

# Ethics of Virtual Reality Applications in Computer Games Production

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**Abstract** A current trend in the gaming industry is to provide more realistic and believable looking animations. Therefore, motion capture has been used to create such animations. Lately, immersive virtual environments have been developed to support motion capture actors with their work. Using virtual environments as work environments has already been explored but no ethical analysis or applied ethical code has been provided for such situations.

In this paper we investigate the ethical implications of introducing a highly immersive virtual environment within motion capture and discuss under which circumstances it is ethically justified to place an actor in such an environment. Moreover, we provide an overview of research in computer games ethics, virtual realities and acting, as well as an investigation of potential moral and ethical issues in motion capture. A discussion shall help finding an ethical consensus within the field of motion capture and for related situations.

## 1 Introduction

Computer games are becoming more and more realistic nowadays (Wages, Grünvogel, & Grützmacher, 2004). This is not only because of hardware and graphical improvements but also because human motions are captured and mapped to computer game avatars. This makes animations and motions in games increasingly realistic. Motion capture actors act out the desired motions and bring a virtual character to life. Thereby they use their own motions and emotions to form the virtual character.

Moreover, not only the aesthetic appearance of a game is of interest but also the level of immersion into the game, as well as the way of playing and the level of realism. Therefore, applications have already been developed to combine gaming with virtual reality (VR) environments (Yoon, Jang, & Cho, 2010; Liarokapis,

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2006). Currently VR technology and computer games, created for such technology, experience a hype. This is especially because technology becomes more affordable and usable for home entertainment.

Even for theatre plays the combination of computer game technology, motion capture and traditional theatre has already been explored (Andreadis et al., 2010). One could think easily of multiple application scenarios where the combination of VR technology with computer games or graphics could be applied.

In this analysis, we use motion capture acting as an example of how VR technology in combination with computer game environments could be used to help actors with their work. A motion capture actor's job is to contribute to the task of letting motions and expressions of emotions of an avatar appear in-game as realistic as possible. Nonetheless, the current acting environment for motion capture actors is very simplistic and the actors' work is not supported by technology in general motion capture shoots, in particular for computer games. Placing an actor 'inside the game' for which an actor is acting can be assumed to support the actor's work.

When applying technological advancements such as a virtual reality environment to a field it is worth to investigate potential ethical issues that could occur when actors are supposed to work with it.

This paper is organized into four main sections. The state-of-the-art overview covers the ethical discussions addressed in this paper, namely: the ethics of computer games, virtual reality and acting. Then we describe and discuss the possible ethical implications of motion capture actors when being placed into a highly immersive virtual work environment. This section gives an overview of the issues identified and describes the scenario that we use as a basis for discussions. The following section provides an ethical analysis on three questions extracted from the previous section to look at the raised questions in more detail. On these findings, section 5 builds up a discussion towards an ethical consensus that can be applied in motion capture. The term 'ethical consensus' is seen in this paper as a more defined ethical code or agreement between the stakeholders involved in motion capture. This includes for example a consensus between the gaming industry, the actor and the gamer as well as actors placed in a highly immersive work environment.

## **2 State-of-the-Art**

To understand ethics that could be applicable for motion capture, we need to look at professional ethics that have been discussed in related areas. Professional ethics have been discussed in many fields; one of those is computer science where discussions about known and potential issues are ongoing and constantly evolving into new areas (Moor, 1985). As computer technology and their applications is evolving, ethics for virtual environments (Brey, 1999; Whitby, 1993; Ford, 2001) and computer games (Gotterbarn, 2010; Dodig-Crnkovic & Larsson, 2005; Ford, 2001; Bruck & Watters, 2009) have moved into focus and discussions in the fields are already established. On the other hand, a brief literature search has shown that fewer

ethical studies have been written about the ethical implications of computer games in combination with virtual reality as a work environment.

To provide an overview of the related topics, we address the three areas of interest: ethics in computer games, virtual realities and acting.

