods, it is important not to forget that the ultimate master of his own life is the user himself. If game developers can reduce the risk the consumer can take, they can't control how the player is going to deal with the product. Regarding that matter, Madary and Metzinger followed the concept of Constitutional right to mental self-determination ( Bublitz and Merkel, 2014) when they declare:" "The individual citizen's freedom and autonomy in dealing with their own brain and in choosing their own desired states of mind (including all of their phenomenal and cognitive properties) should be maximized." For them, the role of a VR software designer is not to protect the consumers from themselves but to "help individuals exercise this freedom in an intelligent way, in order to minimize potential adverse effects and the overall psychosocial cost to society as a whole" ( Madary and Metzinger, 2016). Game developers can't be considered as baby-sitters for their users in the sense that they can't force a certain use of their game, but it doesn't prevent them from providing safe products.

## 4.2   Video game theory applied to VR

Most of the ethical concerns regarding video games can be applied to VR, this section intend to emphasize the ethical recommendation in the context of the use of virtual reality. If these recommendations could easily be applied to the whole gaming industry, the major impact of VR on the brain compared to "classic" gaming make them particularly relevant. In order to stay concise, this section will treat the ethical considerations regarding: - Workforce - Violence - Addiction - Interaction - Freedom and autonomy

### 4.2.1   Workforce

One of the big problem of the game industry is the fact that the workforce is constantly, and quickly, changing. With constantly renewed team members, constructing a solid code of conduct within a company can be a challenge. If we can't possibly pretend to teach game companies how to manage their own teams, we can argue that a clear, short, code of ethical conduct could be provided to any newcomer. The constant switch in the workforce could also be an asset as it allows a constantly renewed vision of the medium. If the recommendations presented in this paper are supposedly applicable to any game company, they are still very global and require further researches. We therefore advice the game producers to generate their own set of rules according to the company values in order to complement the present recommendations.

### 4.2.2 Violence

The question of violence is a sensitive subject when it comes to game creation. If we can't possibly ask game companies to ban violence from their products (as asked by the Swiss government), special attention should be given to under-aged players. If a company can't be hold responsible if a minor buys an M-rated game, the media used to advertise the M-rated games can have an impact on the amount of minors touched by the campaign. We advise game company to carefully select the media used for the marketing campaign of a game in order to target a more mature audience. This can, for example, mean that advertisements for M-rated products should not be broadcasted on classical medias such as TV during prime-time. It also appears that several game designers have their own limits when it comes to the representation of violence. We do not pretend to tell the game creators where to draw the line between acceptable and unacceptable representation of violence. However, limiting ultra-violent behavior such as rape, killing/abusing children or animal abuse seems appropriate (except when it is justified, for example in the case of games created to inform the users about the violence of extreme situations, but if depicted, extreme violence should not be glamorized).

### 4.2.3 Addiction

Preventing addiction can be challenging for game creators, as releasing addictive games is a quite lucrative activity. This paper doesn't pretend that game producers are responsible for the deviant use of their product, however, gamers with a tendency to addictive temperament should have a way of limiting themselves. This kind of behavior happening commonly with persistent online games, we recommend that, in addition to the game, the producer provide a way to monitor the time and money spent by the user. When possible, the game developers could add a functionality allowing the user to limit the time or the money spent playing. As "unlimited" data-use on smartphones have a "reasonable limit", further research could be done to determine a reasonable limit for online games before it can be considered as an addiction. When passing this limits, user could receive a gentle reminder of the time spent playing, as cutting the user from the game world appear to be too radical.

### 4.2.4 Interaction

Interactions between users are a crucial part in online gaming and, if encouraging the players to co-operate within the game world is surely greatly recommended, the game companies should be aware of potentially harmful behavior within the game. Moderators are already common in this sector and players are often able to warn the company about the behavior of some users but, in order to provide a complete ethic recommendations, this matter had to be evoked. Moderating personal conversation within the game world is an invasion of privacy; however, players should be able to get in touch with the administrators or the moderators -if any-, if they spot unacceptable behavior from other players.

### 4.2.5 Freedom and autonomy

Ultimately, the final choice is always in the hands of the players. The game exists only to be played with and, as safe and ethical as it can get, the product can always be used in a way that haven't been predicted or designed by those who created it. This paper doesn't pretend to give the game creators a set of rule to define what is acceptable and what isn't but to help them understand the repercussion

some decisions, made during the creative process, can have on the player experience. When choosing to buy, and play, a game, the consumer agrees to deal with the content provided by the game company, and the company agrees to let the player use his new purchase as he wishes to. With that said, informing the user about the content of the game, even when not M-rated, is an excellent ethical practice and should be automatic. We would here argue for the principle of "when in doubt, inform the user".

## 4.3   Possible ethical recommendations

This section is a sum-up of the totality of this research paper destined to any game producer keen to develop a dynamic of ethics within his game. In order to keep this potential guideline as accessible as possible we will here define 10 ethical recommendations that could be applied by a large majority of game designers but which is particularly important when dealing with virtual reality. However, this research paper doesn't claim to provide a definitive ethical code of conduct, but calls for further research.

