

Grand Challenges for Augmented Reality

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Link to original paper online:

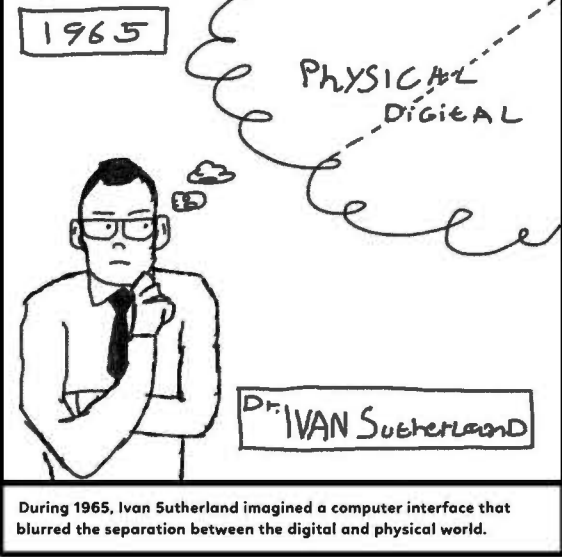
<https://www.frontiersin.org/articles/10.3389/frvir.2021.578080/full>

Project created for the class:

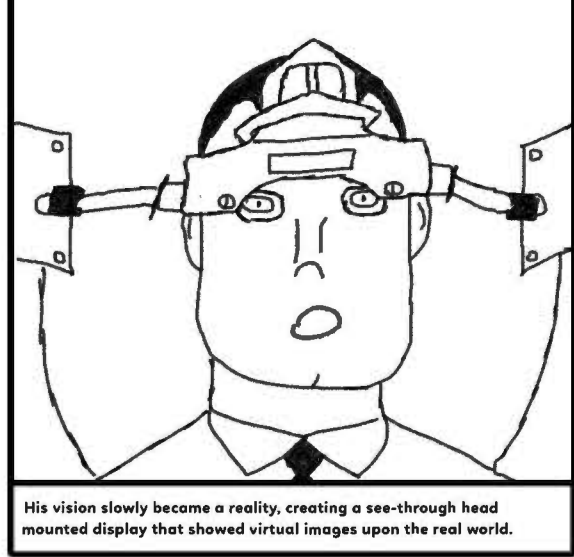
Visual Thinking and Composition, Winter 2020

Tilburg University, Department of Communication and Cognition

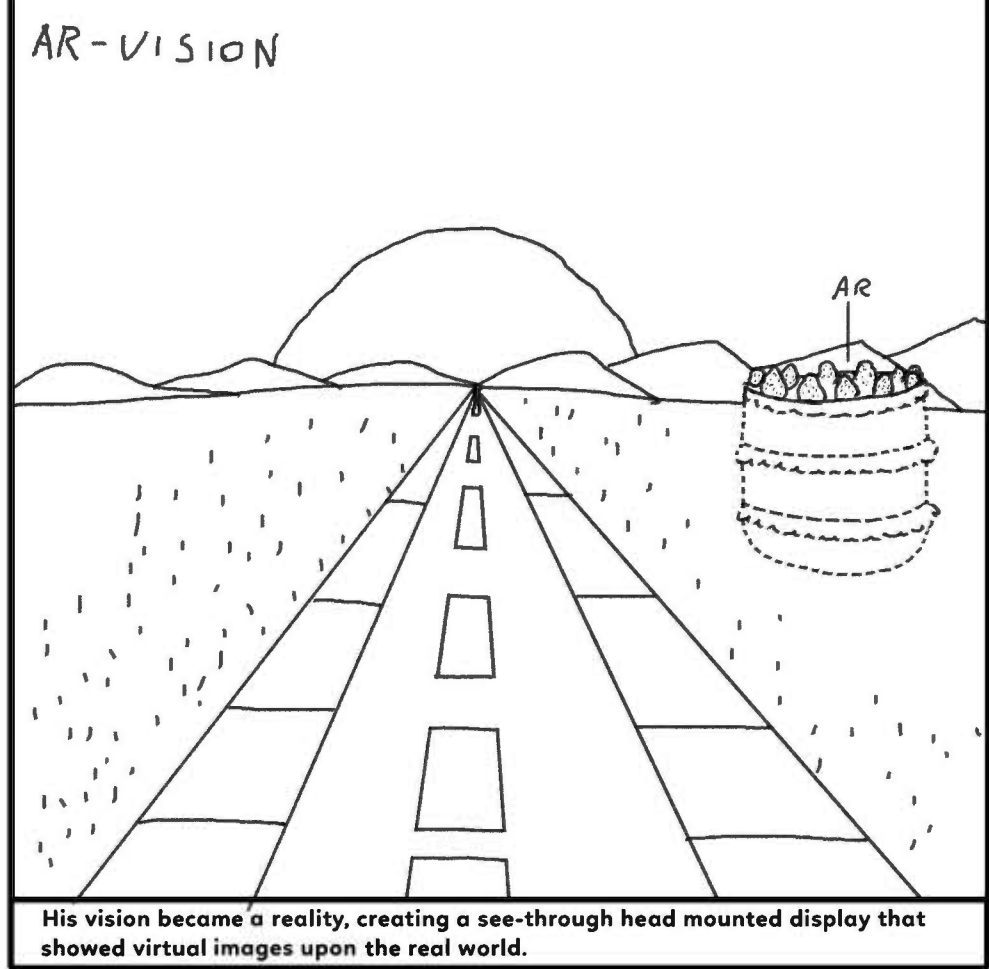
Instructor: Neil Cohn, neilcohn@visuallanguagelab.com, www.visuallanguagelab.com



During 1965, Ivan Sutherland imagined a computer interface that blurred the separation between the digital and physical world.



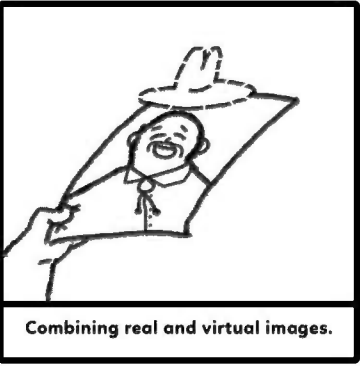
His vision slowly became a reality, creating a see-through head mounted display that showed virtual images upon the real world.



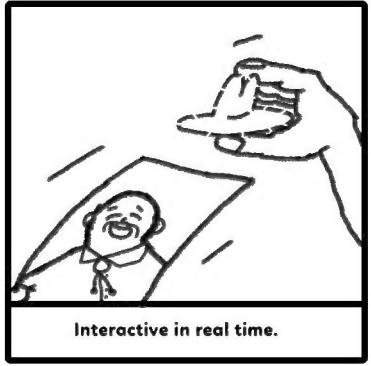
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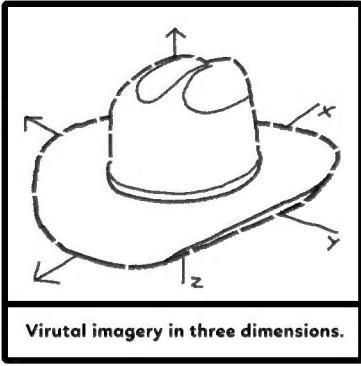
Sutherland created the first working Augmented Reality interface which is comprised of three key characteristics.



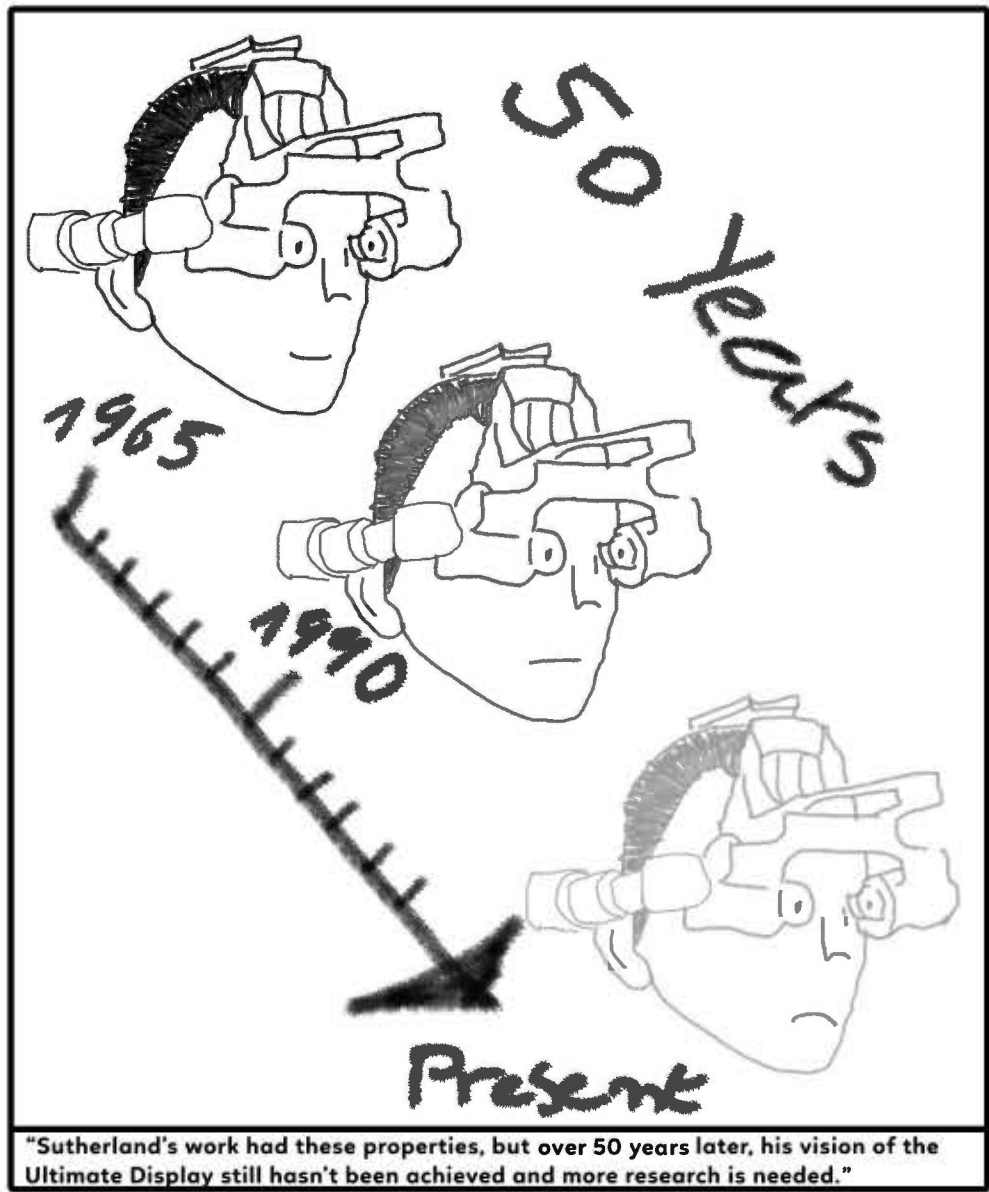
Combining real and virtual images.