## ***2.1 Ethics in Computer Games***

Ethical aspects of computer games have been discussed within different contexts already (Gotterbarn, 2010; Dodig-Crnkovic & Larsson, 2005; Gotterbarn & Moor, 2009). Especially the contents shown in computer games and their ethical implications have been discussed (Gotterbarn & Moor, 2009). In previous research it was suggested that the actual effect of computer games needs to be determined and that one must be cautious about the "widespread indiscriminate use of video games" (Gotterbarn & Moor, 2009). Also the researchers' concern was that computer games have increasing graphic capabilities that could provide gamers with open-ended possibilities of immoral actions that might even be rewarded. In another paper it was additionally pointed out that the "ethical decision-making" in video games and video game curricula should be changed and adopted to a more realistic approach (Gotterbarn, 2010). A general point of discussion around the ethics of computer games is about the content and how computer games are designed.

To improve this, suggestions have been made that "game developers should follow an ethical consensus because they reach a large population of young people" (Dodig-Crnkovic & Larsson, 2005). Others have a slightly deviated understanding and have argued that: "players are actually reflective, and responsible for the choices they take while playing games. Games are objects designed with affordances that suggest a certain experience that is evaluated by its players' moral sense" (Sicart, 2005). So basically it was pointed out that players of computer games are "moral beings" and construct an "implicit code of values" that can be used by game designers (Sicart, 2005).

This leads us to the issue that "game designers are still struggling with what kind of ethics code they should adopt" especially "because video games are a newer medium" (Takahashi, 2005). In the same research, it was mentioned that the distinction if a game is unethical or not depends on the "eye of the beholder". It is furthermore stated that consumers steer the market and in some cases even demand e.g. violent games. Then the gaming industry feels the pressure to comply with this demand to not lose market share to other competitors in the field. One of the interviewed industry professionals in their research even mentioned that violent computer games can allow to explore behaviors that would not be possible in the real world and allow to "clear negative emotions" (Takahashi, 2005). On the other hand, it is said in their article that there should be a clear distinction between what happens in the game and what happens in the real world. So the player should be aware that it is just a game.

Another research suggested to follow a model from Bertolt Brecht which makes the audience aware that they are being played and teaches them "not only to act, but emotionally and ethically respond in a specific manner" instead of implementing an ethical code (Pinchbeck, 2006).

The discussions on which kind of ethical code should be used for computer games is ongoing and should, in our view, constantly be adapted to new situations, technologies or applications. Combining virtual realities with computer games might be such a situation.

## ***2.2 Ethics in Virtual Realities***

Research within ethics for virtual realities seems to consider the ethical implications of the technology and their application areas (Cranford, 1996; Whalley, 1995; Thurmel, 1994; Beardon, 1992) but also the representation, interactions and the behavior in virtual realities has been considered (Brey, 1999; Ford, 2001).

Within the field of ethics for virtual realities, the issue has been raised that there is a need to regulate the actions of a user through an ethical consensus (Whitby, 1993). The call expressed was that designers should implement barriers that do not allow immoral actions or that even virtual or real punishments could be a result for immoral actions. The concern of immoral actions in virtual realities has also been raised by other researchers who mentioned that VR could imaginably allow the freedom to commit e.g. rape and murder (Brey, 1999; Whitby, 1993). It was pointed out that actions might be performed which would be morally questionable in the real world. Especially because technology could allow to create VR applications that can graphically depict and create "immoral acts including murder, mutilation, torture, rape, robbery, and grand theft" (Brey, 1999), ethics in virtual environments become even more of interest. In the event that such environments become available to the public, an ethical code for VR applications must be of importance. When thinking about actors working in such a virtual environment (VE) for several hours, it is questionable how it affects the actors mind and if there are psychological issues that need to be considered.

