
Filtered Reality – Keeping Your Peripheral Vision Clean

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Abstract

The main purpose of the recently advancing Augmented Reality glasses is the augmentation of the physical world with additional information. In this paper we introduce the concept of *Filtered Reality* for Augmented Reality glasses. Instead of adding digital information to the real world, we envision Filtered Reality to use digital information to remove parts of the reality out of the field of view of the user. Similar to the functionality of horse blinders, Filtered Reality allows the user to stay focused on specific tasks or to leverage his mind from the appearance of certain real world objects.

Introduction

Most parts of the human retina are used for peripheral vision. It lets us detect changes that are happening around our foveal vision [6]. In HCI it has been extensively used in different projects [3,4,5,8]. Today's operating systems make use of the peripheral vision as well. For example OSX shows notifications in a corner of the screen, which normally lies in the peripheral part of our field of view for a sufficiently large screen. Even though these notifications are very small, they are still visible and may lead to distraction from the users original task [7]. This behavior is an evolutionary survival instinct that allowed primal humans to detect menaces approaching them and allowed them to escape or defend themselves against it [6].



Figure 1: Filtered Reality in *ambient mode*. Top: Unfiltered view with unwanted elements Middle: Background filtered view where the unwanted element is filtered out with background knowledge Bottom: Black-out view where the unwanted elements are grayed out reminding the user of their existence

For horses, a very similar phenomena can be observed. Their eyes are situated on the side of their head. In nature, this is seen as an indicator that they are normally hunted. Such an arrangement of the eyes leads to extensive peripheral vision, which in case of domesticated horses can lead to problems. When riding a horse, the horse is often supposed to stay focused on instructions or a particular task. This is especially important when riding a horse in public or in the direct proximity of people. Through the extended peripheral vision, the horse is exposed an enormous amount of visual stimuli. These can scare the horse and making it bolt. To prevent this, horses are often wearing blinders, which allow them to remain focused by decreasing their field of view [9].

In this paper we introduce the concept of *Filtered Reality* for Augmented Reality (AR) glasses. The introduced concept origins from the aforementioned horse blinders. In contrast to AR, where the goal is to augment the real world with digital information, we envision *Filtered Reality* to exploit digital information to blind out particular parts of the reality out of the field of view of the user. This will allow the user to stay focused on a particular task or it will remove unwanted distractions or annoyances from the current field of view. Using head mounted displays the reality of the user can be filtered by either (1) overlaying background information in front of distracting objects or by (2) reducing the field of vision of the user to keep him focused. In addition to the concept, we describe possible application scenarios and we further present an initial prototype, implementing the most radical version of filtered reality: blocking the whole field of view.

Concept

Idea

The concept that we introduce in this paper is called *Filtered Reality*. With the recent advantages in head mounted display technology, AR-glasses such as Google Glass will be available to the mass market in the near future. Even though Google Glass is only partially suited for Augmented Reality as it only augments a small part in the upper right corner of a user's current field of view, its current propagation boosts up the development of numerous head mounted displays which are better suited for augmenting the whole field of view of the user. While the main purpose of these devices is to add digital information on top of the users field of view, the concept of Filtered Reality envisions the exact opposite.

By using the digital knowledge about content and preferences of the user, Filtered Reality Glasses would remove information from the reality around the user. We envision two different modes: The first one, called *ambient mode*, filters undesired objects from the user's environment. The second mode, called *focus mode*, filters everything except the one thing the user tries to focus on. To realize these two modes, we can apply two methods for altering the current view: At first, we can simply overlay the unwanted parts of the users field of view with a black layer. Therefore its called the *blackout view*. As a second altering method, called *background-filtered view*, the unwanted parts in the current view can be replaced with information from the background. Naturally it is possible to blend between these two modes or even create settings for specific objects so that both modes could occur at the same time.



Figure 3: Filtered Reality in *focus mode*. Top: Unfiltered view with incoming call and Bottom: Blackout view where the incoming call is hidden.