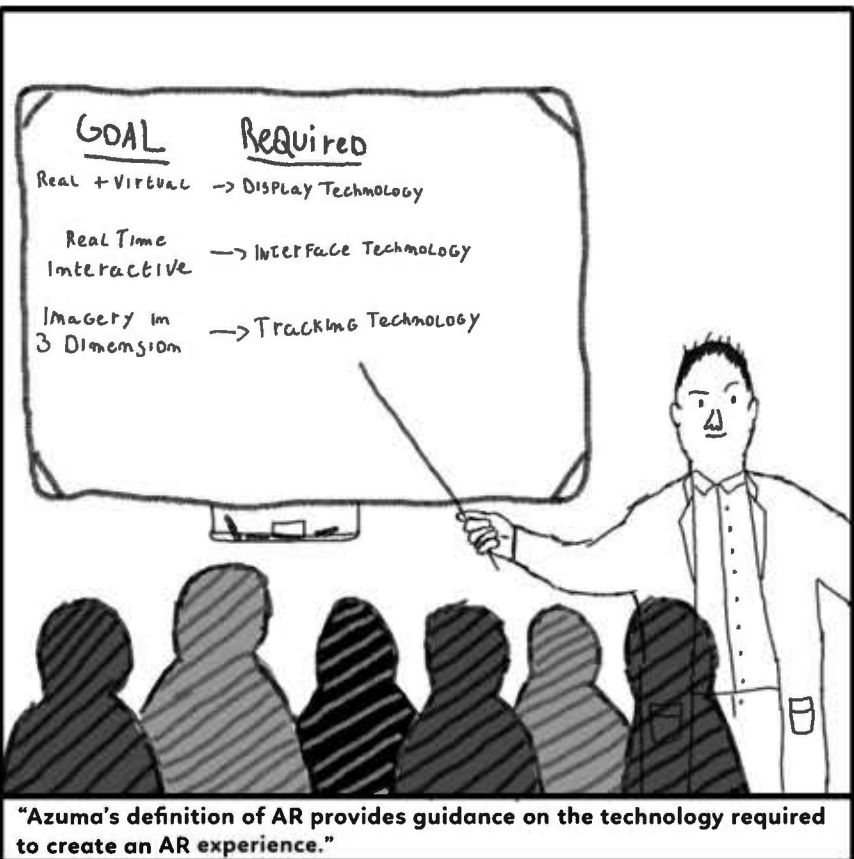
Interactive in real time.



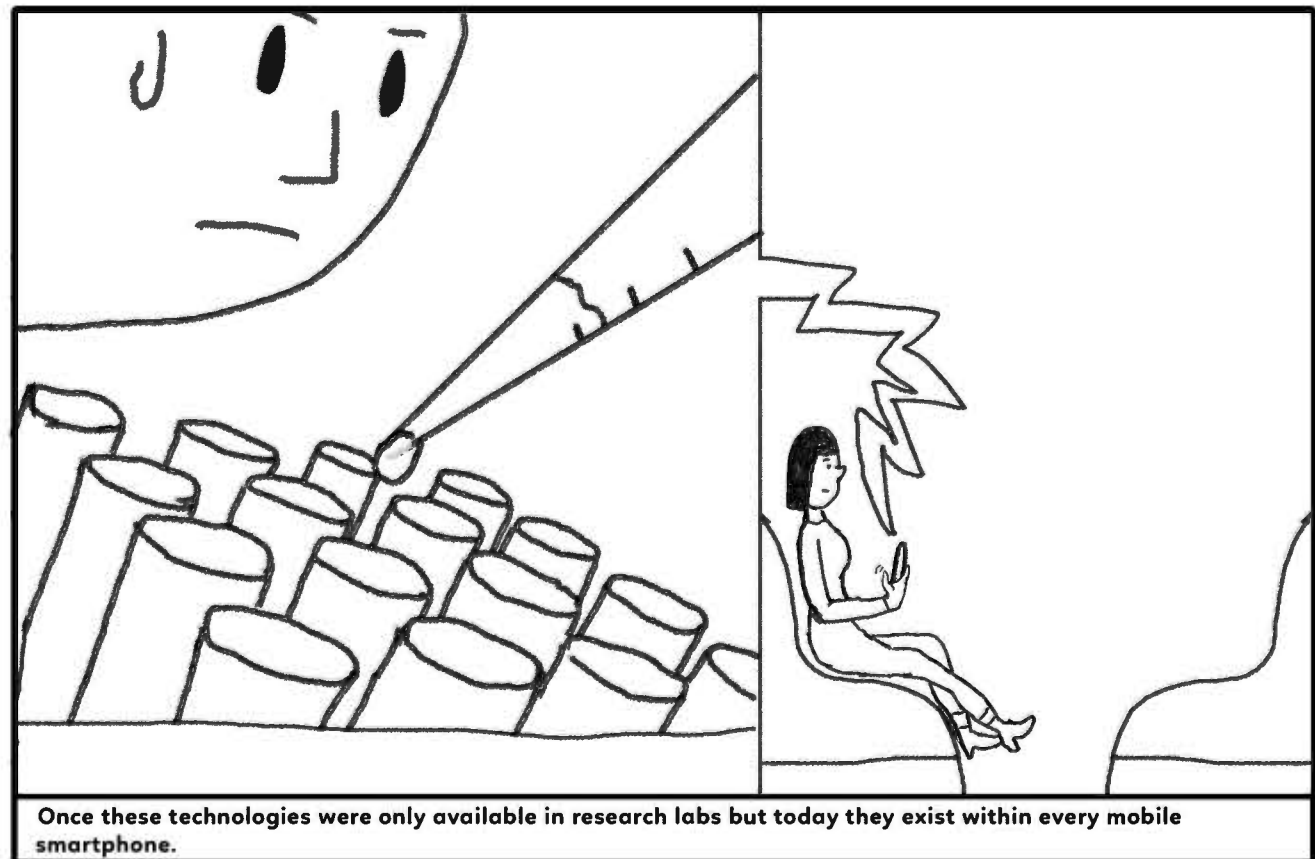
Virtual imagery in three dimensions.



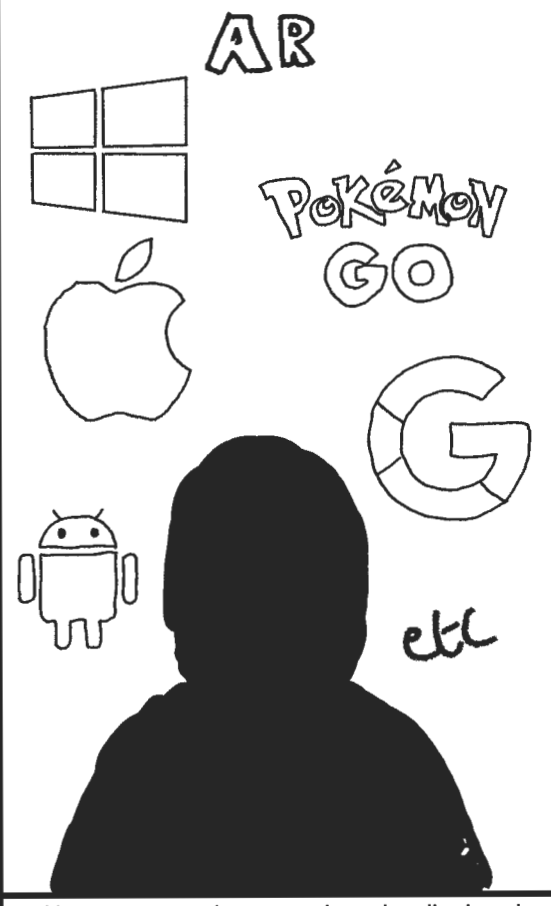
"Sutherland's work had these properties, but over 50 years later, his vision of the Ultimate Display still hasn't been achieved and more research is needed."



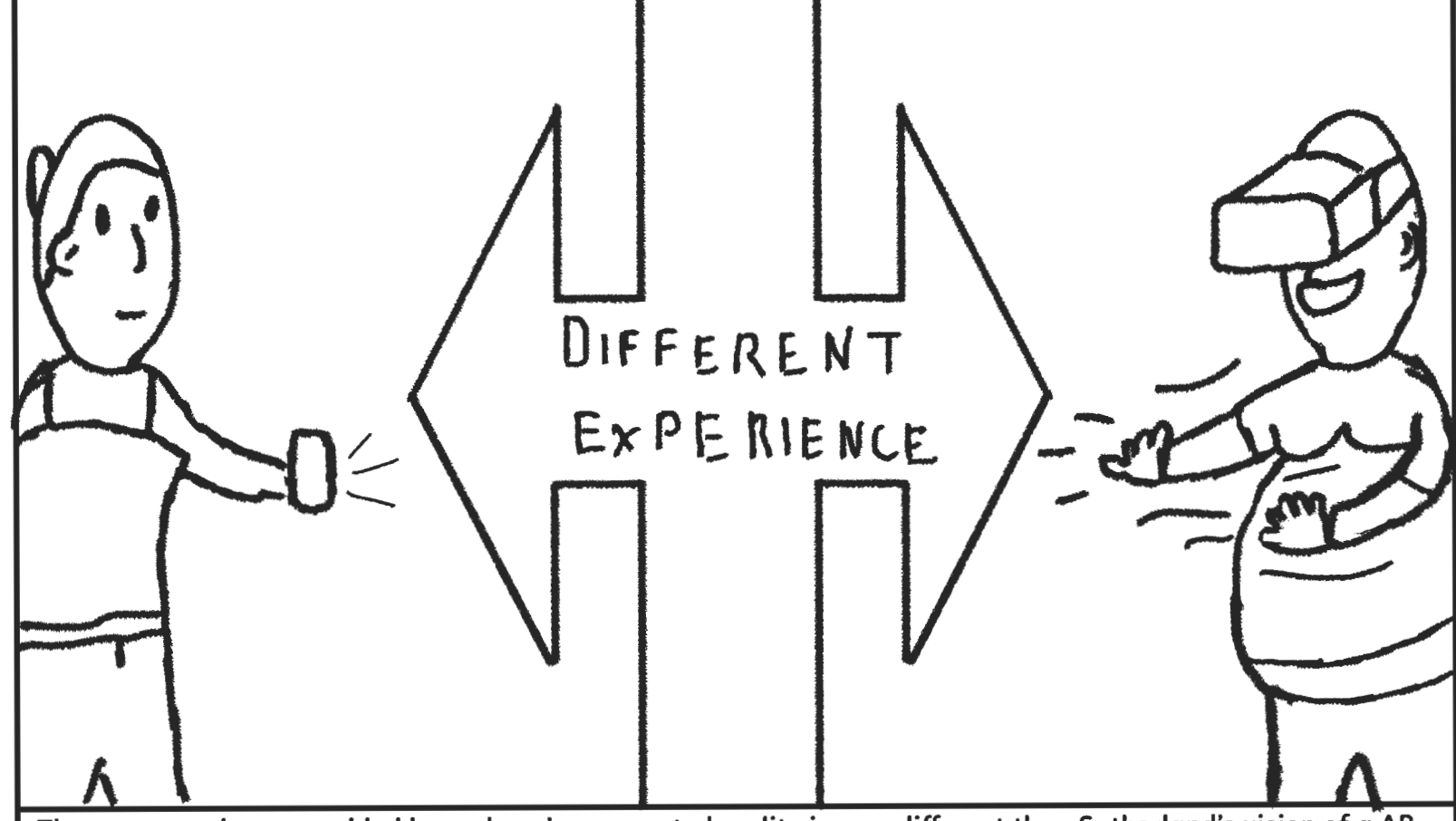
"Azuma's definition of AR provides guidance on the technology required to create an AR experience."