Ethics in virtual realities have also been discussed in the field of psychological sciences. VE-related side effects have especially been pointed out (Rizzo, Schultheis, & Rothbaum, 2002; Bruck & Watters, 2009). Cybersickness, aftereffects, altered sense of reality, limited self-awareness and the loss of choice have been identified as possible occurrences in virtual realities. A "general discomfort, fatigue, headache, eyestrain, difficulty in focusing eyes, increased sweating, nausea, difficulty in concentrating, stomach awareness and blurred vision" was also observed as more present when showing a fast moving simulation in comparison to a slower moving simulation (Bruck & Watters, 2009). Another research project tested the perception of crime by using a virtual environment. It was also compared how the perception of crime is perceived in the real world and in comparison to the virtual world. Within this research it was found that participants appeared more

observant in the virtual environment (VE) and sometimes even more fearful than in the real environment (Park, Spicer, Guterres, Brantingham, & Jenion, 2010). This also adds to the question on how moral it is to expose a motion capture actor to such conditions and how this could be avoided by technology solutions and ethical guidelines.

It has been mentioned before that when IT is introduced into our lives it will change our experiences and the way of living or working with it. Therefore, it was stated that it needs to be ethically analyzed how to prevent harm to human beings and to look at the effect of the introduced IT on the users (Van den Hoven, 2008). In our scenario it is not IT but another form of technology that shall be introduced and an ethical analyses needs to be conducted. It has even been mentioned that actions in virtual environments can be harmful to others and raise moral issues within all major traditions in ethics (Brey, 2008). This is why we need to investigate how this could affect actors in a VR environment.

As mentioned by others, "morality has always been in a state of flux" where the discussion about moral questions might not lead to an ethical consensus (Whitby, 1993). This might be the case but nonetheless guidelines that are moral at this present time can be given to steer and control the morality of the current society and secure a VR experience that is not harmful and also secures the general acceptance of the technology to be used in work and entertainment environments.

### ***2.3 Ethics in Acting***

Even in acting education, ethics have already been discussed. The use of power and the problem of inter-corporeal actions like in extreme cases seduction, rape, nakedness and sexual intercourse that actors were forced to act out by acting teachers have been ethically questioned. In this specific study the approach of the acting teachers and their use of power to enforce such scenes was addressed (Isaac, 2013).

The job of a motion capture actor is to act out motions and emotions in a believable and naturally looking way, for example, for a computer game. To trigger more natural emotions, actors might be placed in a highly immersive virtual environment to support their act. Directors and animators could have the power to create immoral scenes and situations enforcing actors indirectly to act out scenes that are ethically questionable. This implies two ethical issues, first it comes back to the question of content shown to the actors and second it addresses the problem of the effects on the actors' psychology when placed in a highly immersive environment for a longer time.

### 3 Possible Ethical Issues Within Motion Capture

From the state-of-the-art we can see that a futuristic motion capture environment deals with similar ethical issues than other fields. Nonetheless, we see that there are specific differences to motion capture and therefore we need to look at the possible ethical issues that could occur within motion capture acting.

Before discussing possible ethical issues and the implications when placing an actor in a highly immersive virtual environment we need to describe the imaginative environment that we are using for explanations. The environment is fictive but yet not far from reality and already technologically possible to implement. Figure 1 shows an actor in a motion capture environment wearing virtual reality glasses to see and 'feel' the virtual environment.

For the depicted environment we have to know that different stakeholders and also different ethical fields come together. Actors, directors, game developers and game publishers are interested in the results of a motion capture shoot. While acting, the fields of computer games and virtual environments come together to support the actors with their work. The goal of all stakeholders is to deliver realistic and natural-looking animations. Game developing companies get their demand from the market, generally speaking from computer game consumers. In this market it seems to be a trend that gamers seek to play games that are increasingly realistic in terms of movements and emotions. So it is in the interest of the gaming industry to support the needs and wants of realism that gamers seek and pay for.



**Fig. 1** Motion capture actor in a futuristic virtual environment supporting the actor's work

This implies that game designers and developers work on creating storylines, characters and environments that shall occur fairly realistic. Actors and directors then support the need of realistic motions and emotions through motion capture performances.