Ambient Mode

The *ambient mode* is meant to remove specific content from the environment of the user. With that, it allows the user to change his perception of the environment in an ambient way. The content that is removed are elements that the user doesn't want to have in his mind. If for example the user wants to block out a specific person (e.g. his ex-girlfriend) from his life, every time this person appears in his field of view, it is overlaid. This allows him to roam freely through his environment without wasting cognitive resources or getting emotional over certain elements that he normally would encounter.

The background overlay view is especially suited for the *ambient mode*. Overlaying the unwanted elements with available information about the background that is behind the removed element makes it look more natural and nearly unnoticeable for the user. But since such information will not always be available they either have to be interpolated from the environment around the object or the blackout view can be used.

Focus Mode

The *focus mode* is derived from the idea of blinders for horses. We envision this Filtered Reality mode to be employed in use cases and application scenarios in which the user's focus should not be disrupted by visual stimuli from the peripheral field of view. But it can also be used to steer the user's focus and attention to a specific point in the environment. In this setting especially the peripheral vision of the user should be freed from disruption. When the user tries to focus on a certain task, possible changes in his environment can lead to him wasting his cognitive resources on these changes and with that losing his focus. Therefore the



Figure 3: Sensory Deprivator 5000 [2]

whole view except the parts that are needed for completing the user's main task are overlaid with a blackout view. For example if the user is writing something, everything that is unnecessary for this task is blocked. This is depicted in figure 2.

In the 14th episode of the second season of the American TV series "How I met your Mother", one of the main characters, Ted Mosby, is wearing a set of glasses that are meant to keep him focused and shut off from external influences. They are called the Sensory Deprivator 5000 and consist of sunglasses that are completely covered with duct tape except for two small holes in the center of each glass [2]. Additionally they have blinders on the side to limit the field of view to an absolute minimum (compare figure 3). This system allows him to stay focus and block out any external influences, in his case getting to know the result of the SuperBowl.

Initial Prototype

Our initial prototype represents the most extreme version of Filtered Reality since it is blocking the whole field of view of the user with a Black-out View. Even though this seems not to be useful, there are scenarios where such a device can come in handy. It is following the approach of the Joo Janta 200 Super-Chromatic Peril Sensitive Sunglasses of Zaphood Beeblebrox. They are designed to "help people develop a relaxed attitude to danger. At the first hint of trouble, they turn totally black and thus prevent you from seeing anything that might alarm you" [1]. When for example one is watching a horror movie and there is a scene that might frighten or disturb one, people tend to close their eyes. With the proposed Filtered Reality glasses this can be done automatically. By incorporating a heart



Figure 4: Our prototype consisting of modified ELSA 3D Revelator glasses. Top: Open shades, the user is anxious Bottom: closed glasses, the user is facing danger more relaxed.

rate monitor that detects the increase of stress and arousal, the glasses can be set to black out the vision and leave the user with only the sound. Thus relaxing his mind by not having to watch a disturbing or frightening scene.

Besides closing both shades with a Black-out View the prototype also allows to close both glasses separately. This could be used when a distraction is appearing in the peripheral view of only one side of the user. For example if the user is writing a text and in his periphery a person is passing by on his right side only the right shade could be closed. To implement this of course such distractions need to be sensed.

Our initial prototype consists of a pair of ELSA 3D Revelator glasses connected to an Arduino Uno (compare figure 4). We use a Polar Wearlink heart rate chest strap that communicates via Bluetooth. If the heart rate increases by 15% over the resting pulse the blinds are closed. This threshold reflects the increase that we found suitable when watching horror movies to shut the shades. With this setup we can ensure that the user will not see disturbing parts while watching a horror movie.

Conclusion

To the best of our knowledge the concept of Filtered Reality has not been explored yet. Currently there are no insights in how such a technology can be used to help the user in focusing or to remove information to free cognitive capabilities for other tasks.

Future Work

Besides extending our current prototype with a field camera we want to evaluate its effectiveness.

Moreover, once suited AR glasses are available we want to develop a prototype that also allows for ambient mode.

Additionally not only visual changes can lead to such loss of focus, auditory disturbance can have an equally high impact. Therefore a holistic Filtered Reality system should cope these as well, e.g. by incorporating special noise cancelling headphones that would remove certain sounds and frequencies.

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