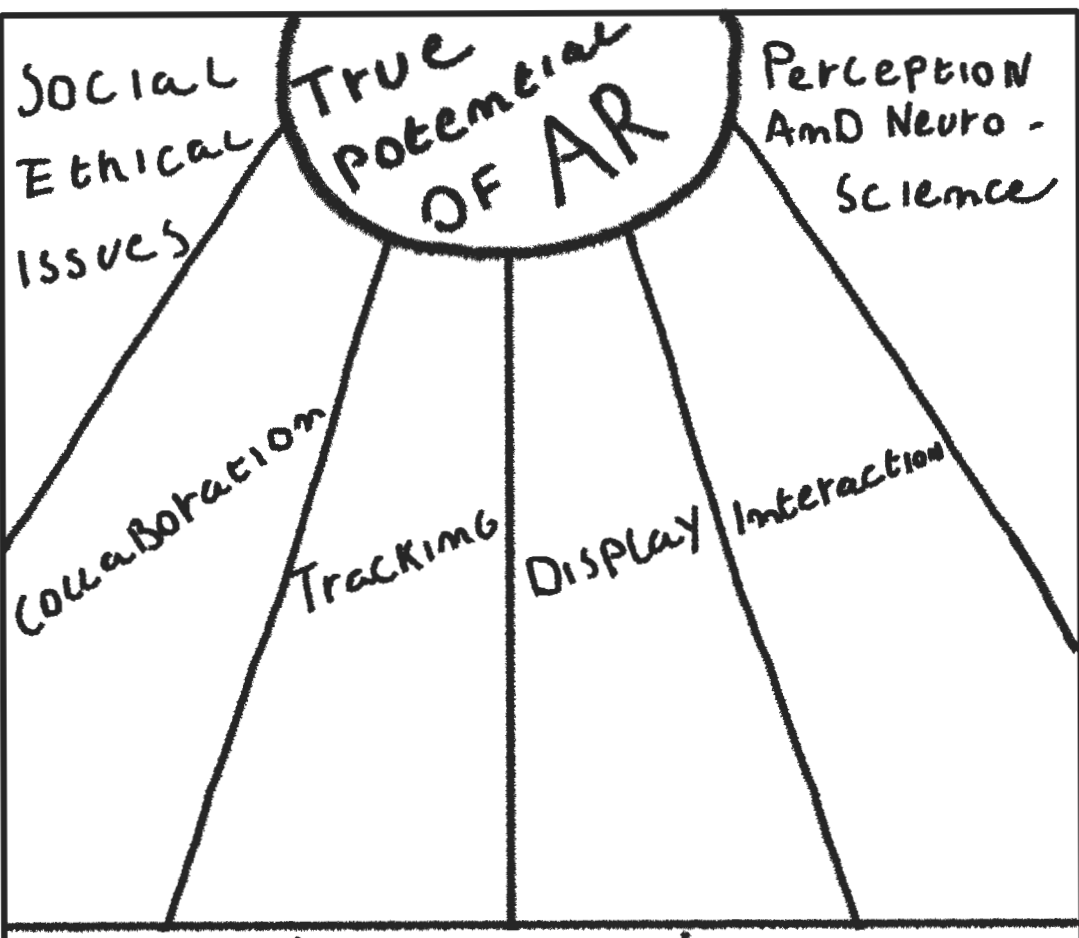
Once these technologies were only available in research labs but today they exist within every mobile smartphone.



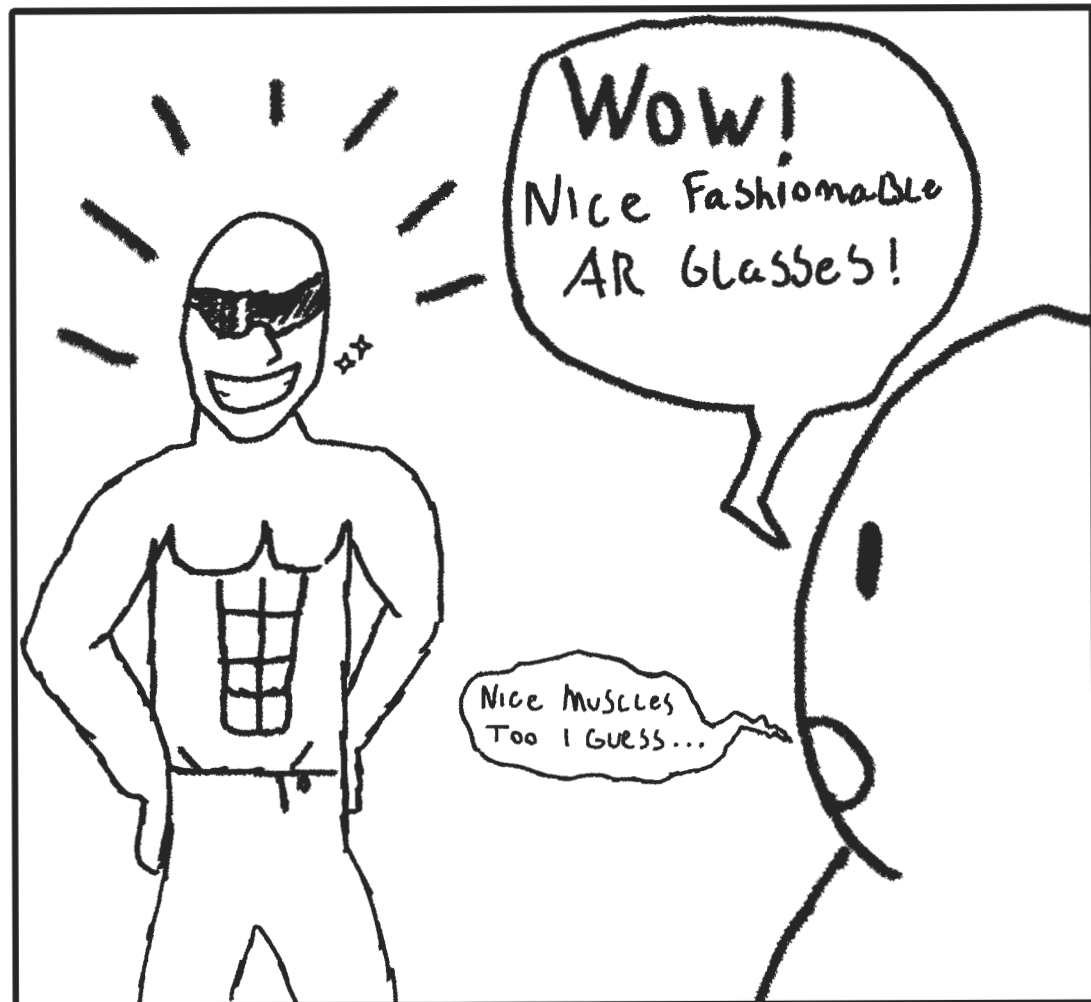
In this current age, various companies and applications show just how readily accessible Augmented Reality is.



The user experience provided by a phone's augmented reality is very different than Sutherland's vision of a AR head mounted display



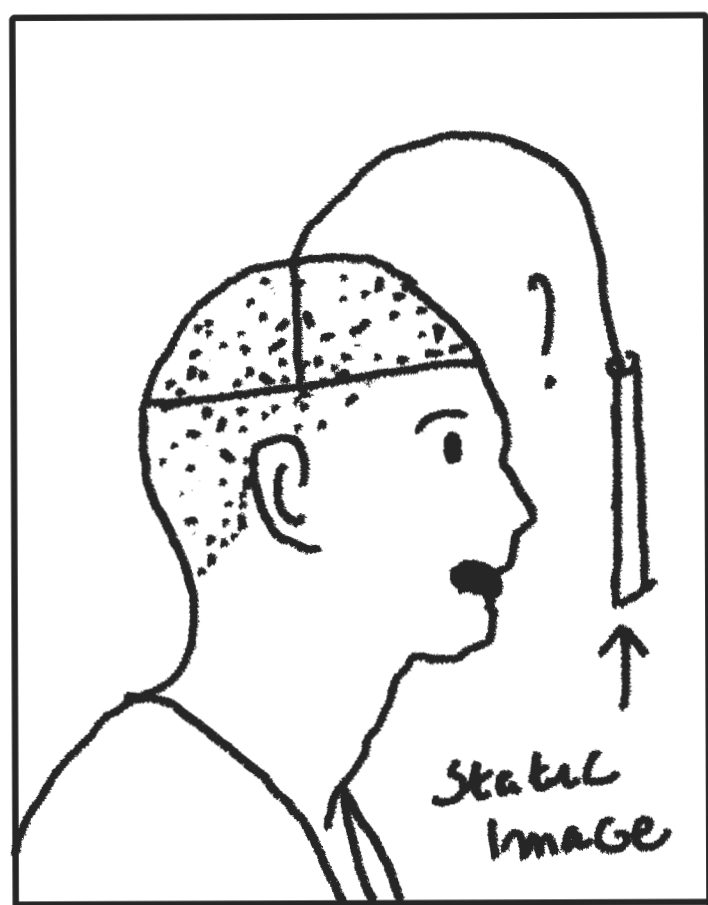
There are grand challenges that need more research to reach the true potential of AR through a head mounted display.