To create a certain amount of realism in a game, the actor is responsible to bring the game character to life and provide realistic and believable motions. This alone does not necessarily mean that any moral or ethical issues might occur. It depends on context and content of the performance an actor is asked to play and later shown in-game. Games and animations can be perceived as very violent or disturbing and sometimes even immoral. It is then questionable who should be held responsible for immoral scenes and which norms or ethical code should be applied. Actors enrich the perception of realism through their skills, the games industry designs the games and story and the gamers' clientele buy games and seek for realism in unethical games. One can see that there are multiple stakeholders, from the consumer to the game publisher, involved before a game gets on the market and it might not be easy to answer the question who is responsible. Especially, when we consider that content can be seen as immoral by one person and seen as acceptable by another (Brey, 2008). However, when we talk about professional ethics, responsibility lies on different professionals involved, each of them responsible for their own conduct. Regardless, one point needs to be mentioned, animations can appear quite realistic with modern technology and techniques like motion capture. Therefore, it needs to be considered if ethical issues are involved within the application or the content of those animations. Ethical guidelines that result from discussions within computer games ethics might help to apply an ethical consensus on this matter.

More ethical issues within motion capture can occur when thinking about an actor working in a highly immersive virtual environment. Here, we imply that an actor experiences a strong feeling of being immersed and 'present' in the virtual world. Presence is a term that has been introduced by other research to describe the degree of a persons feeling of "being there" in a virtual environment (Slater & Usoh, 1994). For such a scenario we think of using an immersive environment where an actor can feel present to a large degree and immoral scenes are displayed that the actor needs to act out. As mentioned before, research has shown that virtual environments can increase the subjective experience such as the feeling of fear (Park et al., 2010) and possibly other negative feelings as well. However, a professional actor is trained to distinguish between the real world and the world on stage (Sawoski, 2010). In other words an actor must be aware of the actions of the character and the actions of the actor as a person. Still, it has not yet been tested what effects a highly immersive virtual environment would have on an actor under extreme conditions and even on a sub-conscious somatic level, especially when extremely violent and touching scenarios are shown to the actor. One could argue that this might trigger more natural reactions and actions but the general question remains: what happens when virtual reality becomes more real and the border between reality and play becomes harder to distinguish. In other research it has even been argued that "virtuality threatens to alter our perspective on reality, causing us to see it as yet another sign or simulation" (Borgmann, 1999). Psychological issues that actors experience because of the work in a virtual environment (VE) could occur. In such a case one would have to make very clear to the actor, and the actor to himself or herself, that the performance is not real and only the character to be played experiences the reality, not the actor. Professional actors have the experience and training to deal with such circumstances better

but for motion capture acting, the term 'actor' is quite vague. Here an actor might also be an inexperienced actor, a stunt man or a professional athlete. The effects of a highly immersive virtual work environment when using it over a long time and in an inappropriate way have not yet been studied. Therefore, we must find guidelines or techniques to prevent issues due to acting in highly immersive virtual environments. 'Greater than life' experiences can even challenge experienced professional actors. A scenario where such an ethical issue is possible is when actors need to perform cases of torture, extreme interrogations or training of special forces under severe conditions.

Furthermore, it needs to be tested if and how the end users of a motion capture performance are affected when these performances become even more realistic and believable. This relates back to content and context of computer games but also includes the gamers' actions and their effect on the gamers' real life. As mentioned before, professional actors are trained to distinguish between what is real and what is performance. It is questionable if gamers can make this distinction too. When computer games are becoming more realistic through better graphics and hardware but also the contribution of motion capture performance that enrich 3D characters through motions and emotions that allow to appear human-like, we should also consider the effects that might occur when gamers are exposed to games that appear close to realism and depict unethical content.

