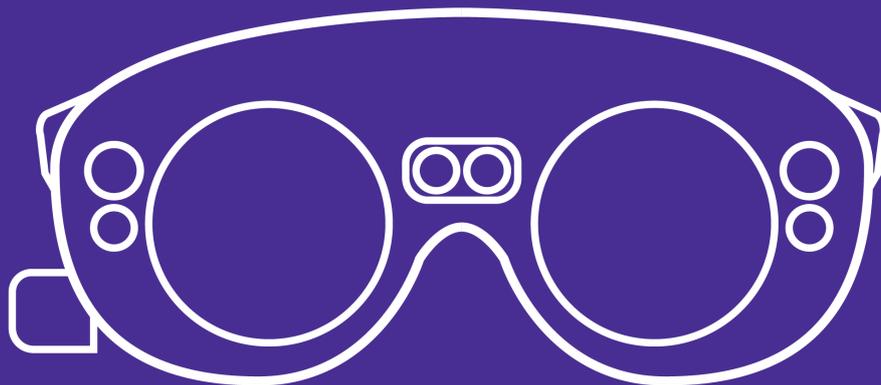


Conclusion & Recommendations

Including personal vision



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Conclusion

AR wearables can be seen as the infant child of mobile AR and VR. It has great potential but must mature before really becoming useful for a broad audience. AR wearables could have a bright future, so it is good to know how to design an experience on them already.

AR can be used in a lot of different fields, for instance: educational, distribution and creative jobs. AR on mobile phones is already consumer ready and is used mainly as filters in Snapchat and Facebook. In the future, when AR technology is more optimized, AR could be used in more serious ways, like healthcare.

The added value of an AR wearable is that it gives the user more freedom to control the digital environment, because both hands are free. When the field of view becomes bigger, the AR wearables will become more intuitive, because screens can never capture a broader field of view than the flat screen itself. This also brings a new challenge with it, like taking the environment into account when designing. The controls, UI placement and user constraints should be considered.

AR wearables offer a new way of interaction, so a good onboarding is required. This could be done by a tutorial that lets the user become familiar with the device. A clear hierarchy is required to give the user an idea of what the most important aspect of the application is. Because the field of view of an AR wearable is already small, it is good to keep it as empty as possible and only show one main function at a time. Feedback can be given in multiple ways. Visual feedback is the most obvious one, and it should always be used. Audio feedback is also an important way of letting users know what they are doing. Haptic feedback, however, is situational and can only be used if the user has a controller or other handheld device, which in turn decreases the added value of AR wearables.

Because AR wearables offer a lot of possibilities to work with, it is required to know where a menu could be placed for the best results. Vertical menus offer the best user experience, because they can be interacted with in an optimal way. Situational menus, like menus that are attached to the arm or a wall, are also recommended, because they enhance the experience of the users and give them a feeling that they are augmented. Horizontal menus and Heads up Displays are less recommended because they are harder to use or have a bad user experience. As seen with VR, the controls for AR wearables are not yet standardized. Every different AR wearable device has different ways of control. It is far too early to tell which of these controls will become dominant. Most devices try to implement hand-tracking, but it works semi-ideal at best. But as seen with smartphones, when given time, a dominant way of user control will emerge. For now, the use of a controller is advised.

While there are some minor physical strains that are the results of the bulkiness of the AR wearables, the real risk is the prolonged eyestrains it could lead to. These strains, however, have not been researched yet and AR wearables are not used for a prolonged time. But in a future, AR wearables could be used on a day-to-day basis and in an uncontrolled environment. This could lead to perception impairment. This impairment, combined with the "flow state" of the user due to immersion, could result in real dangers. The developer determines the cognitive load. A low cognitive load leads to good information transfer. On the other hand, a higher cognitive load could lead to a better immersion.

Based on the experience of the building and testing of the prototype, UX design guidelines for AR wearables were made.