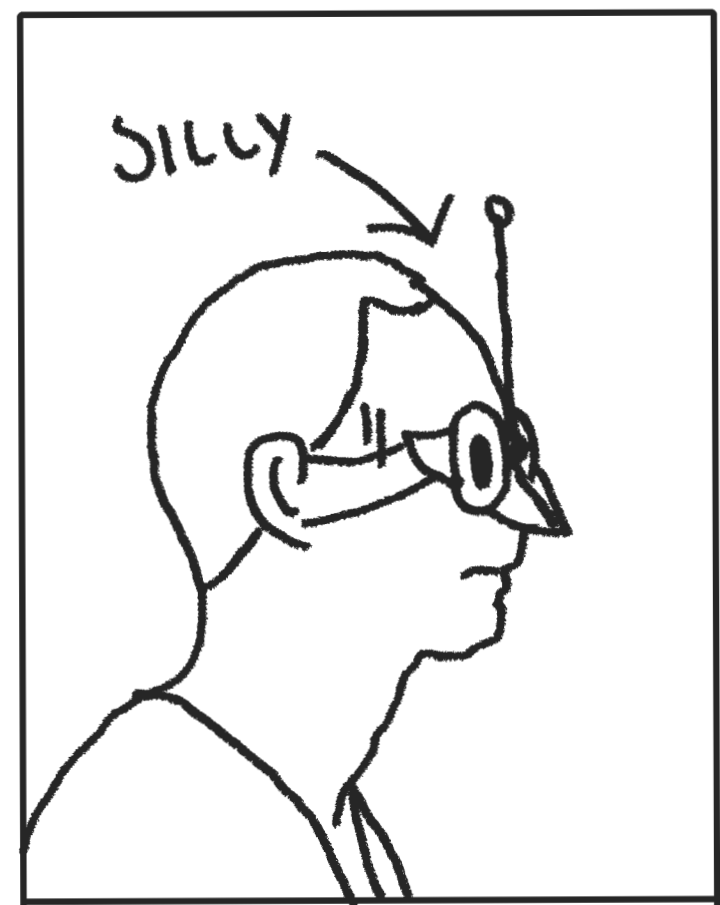
A grand challenge in display technology is to created a socially acceptable head mounted display that has a wide field of view and high resolution.



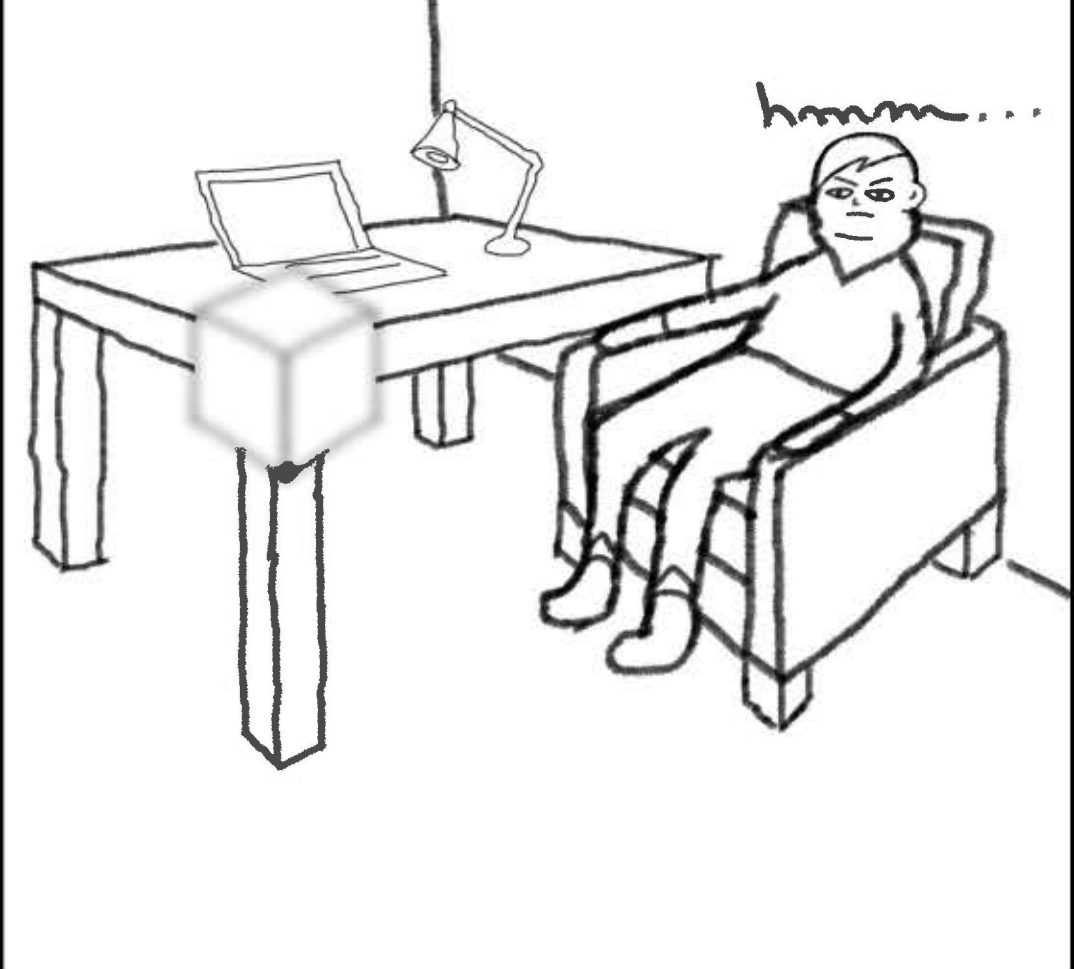
Many prototypes have been made that falter in social or technical regards.



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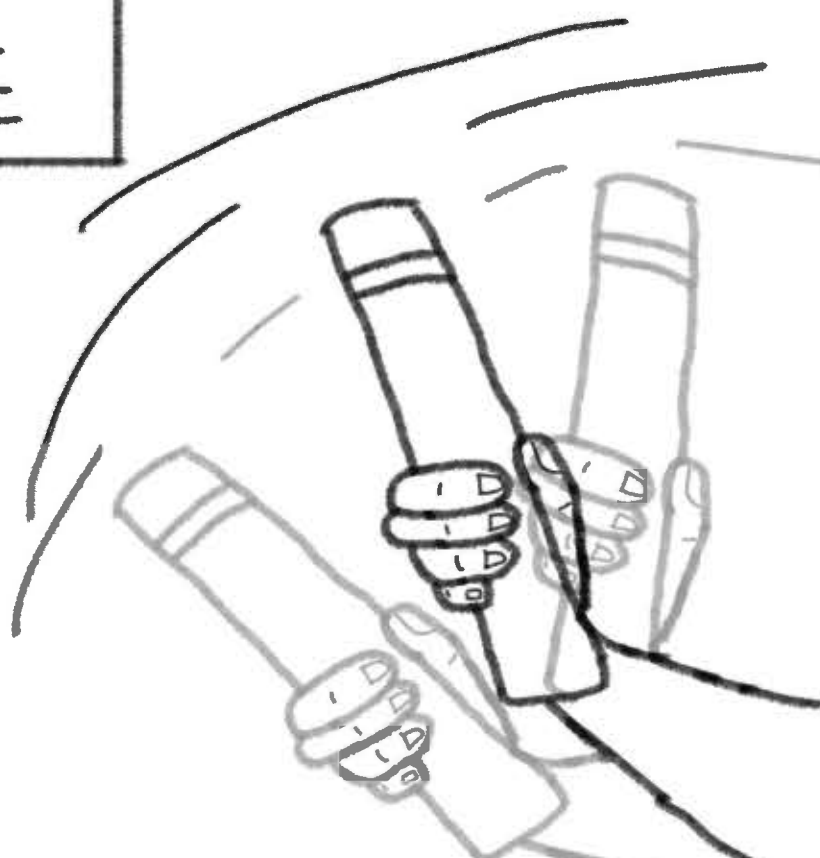


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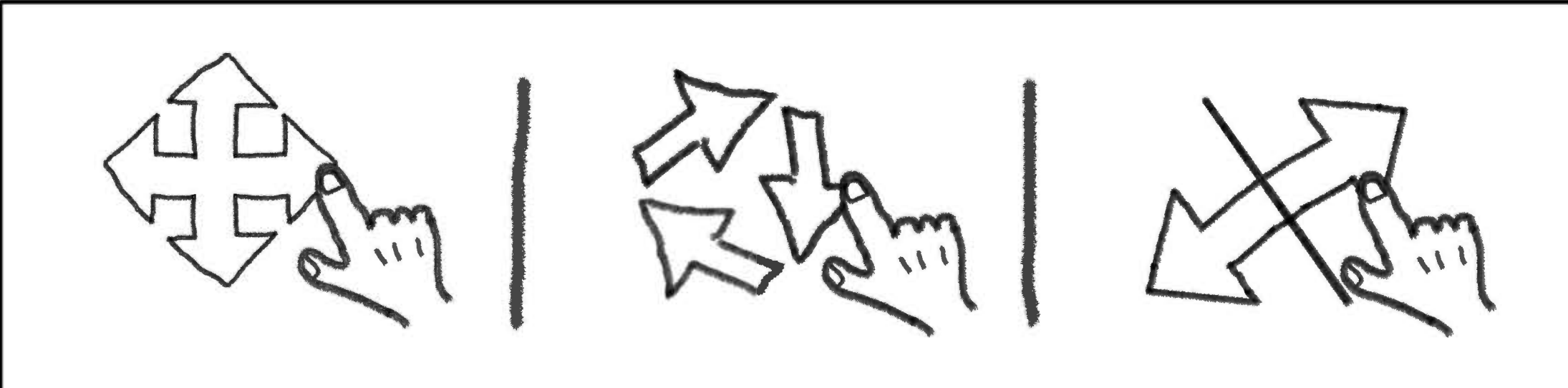


Another issue is the vergence accommodation problem. This is caused when HMD's only have a single focal plane, preventing people from keeping the AR content in focus when they look at real world object from a distance.