## 4 Ethical Analysis

The moral issues pointed out in the previous section resulted in three questions that we think summarizes their essence and therefore are used in the following to analyze the ethical issues in more depth. Stakeholders that we address in this analysis are actors, directors, game developers, game publishers and gamers.

The resulting three questions to be analyzed are the following:

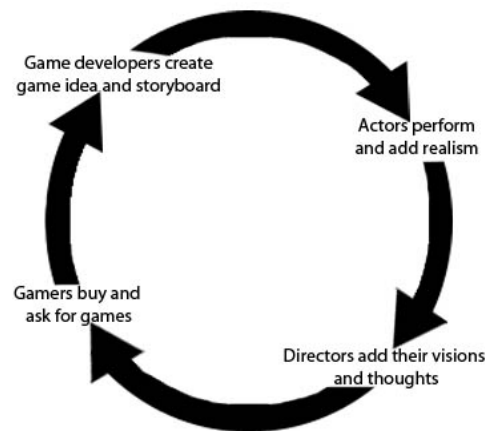
- 1) What are the responsibilities of stakeholders of a performance and how to avert unethical performances?
- 2) Could an actor be psychologically affected when working with disturbing content within a highly immersive virtual environment (such as e.g. violent scenes)?
- 3) How are gamers affected when being exposed to games with more human-like 3D characters that are behaving unethically?

### Analysis of question 1:

To analyze the first moral issue mentioned-above, we need to investigate who is responsible for the content of a performance. This question is not as simple to answer as it might seem at first. An actor is performing and giving the 3D avatar a touch of a human person and helps making the animation more realistic and believable as well



as shaping the personality of the virtual avatar. After that, the directors add their thoughts and guide the performance of an actor. As another instance, game developers create the idea and the storyboard for a game and therefore create content and context of the game. The question on who is responsible could also be redirected to the consumers that are buying computer games with unethical content. It seems like a viscous cycle where demand and offer are closely related. In figure 2 it is depicted, how the demand and offer of unethical computer games content is related between the stakeholders of the scenario chosen in this paper. The cycle also reflects in a very abstract way the process and connections between the game development industry, motion capture and the consumer. One needs to keep in mind that this figure is meant to illustrate the relations of stakeholders when producing a game with unethical content.



**Fig. 2** Cycle of demand and offer within computer games development, including motion capture, that can become viscous in case of unethical games

It might not be the right way to find a solution to who is responsible for the development of computer games with unethical content but rather to apply an ethical consensus to steer the use of content in computer games. As others have already addressed, a more realistic ethical consensus for computer games needs to be found (Gotterbarn, 2010). One solution could be similar to what has been done for the film and movie industry by applying an ethical code to the creation of content for computer games (Takahashi, 2005). This could help to steer the development of computer games to reduce highly unethical content and the demand for it. Other research suggests to "extend the age-based censorship for media, . . . including VR" and to encourage designers to establish high ethical standards with the help of professionals (Whitby, 1993). This might be an additional option towards an ethical consensus but it cannot be the complete solution, we need to discuss a minimal eth-

ical consensus that is applicable to the gaming industry first.

### **Analysis of question 2:**

For the question if an actor could be psychologically affected when working with unethical content within a highly immersive virtual environment, the stakeholders are actors being exposed to a highly immersive environment and game developers providing unethical content that is shown in a virtual reality environment.

Previously (highly violent etc.) games have been produced for the use on computers, game consoles or mobile devices. There, gamers control the games from outside the game world. This creates a physical distance between the game world and the real world, even though games can pull the gamers attention towards the game and allow for the feeling of presence. When bringing real humans into the virtual world, immersed and exposed to the game content shown to them, the physical distance is taken away. The player, actor or user of such a system perceives the happenings and the virtual environment now directly.