1. Define your level of responsibility

    (a) The game company is responsible for the well-being and the training of its employees.

    (b) The data collected during game sessions such as the "kinematic fingerprints" -or body movements- evoked in the ethical code of conduct regarding the use of VR should be accessible on demand by the subject. The user should also be informed about which kind of data is collected (if any).

    (c) The embodiment power of Virtual Reality can be dangerous for the player health, not representing the avatar body entirely (for example just the hands) could be a way to avoid traumatic experiences for the player.

2. Target your audience

    (a) If your game includes content that is inappropriate for minors, we recommend that the game producer carefully select the medium with which the game will be advertised. For example, we recommend avoiding prime-time on national TV channels and YouTube channels followed by a younger audience.

    (b) If your game is potentially addictive, we recommend to include a way for the player to reach for help if the situation gets out of control. This access to information can be a contact number or email address for psychological help or simply a link toward a potential helpful association. The Computer Gaming Addicts Anonymous (http://cgaa.info/helpline/) for example, provides a free help line 24/7.

3. Interact with the player

    (a) The use of VR can lead to important impact on the brain, and your player might want to be aware of that matter. Displaying a simple warning message before starting the game or when the product is bought could prevent unwanted consequences for the player and the game company.

(b) If your game contains risky content, display a short notification before the purchase (or on the box for physical products) to inform the user about the content. If the user still wish to proceed with the purchase, he shouldn't be able to attack the company for shocking content.

4. Let the player set up a limit

   (a) Long-term immersion in VR can have long-lasting impact, we encourage the game company to allow the player to set a "time limit" for his gaming session, after which notifications will be displayed to warn the user about the time spent in immersion. Once the limit fixed by the user is passed, we recommend to send notifications at regular intervals.

   (b) If your game implies in-game purchase, the user should be able to set a limit regarding what he can spend before entering the game. If the user decides to go passed that limit, a confirmation checkbox reminding the user that the limit has been exceeded by XXX$ could be displayed.

5. Know your product

   (a) Whether the game is open ended or not, the game producer should be aware of the potential impact that the game can have on the player and act accordingly. If there is a doubt about part of the content, informing the user about the potential risks seems necessary.

   (b) We recommend proper user-testing for virtual reality game in order to reduce as much as possible the risk for the user health (motion sickness, psychological impact, etc)

6. Know your team

   (a) Companies often have a code of conduct within the workplace, we advise to include some of the ethical recommendations according to the company policy.

   (b) Each team works differently, proper training should therefore be provided from the recruiting company to the newcomers.

7. Forced content

   (a) If the producers wishes to include social invitations within the game, these should not be forced. If a display is continuously visible within the gameplay to ask the player to invite friends, the user should be able to close the dialogue box if he doesn't wish to proceed.

   (b) In-game purchases, if any, can be considered unethical if the game cannot be completed without them.

   (c) A commercialized game is considered by the public as a finished product, selling games in kit where the main game is only playable when combined with additional parts (which have to be paid for) is not advised.

8. Call for research

   (a) There is no "reasonable limit" from which video games are considered dangerous for the user. We therefore call for further research on that matter. If the user passes that limits, notifications to remind the player of the time spent in the virtual environment could be displayed at regular intervals.

(b) If notifications are sent at regular intervals, the time set between each interval could be defined universally, or be specific to each game. Researches to determine the ideal time-lapse in order to keep the immersion between the notifications while keeping them present enough to be noticed is advised.

9. Original content

   (a) The gaming industry is a creative field, the intellectual property rights of each parties of the game production should be respected.

   (b) Market researches are advised before releasing the game in order to create original content adapted to your users.

   (c) The use of virtual reality headset should be accompanied by in-depth testing in order to prevent unexpected and unwanted physical (motion sickness) or psychological (PTSD, personality disorder) impact.

10. Stay informed

   (a) Game companies should be aware, at least to an extent, of the state of the art regarding academical researches in their field.

   (b) Likewise, game companies should be aware of the way their product can impact the psychology of the player.

*Chapter 5*

# Conclusion

We started this research paper by asking the question of whether or not technology was morally neutral. If we could argue in favor of the affirmative, the moral decisions have to be made by those who use that technology. In that sense, game designers, and every actor of the game industry in general, have to take into consideration the effects their products can have on the user's behavior. The game producers cannot be considered responsible for the well-being of their users. However, they get to know their product way before the public does, it is therefore their responsibility to provide all the information necessary to the players. Being transparent on the motivations and the goal behind game design is crucial when it comes to the use of virtual reality as, if the world is virtual, the impacts are real.

If game designers are obviously the first concerned by this research paper, it seems useful to keep in mind that the principal person responsible for the user mental health is the user himself. This paper doesn't intent to transfer the player's responsibility toward himself to the game creators, but give the gaming industry a tool to protect itself against abusive users such as trials enthusiasts. With that said, the gaming industry has everything to win by helping the user understand the underlying rules behind the process of creating a game and accompanying him toward good gaming practice.