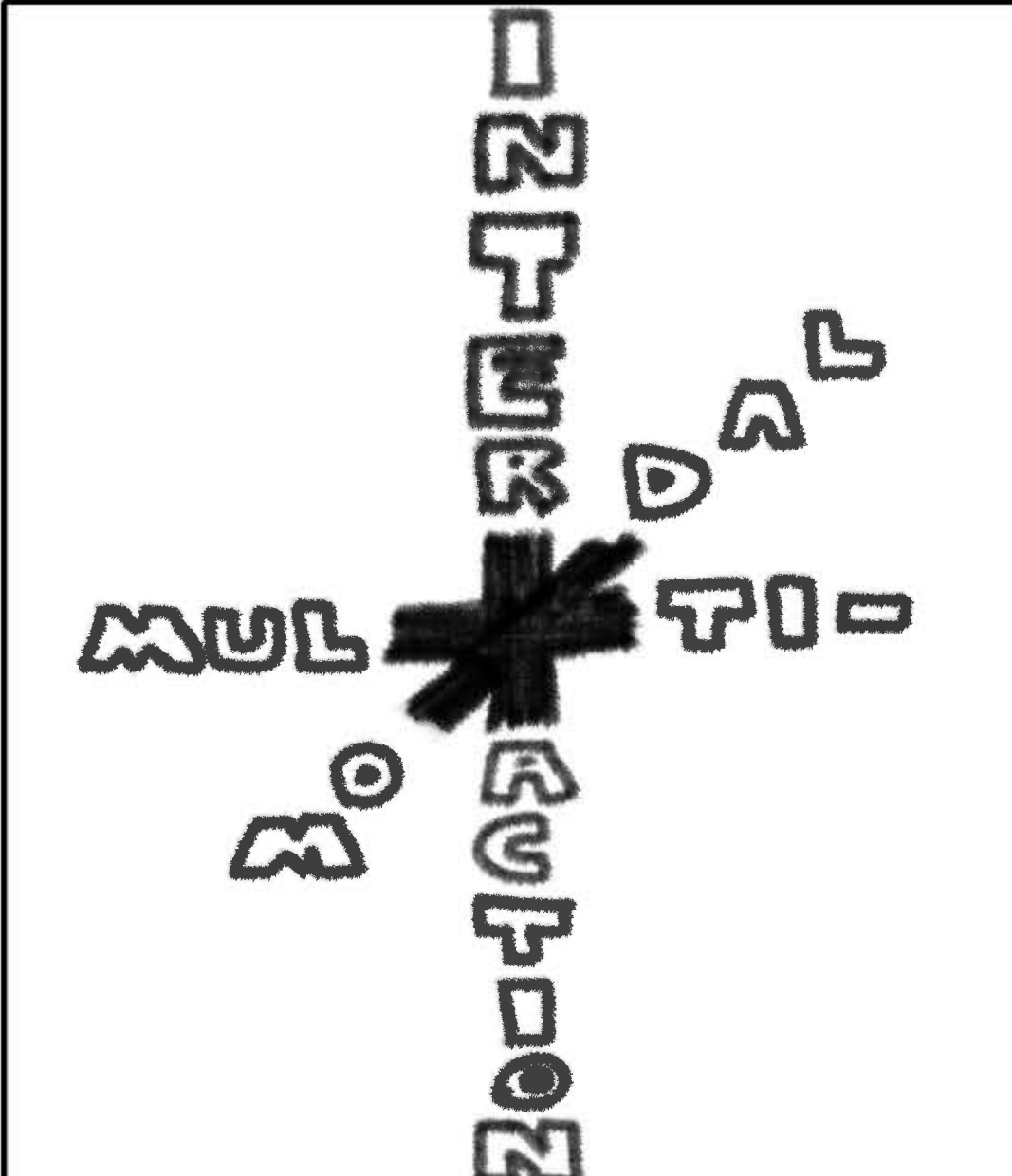
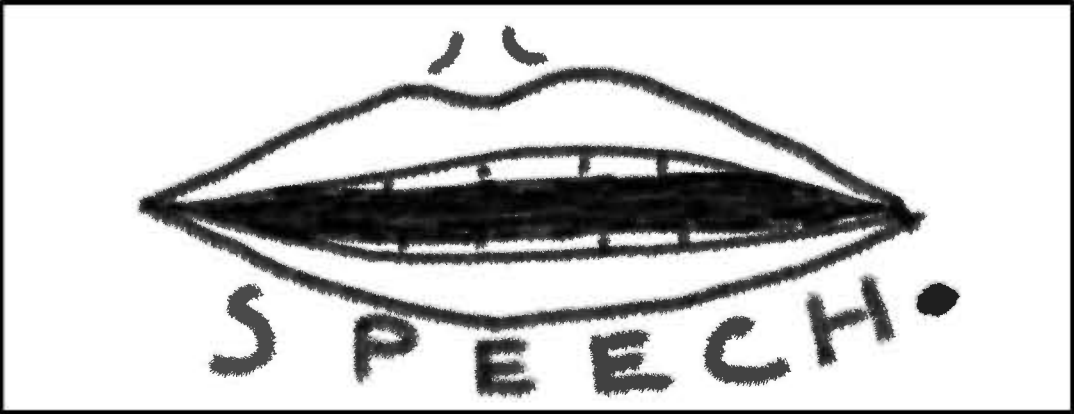
Interaction
Recognized:
WAVE



Sutherland's system supported simple interaction with a handheld wand, however there are many instances of other natural user interfaces that have been used to interact with augmented reality content.

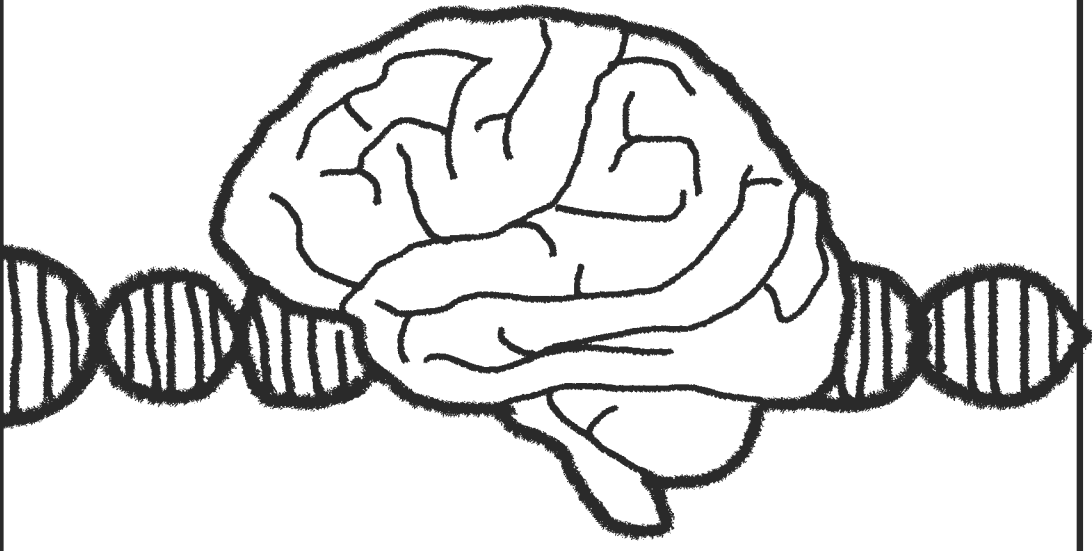


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Research is developing significantly by combining speech, gesture and eye-tracking to create an even more intuitive and multimodal interaction.

