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Social interactions in VR

Seminar by

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Group Gaze

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Abstract

With the increasing use of virtual reality (VR) technologies in research and consumer environments, another application of VR arises for scientific research. One use of applying VR is to capture the gaze of a participant, which provides information about their focus in a given scenario or scientific study. The gaze direction of the participant provides valuable information and momentary snapshots about the focus of attention and can be evaluated accordingly for social studies.

In this literature review, we are proposing gaze as an important factor for the research field of social interaction, which can significantly improve the social experience in VR both directly or indirectly. This can lead to an enhanced VR experience that feels real to the end user. This literature review aims to give a brief overview about the topic of gaze in VR and what the current state of research is in selected scientific literature.

Keywords – gaze, virtual reality, social interactions, communication

Contents

1 Introduction

The question what guides our gaze in realistic settings has been of interest to researchers for decades. In typical laboratory settings, where the movement of head and body is limited, eye movements typically consist mainly of saccades – rapid shifts of gaze – and fixations. This is also possible for experiments with subjects in VR. Here, the eye movements of the test subject are recorded with an eye tracker built into the VR goggles. The eye movements of the test person are recorded and with the help of colliders on the objects of the scene in VR, it can be reliably analyzed afterwards at which object the test person's gaze was directed. Gaze in VR is helpful because we as humans already communicate a great deal through our gaze alone. Who and how we look at someone can be a complete communication on its own. Therefore, it would be helpful in order to conduct research for social interactions to realistically modell these interactions in VR.

2 Methods

In virtual reality the human gaze is drawn to people showing emotions (Berton, 2019 [1]; McCall, 2016,[2]), and other humans which exhibit risky behaviours or to people holding objects in their hands (Rubo, 2020 [3]). This phenomena is very similarly to the real environment. In VR gaze can be analyzed on a scene-wide level to tell apart what people will look at. If no stimulus is being applied and the scene is designed neutrally, gaze spreads between all elements in the current scene.

Humans tend to immerse better while using VR technologies, in which humanoid figures or other humans play a role. (Gonzales Franco, 2020 [4]) These actors have to be of quality, in order to deem the VR experience, thus the (social-) interaction with the actors, real. In order to make the virtual interaction feel realistic to the user, we need to identify important communication and interaction techniques and aspects that humans use either consciously or unconsciously because modelling everything that is going on in any human communication, especially face expressions and blinking, would be inefficient for most scientific research. (Kruzic, 2020 [5]).

Gaze behaviour is similar between the virtual environment (VE) and the real environment

(RE) while gaze differs from person to person. Gaze behaviour is strongly influenced by the elements in the scene, whether they are in motion and also how the user perceives them - for example either positively or negatively. Gaze can control the mood of a person. This has been shown in a study where participants were exposed to environments with a majority of negative stimuli. Participants with a disposition to control their mood did so by directing their gaze at positive connoted areas in the scene. (McCall, 2016 [2]).

Approaching actors draw gaze more strongly towards their object in hand and head than still standing ones (Rubo, 2020 [3]). This, combined with the tendency of gaze being drawn to the face of actors can show the importance of facial animation, as gaze is drawn to it often (McCall, 2016 [2]). Further gaze seems to be drawn to persons with angry and sad expressions relative to neutral ones (Rubo, 2021 [3]). The same happens with smiling expressions, which attract gaze (Rubo, 2021 [3]). Neutral faces on the other hand will induce gaze being drawn to the chest area.(Franco, 2020 [4]) Combining this with the proposal that gaze induces the feeling of co-presence the virtual environment can be improved by making actors watch for these clues and respond to them with gaze (Vinnikov, 2017 [6]). Also, it is possible to let agents exhibit a mutual gaze on a person to improve the impression of the agents. Gaze-contact can induce stress and avoidance of gaze does not always reduce the stress level. Induced stress is mostly apparent in individuals that are being judged contrary to non-judged individuals. (Vatheuer, 2021 [7]) It was suspected that gaze can affect the conformity level of persons.

When designing gaze interaction, scenes - and also automatic gaze of actors in VR - it is important to consider some factors that occur in real life. As gaze is an important factor for communication in all humans, we are very receptive to it. Although, it was also concluded that this gaze-contact is only more effective when combined with other social clues. (Kyrlitsias, 2020 [8]; Moser, 2020 [9]) Usually, higher-ranked persons prefer mutual gaze while lower-ranked individuals try to avoid it. (Rubo, 2020 [3]; Toyono, 2019 [10]) To conclude, we can say that gaze interaction designs have to pay attention to the social hierarchy of the involved actors as well as on the personality traits of the human that is being looked at.

It was found (Hömke, 2018 [11]) that while a human is engaged in a conversation, he perceives the subtle changes in blink duration and blink behaviour as a communication

signal. This is supported by the fact that long blinks were observed to be more likely during the mutual gaze window. Longer blinks are perceived as a signal for mutual agreement on the things said (Kyrlitsias, 2020 [8]). Blinking could lead to a higher perceived social presence and a more accurate impression of the gaze partners personality.

3 Conclusion

We can conclude that gaze serves as one important factor for social interactions in VR. It can manipulate the attention of a person if exerted by external actors and serves as an indicator for human attention as well. Gaze and the connected blinking behaviour is being used in communication heavily and can induce higher motivation in humans performing a task. Gaze also serves as an indicator in VR which elements of a humanoid have to be modelled at near reality-like level as it indicates which elements are being looked at the most. When designing the gaze of external actors, it is important to reflect on the personality of the human experience the gaze behaviour of the actors and change it accordingly. While designing the virtual environment, it has to be taken into consideration that gaze behaviour changes with the mood of a person and is drawn to positive connoted fixation points mostly and that gaze of a person is drawn to moving elements and approaching humanoids. For the latter, gaze is more specifically drawn to their object in hand or their face, while gaze is drawn to their face with a higher chance when their face is animated and expressing emotions. All in all, we consider gaze to be an important factor to take into consideration for designing social interactions in VR as well as the virtual environment itself.

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