The field of ethics in the gaming industry is still underdeveloped compared to the amount of technological progress made these past few years. If this research paper presents the outline of a potential code of ethical conduct concerning the gaming industry, further research is needed and I invite any actor of the gaming industry to complement this draft from a professional and experienced point of view.

# Appendix

**TABLE 1 | VERE code of conduct for the ethical use of VR in research and by the general public.**

| RECOMMENDATIONS FOR THE RESEARCH ETHICS OF VR |
|---|

**1. Non-maleficence**

    a. No experiment should be conducted using virtual reality with the foreseeable consequence that it will cause involuntary suffering or serious or lasting harm to a subject.

    b. A rational, evidence-based identification and minimization of risks (also those pertaining to a more distant future) ought to be a part of research itself.

**2. Informed consent**

    a. Informed consent for VR experiments ought to include an explicit statement to the effect that immersive VR can have lasting behavioral influences on subjects, and that some of these risks may be presently unknown.

    b. Experimental VR research should not be carried out on subjects incapable of informed consent.

**3. Transparency and media ethics**

    a. In experimental work developing new clinical applications, researchers should be careful not to create false hopes in patients by repeatedly reminding them of the merely experimental nature of the research.

    b. VR researchers aiming at new clinical applications should work in close collaboration with physicians who may be better situated to make informed judgments about the suitability of particular patients for new trials.

    c. Scientists and the media need to be clear and honest with the public about scientific progress, and not only in the area of using VR for medical treatment.

    d. In interacting with the media, scientists should cultivate a proactive attitude, especially if they are the first to become aware of novel types of risks through their own work. Communication with the public, if needed, should be self-initiated, an act of taking control and acting in advance of a future situation, rather than just reacting.

**4. Dual use**

    a. Potential military applications of VR, AR, and SR should be closely monitored by policy makers and funding agencies alike.

    b. Torture in a virtual environment is still torture. The fact that one's suffering occurs while one is immersed in a virtual environment does not mitigate the suffering itself.

    c. Policy makers should aim at international arrangements among countries to add VR, AR, and SR in a process to harmonize lists of dual-use technologies to be controlled.

**5. Internet research**

    a. The scientific community has to take steps to avoid the abuse of informed consent with this technology, especially in the interest of preserving public trust.

    b. The ability to toggle between VR, AR, and SR may create situations in which users are not able to maintain an understanding of when their informed consent to share information is in effect. Users should be repeatedly reminded within VR that they have given informed consent.

**6. The Limitations of a Code of Conduct**

    a. Scientists must understand that following a code of ethics is not the same as *being* ethical. A domain-specific ethics code, however consistent, developed, and fine-grained future versions of it may be, can never function as a substitute for ethical reasoning itself.

    b. Such reasoning must be conducted in a way that is sensitive to the contextual and implementational details of particular experimental paradigms, details that cannot be captured by a general code of conduct.

| RECOMMENDATIONS FOR THE USE OF VR BY THE GENERAL PUBLIC |
|---|

**1. Long-term immersion**

    a. Longitudinal studies and further research into the psychological effects of long-term immersion are needed.

    b. Users must be made aware that these studies are seriously limited in that they will, due to ethical constraints, exclude users who may be most vulnerable (such as children or those with latent mental illness). Some of these vulnerabilities may be unknown to science and unknown to the users themselves.

**2. Increasing virtualization of social interactions – we call for focused research, large longitudinal studies, into the following questions:**

    a. What, if anything, is lost in cases of social interactions that are mediated using advanced telepresence in VR?

    b. If such losses were unnoticed, what negative effects for the human self-model could be expected?

**3. Risky content**

    a. As compared to the viewing of traditional movies containing graphic violence or pornography, the impact of full immersion settings and the associated risk of users suffering psychological trauma will steadily increase as VR technology advances. Users have to be made aware of this possibility.

    b. VR technology holds the potential to create robust social hallucinations, to directly manipulate the sense of agency, to modulate personality traits via identification with virtual characters, or to causally interact with deeper levels of self-consciousness (UI-manipulation). Users have to be made aware of this possibility.

    c. Avatar ownership will be an important issue for regulatory agencies to consider. There are strong reasons to place restrictions on the way in which avatars can be used, such as protecting the interests and privacy of individuals who strongly identify with their own particular avatar on social networks. On the other hand, these restrictions may prove impractical to implement and may unnecessarily limit personal creative freedom. Regulators must strike a rational balance between these concerns.

**4. Privacy**

    a. Users ought to be made aware that there is evidence that advertising tactics using embodiment technology, such as VR, can have a powerful unconscious influence on behavior. For example, a combination of "Big Nudging" strategies (collecting big data for the purposes of nudging the general public) with VR technology could have long-lasting effects, which might also affect underlying mental mechanisms themselves.

    b. Data protection: users ought to be made aware of new risks involving surveillance, such as reading out "motor intentions" or a "kinematic fingerprint" during avatar use.

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