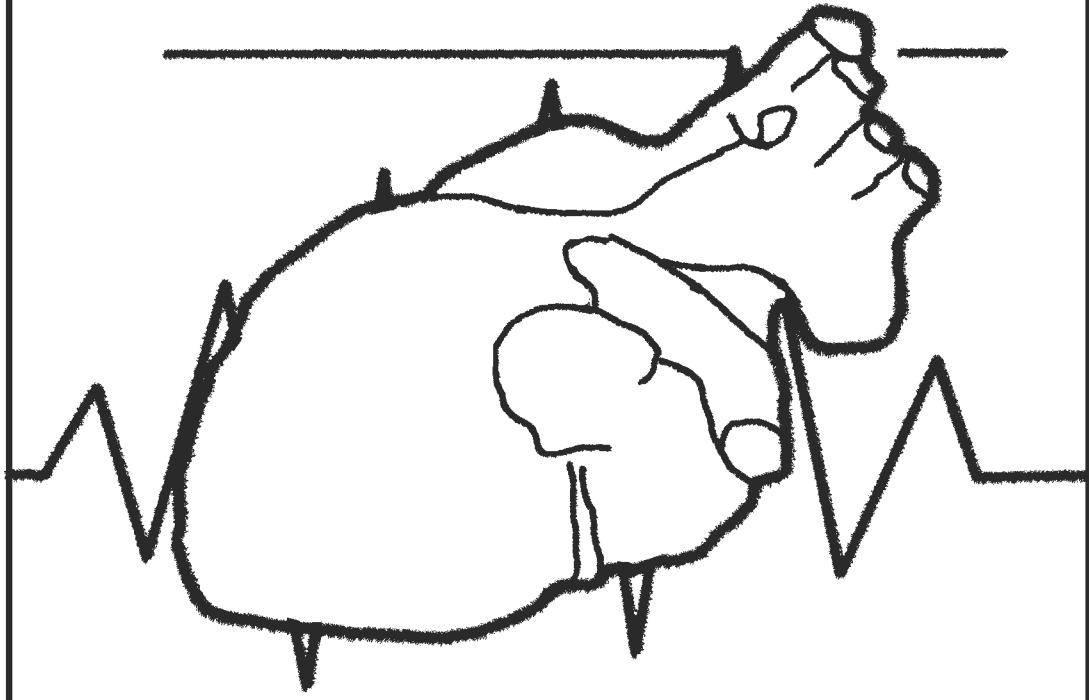
AR + Brainwaves



INTERACTION

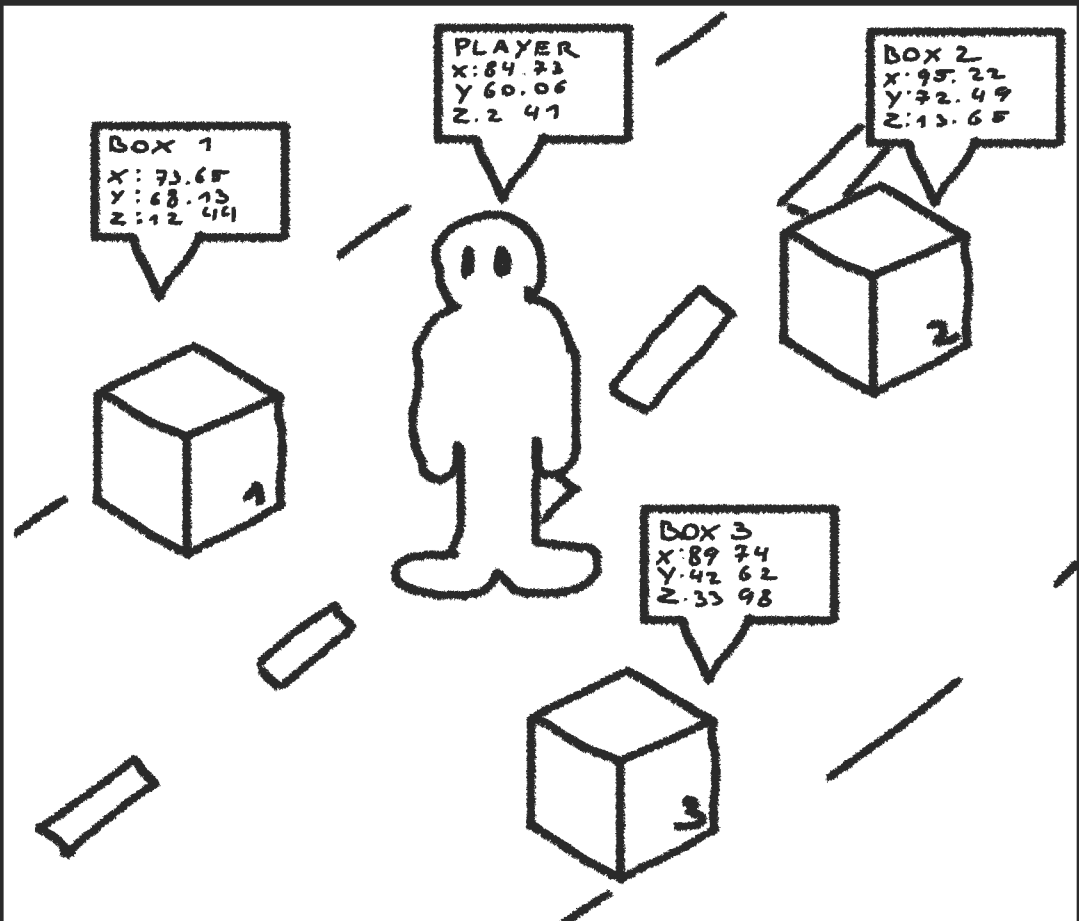
Ideas that are currently not possible in the real world should also be considered to create even better AR interaction methods.

AR + Heart Rate

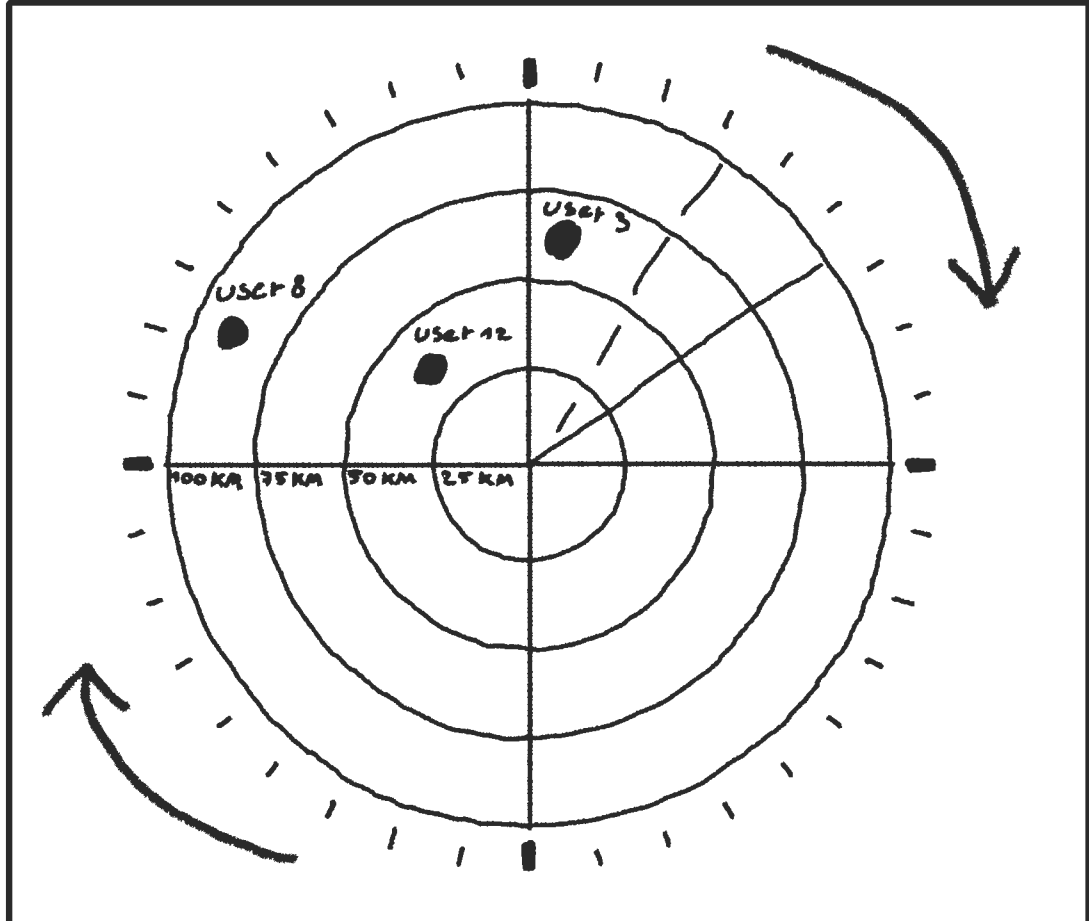


INTERACTION

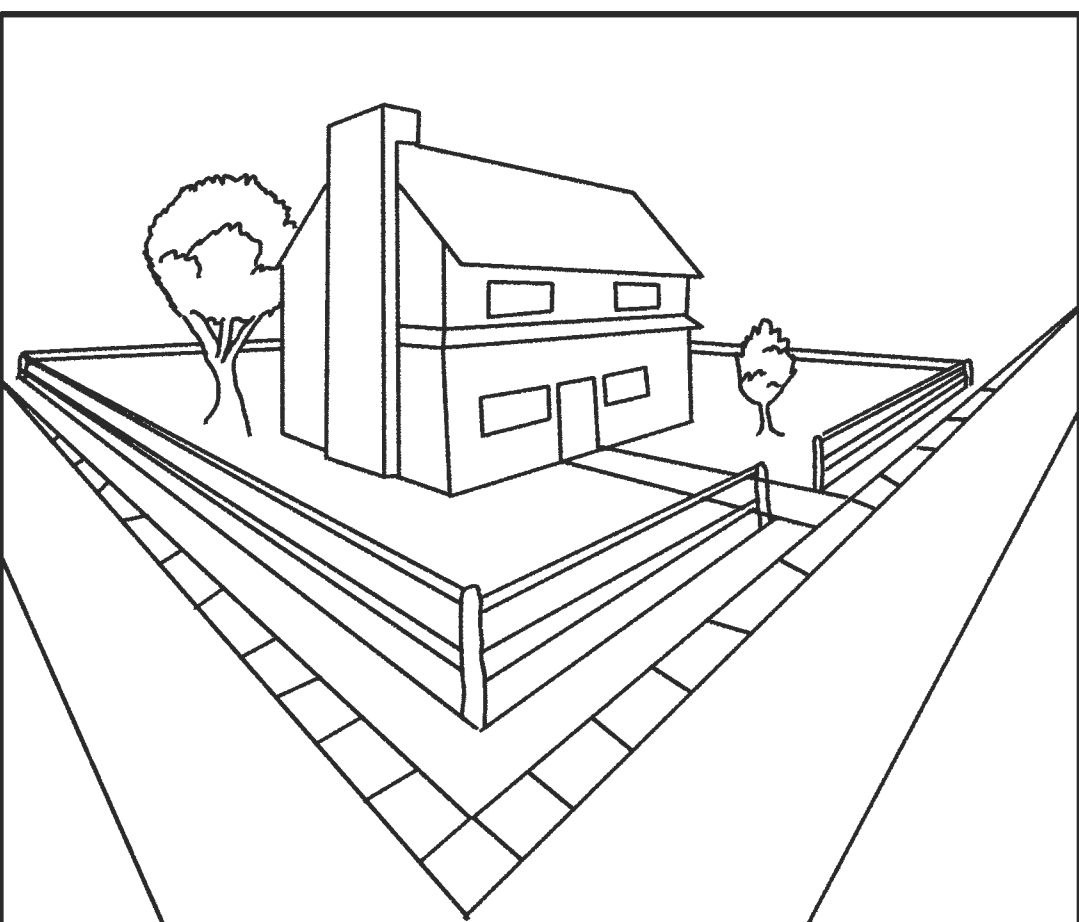
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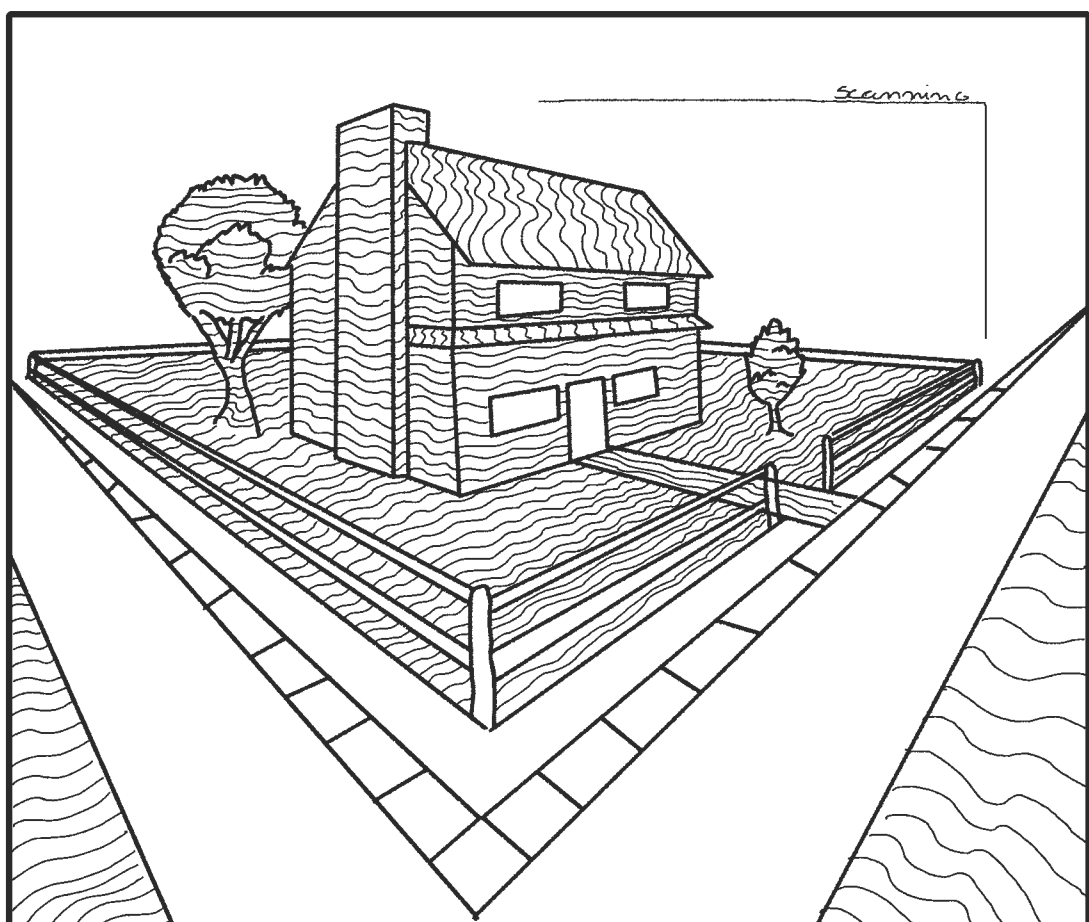
In order for AR objects to remain fixed in space like they are, it is necessary that the user is tracked.