During the research it became evident that AR wearables are not a consumer ready product yet and that designing an application on them is a difficult process. The experience on AR wearables is now mostly a single user experience, the field of view is too small to really immerse a user and the hand tracking is not intuitive enough yet to give a user real freedom of controlling the digital environment. These need to get better for AR wearables to get a place within the consumer market and to be able to set up a user-friendly experience on this device. As history of technology has shown, it is just a matter of time before this will happen.

Recommendations

Future uses of prototype

Showcase to clients

The prototype can be used to show the possibilities of AR wearables to clients of Greenhouse. A video of the user journey will be made, in which the different ways of interaction will become clear. This is useful to give clients an idea of what is possible with AR wearable technology now.

Sharing/Showcasing platform

Within Greenhouse, this prototype can be used to showcase certain 3d-models on an AR wearable. The 3d-model can be put inside a Google Drive folder that is linked to the Magic Leap. After this, the model can be seen inside the vending machine menu of the application. This is great for viewing a 3d model from all perspectives in a 3d environment.

Brainstorming Tool

The prototype can be used as a tool to get a fresh look when brainstorming. Inside the prototype are several dozens of objects and some tools that will help the user brainstorming. The scene can be saved and loaded in at a later moment, saving the user from cleaning up after a session.

Future use of AR wearables

AR wearables are an interesting prospect. At the moment, however, there are limitations that the technology must overcome. The most evident one is that the AR wearables are too big and heavy now. But there are other things that need to improve before it can become consumer ready:

Immersion

The small FoV results in losing a lot of immersion in AR wearables. While a normal person has a FoV of 220 degrees. The average AR wearable has a FoV of only 70 degrees. This results that the experience only renders right in front of the user. Big objects or skyboxes (an environmental map) cannot be used because they are simply too big.

Intuitiveness

Following the immersion, the use of AR wearables must also become more intuitive. Because the FoV is small, the use intuitive interaction, like using hands, is seriously limited. For a successful interaction using hand-tracking, the users must now raise their arms until the hands are within the FoV. This is a tiring experience. The minimum render range of 31 centimetres also influences this.

Shareability

AR wearables are mostly focused at a single user experience now. Some AR wearables can connect to a model of the same manufacturer, but this is still in an alpha phase. To really add value, the AR wearables should have shared reality, so users can choose when to share their digital world.



Personal thoughts on AR wearables

After first researching the Magic Leap and reading reviews about the wearable, I became a bit sceptic about the technology. This scepticism was mainly created by the way Magic Leap was selling their product and AR wearables as a technology. Most videos show an imaginary situation and include post-processing and show functionality that is not yet available.

But after working with the Magic Leap for 5 months, I think AR on wearables does have a future. However, as said before, a lot of things must improve, mainly the technology itself. As the technology will become better, more developers will start working on AR wearables. This will make the community grow and this will make the technology more accessible. For many problems on the Magic Leap, a solution could not be found on the internet and by trial and error these had to be found. This in turn, took a lot of valuable time.

The future possibilities with AR wearables seem nearly limitless. Because of the freedom a user gains by using the AR wearable, many work fields could benefit immensely from the use of an AR wearable over other more common ways of interaction. Think about surgeons being able to see their patients' organs in an AR overlay while operating.

The hands-free nature of AR wearables will help with making work processes more optimized. This will help workers with performing tasks faster, because there is no need to look away from the task currently working on to get additional information. For instance, DHL has been integrating AR wearables to optimize the sorting process. The device shows the user what package they need and where they need to put it. This is far better than having to use a tablet or smartphone for the same task.

I think AR wearables will find their place within society. First as a technology mainly used by businesses and from there on it might hit the consumer market, but this will take time. When wearing an AR wearable, I was sometimes seen as an alien by outsiders (The design of the Magic Leap also helps with this feeling). They found it strange and weird. This means that AR wearables are far from socially accepted yet. But when looking at the use of phones 20 years ago, people were also sceptic and laughed about the use of it. Now it is an integrated part of day-to-day life. But before this can happen, the technology must improve, and this needs time.