For motion capture acting in a highly immersive environment there are even more distinguishing characteristics. Normal users of a virtual reality do not necessarily act, react or move in a realistic way. Movements and interactions can be symbolic and do not resemble everyday reactions and movements. Motion capture actors need to live up to the experience so that they can get to the state of 'being the character'. A normal VR user does not internalize the VR environment to such an extend. VR users only explore and experience the environment where the feeling of presence and 'being the character' might be reached. An actor in a VR on the other hand, needs to internalize the scene to act and deliver a believable performance. Therefore, we can say that the actor is working towards reaching the feeling of 'being the character' and 'living the scene'. In comparison to traditional acting we introduce a highly immersive VR and increase the 'greater than live' feeling which is common for VR environments. This leads to a much higher cognitive load than in ordinary acting and than just exploring a VR.

One problem to consider is, as research has shown, that highly immersive virtual realities can increase the feeling of fear (Park et al., 2010). This could support the assumption that highly immersive environments can place actors in situations with extreme unethical content and this might psychologically affect motion capture actors working in it.

To avoid such events from happening it is of importance that such a scenario must not even be needed. Ethical guidelines and the non-existing need to perform unethical performances could be a way of preventing the need to capture unethical scenes. By unethical performances we mean scenes that depict extreme acts of violence, torture, extreme interrogations, drug abuse or even extreme depiction of sexual acts. In case actors are obliged to work in such an environment it must be defined what is moral and what is not. As this is not yet answered, the exact implications on users of a highly immersive system with unethical content needs to be researched and applicable ethical codes need to be discussed.

**Analysis of question 3:**

The question on how gamers are affected when being exposed to games with more human-like 3D characters that are performing unethical actions can be addressed through the comparison of types of ethical concerns that could occur in our scenario with the ethics of virtual reality, computer games and acting.

When looking at the fact of having a 3D character performing realistic human-like motions and actions might not be an issue in itself, it could even be helpful when we consider educational and sports games. It is clearly up to the context and the actions that the 3D character performs or the gamer is allowed to perform. It might be assumed that a game character performing unethical actions in more realistic, human-like appearance has a larger negative impact on the gamers' reactions and perceptions as current lower fidelity characters. Earlier research supports this statement by saying that more realistic virtual environments are more powerful (Brey, 1999). On the other hand, research in ethics for VR claims that sometimes "well-constructed action, plot, and play-ability" can have a greater effect than "gorgeous renderings that mirror the everyday world" (Ford, 2001). As this issue is not yet fully discovered it can only be the goal to prevent gamers from affecting them in a negative manner. Especially protecting under aged gamers from being exposed to unethical content must be avoided as they could be negatively affected by e.g. 3D avatars performing unethical actions with believable motions and emotions. This issue might even become more imminent when we introduce a highly immersive virtual reality application to the gamers such as we intend to use for actors. It must then be of strong interest to look into ways of preventing gamers from harm.

Again, a refined ethical consensus, as well as the social perception of demanding such games must be addressed to help limiting negative affects on consumers.

**5 Discussion Towards an Ethical Guideline**

We see the need for a discussion towards more defined ethical guidelines for motion capture acting in a highly immersive environment as no guidelines for our scenario exist yet. From the analysis above, we can see that the main ethical issues within a futuristic acting environment are fairly similar to what is being discussed within ethics in virtual environments and computer games. Therefore, existing ethical codes from these areas could be applied but we could not find an ethical code that can be applied out of the box.

There are many interesting concepts that could lead towards an ethical consensus; some of them have been mentioned in the state-of-the-art section of this paper. On the other hand it might be hard to implement ethical codes when discussions within ethics for gaming and virtual realities face different opinions and contradict each other. It can even be said that in some of the discussed areas, contradictions or the struggle to apply the 'right' code exist. One largely discussed example is the content of computer games or the discussion on health issues and their acceptability within virtual realities. To get to an ethical code it might not be the right way to

only restrict unethical content in computer games. This would probably lead to scenarios where unethical games will be designed and distributed through non-profit or private persona. It must certainly be the case that harm should be prevented and unethical actions should not be rewarded. A punishment systems to steer what is seen as moral or immoral was suggested to implement in VR systems (Whitby, 1993). This could be one way of achieving this but what remains questionable is in which situations this applies; for computer games, VE's and in which use cases (work or entertainment environment). The discussion on what is immoral and what is not is still ongoing and it might not be simple to answer this. Other research talks about indecent representations that depict shocking and offensive scenes which still might be seen differently by people, some might find it unethical and others might accept it (Brey, 2008).