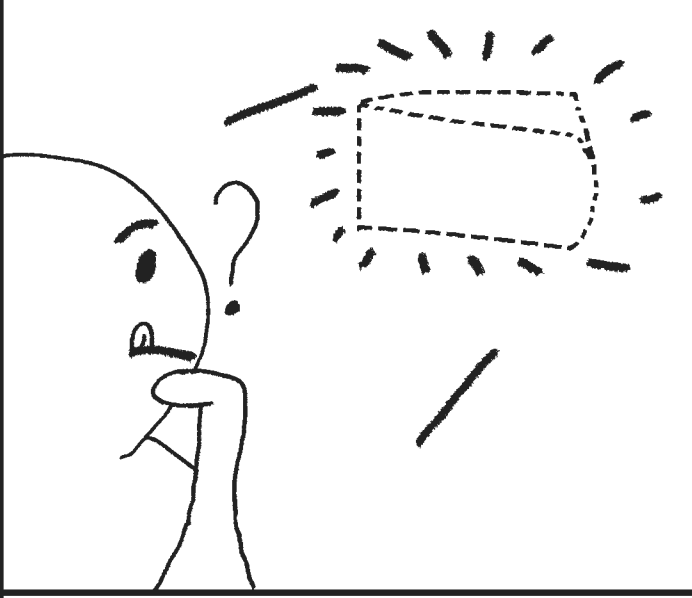
While tracking technology has improved significantly, one area that hasn't been well explored are hybrid approaches for very large-scale tracking.



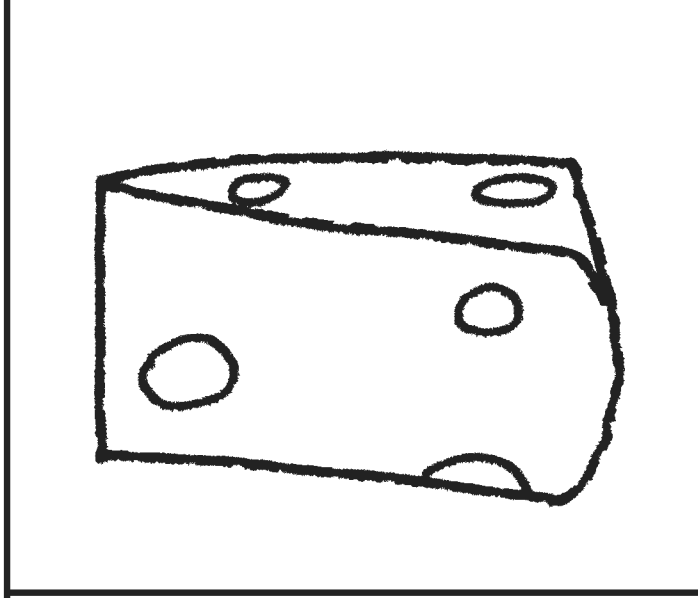
Deep learning could be used for a combination of stationary and mobile tracking to provide some scene understanding.



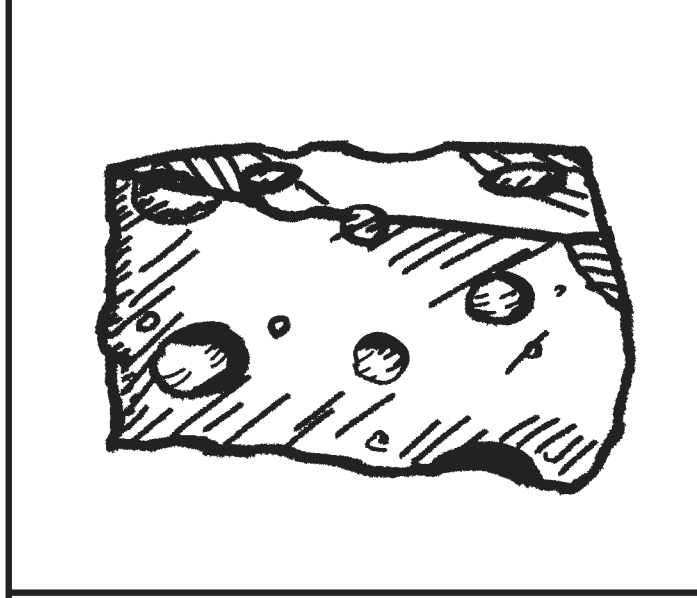
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AR creates an illusion to convince the brain that the virtual content actually exists.



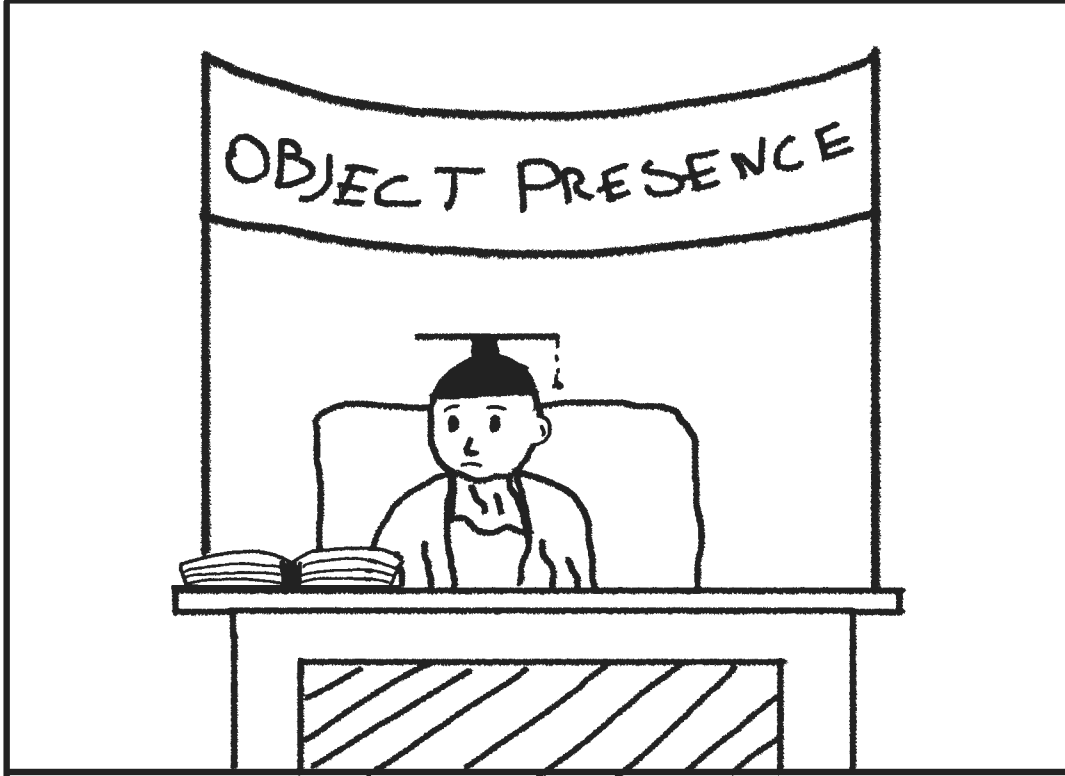
Considerable research has been conducted on how to make AR content appear the same as real objects.



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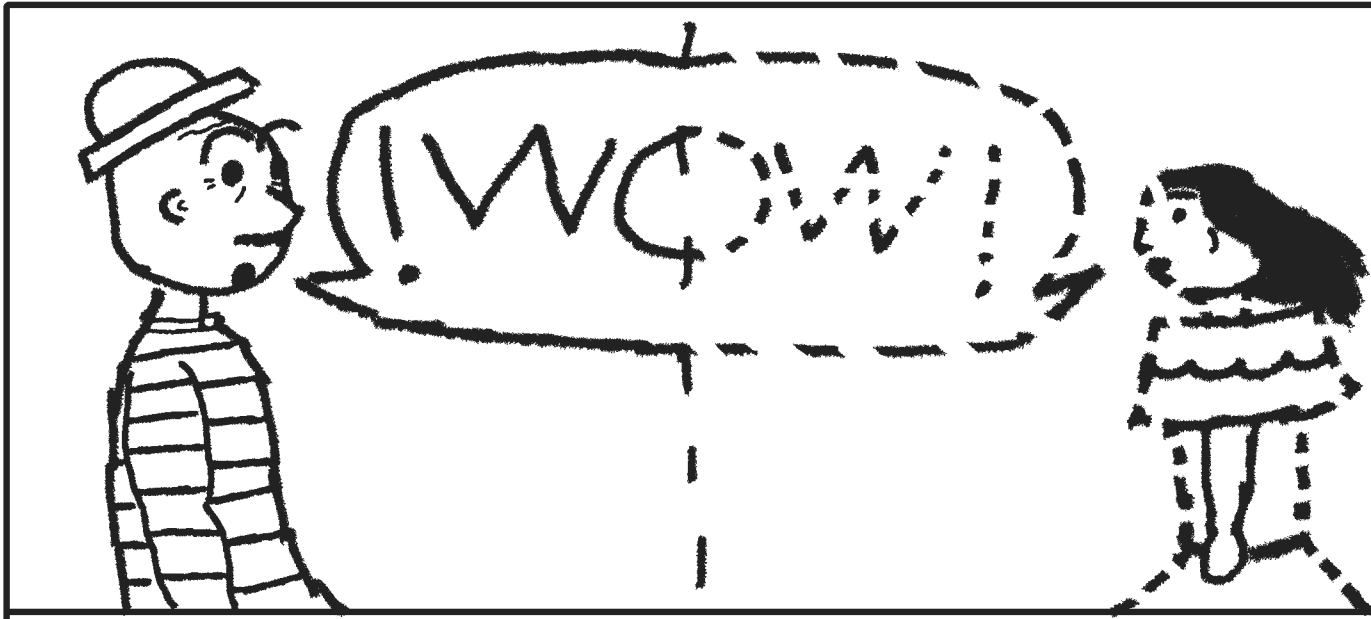
Object that appear to be really there have a high level of "Object Presence". However, unlike regular "Presence", "Object Presence" in AR has not been well studied



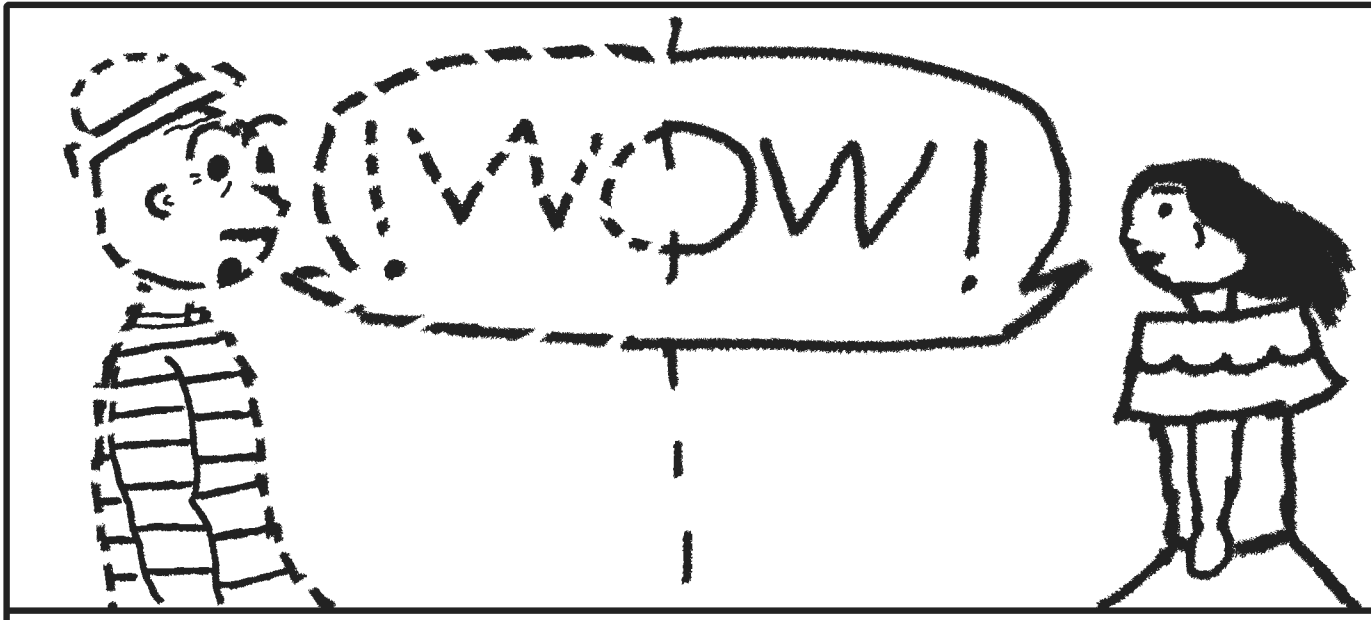
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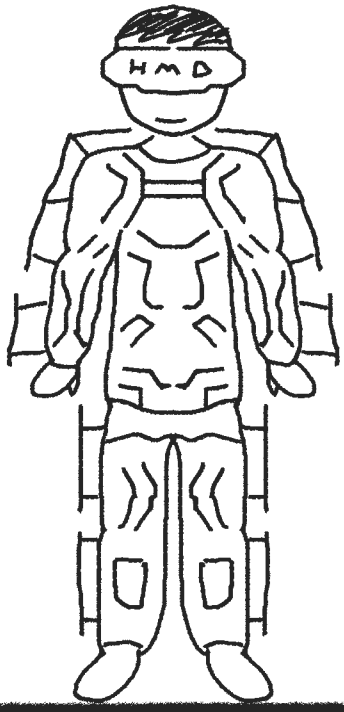
AR can be used a collaborative tool where people can work with each other remotely digitally as if they were face to face.



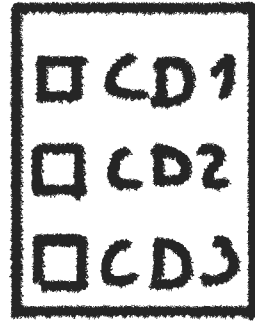
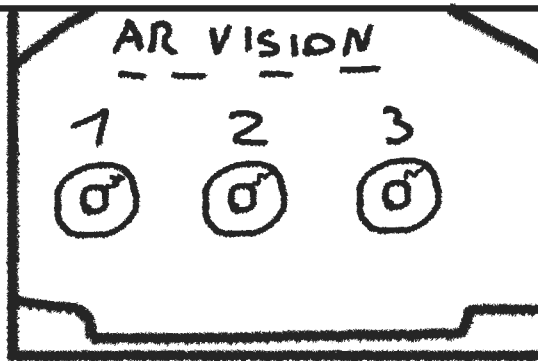
Going as far as creating fully realized 3D models of the participants in a real environment, allowing for richer and natural communication cues.



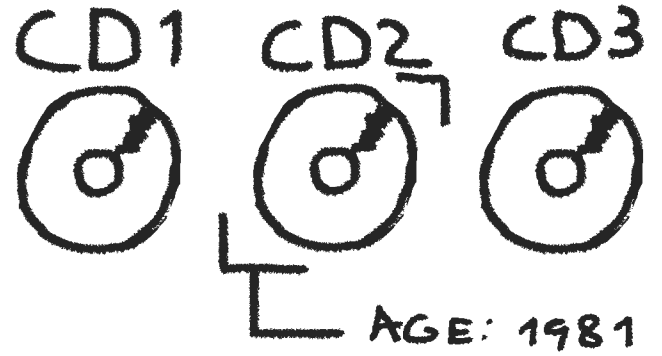
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And although research is sparse, wearable AR Systems also exist...



that allow other people to look through the users eyes...



I THINK CD 2 IS THE OLDEST, TRUST ME!

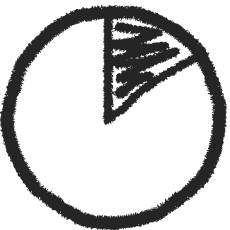
and provide AR cues to help them perform real world tasks.

Are you impressed with the technical features of the AR system?



Yes
 No

Would you wear a head mounted display in public?



Yes
 No

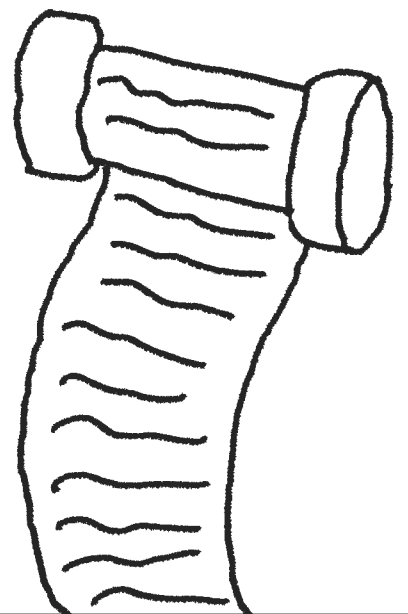
The difficulty to get consumer acceptance of widespread HMD use might indicate that it is more a social issue than a technical one.

MY HMD SAID THERE WAS A SALE!!



However, with widespread use, more ethical issues of what is allowed to be presented solely through a individual's HDM might arise.

LIST OF PROBLEMS



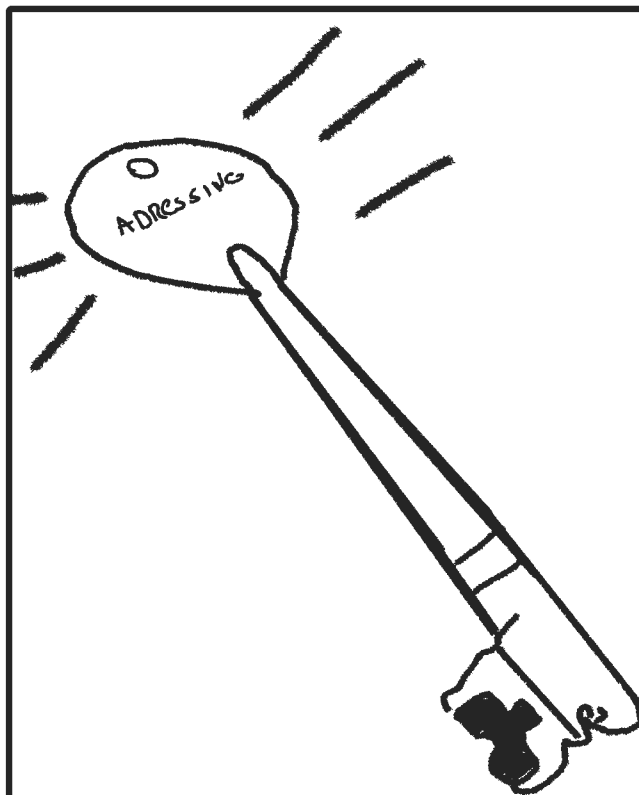
The large list of social, ethical and privacy issues of AR would need to be addressed and more research would need to be performed.

True Potential



Sutherland's compelling vision of how the physical and digital worlds could be seamlessly combined together is barred by the aforementioned grand challenges and lack of research.

ADDRESSING



Only by addressing these challenges can we unlock the cage that is keeping AR from reaching it true potential as a transformative technology.

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