Changing the industry habits but also the thinking of the community that uses the unethical digital content seems to be of more value to achieve an ethical consensus or even to come to an understanding on how to deal with unethical content. This could e.g. mean to make designers aware of the ethical issues and how to avoid them. Unethical actions should not be rewarded, the choices of behavior can be up to the users themselves but the understanding of what is real or virtual is must be supported through the design of the system. Such thoughts are not new to ethical discussions but what needs to be pointed out is that the society that uses or designs virtual reality systems must come to an understanding of what can or should be depicted. It should be made clear that if unethical actions are shown, the difference of what is real and what cannot happen in the same way in real life is understood.

Such guidelines could help towards an ethical code in motion capture as well. We think that an ethical guideline for a futuristic motion capture environment needs to consider and cover the most imminent issues within motion capture acting. This implies the physical and mental health of actors, the content generated and released for computer games, unethical performances and acting conditions that actors are dealing with. As these moral issues are strongly related to ethics from computer games, virtual realities and acting, we see a larger potential to use a subset of ethical codes from these areas to create an ethical guideline for motion capture actors. We need to prevent that the 'greater than life' experiences that actors might have do not include extreme unethical content. It also needs to make sure that discomfort and cyber sickness when using a VR environment does not occur. As the ethical codes in VR, computer games and acting are not yet that evolved to deal with these issues it might be a good way to make actors aware of the circumstances they might be placed in and teach them how to handle them, like other research suggested for visitors of a theatre (Pinchbeck, 2006). Motion capture actors could even learn to distinguish between the real world and the world on stage from professional acting training. At this point we see that more discussions are needed to define a more concise ethical code that can be applied for motion capture acting, especially when introducing VR technology as acting support.

## 6 Conclusion

The discussions to reach an ethical consensus for motion capture acting are still rather basic. This is mainly because of a lack of an existing ethical code in motion capture. We see an ethical code, applicable for motion capture, resulting of a subset of ethical codes from the areas of virtual reality, computer games and acting. These areas have a larger impact, are widely discussed and are closely related to a futuristic motion capture environment.

In this paper, we also discussed possible ethical implications of technology applied to a new environment, involving different areas of ethics. The specific case of virtual reality technology applied to a motion capture environment as acting support has been chosen for analysis. To approach this specific domain of applied ethics, an overview of ethics in computer games and virtual environments has been given.

The ethical implications that were discussed and considered as important when placing actors in a virtual environment as a support for their work can be summarized as follows:

The game content as well as the performance to act out could already be ethically questionable. Especially in such a case, new ethically questionable situations can occur when the scenery of the act is depicted in a highly immersive virtual environment. Actors might experience extreme emotions ('greater than life') that they have to overcome to not be affected psychologically. It is also needs to be considered that working in a VR environment can cause physical implications for actors. This needs to be considered and further researched.

For the scenario used in this paper the ethics within the areas of computer games, virtual environments as well as acting is considered. When introducing technology into a new area where ethics of multiple areas need to be taken into account, such as game ethics, theatre ethics and occupational ethics, it must be considered if those ethical approaches still apply and if there are no new ethical issues that have not yet been studied.

The ethical analysis that we performed has shown that VR technology used in a work environment could be covered by using ethical codes from computer games ethics and ethics of virtual environments, even though there are some questions that we specifically raise in the context of motion capture acting. More research is needed when new technologies are introduced to special working environments that connect multiple ethical fields. In this respect, the work in this paper shall serve as a starting point for discussions and for further research on ethics of motion capture acting for virtual worlds.

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