

# MIXED REALITY: THE IMPACT OF IMMERSIVE TECHNOLOGIES

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This work examines the consequences of Mixed Reality: a world where our physical and digital lives are merged together – and analyses the possible positive and negative changes it will bring to human race.

When the Internet appeared in 1980's, it changed the world we lived in forever, solving one of the biggest problems humanity faced – distance. Today we may be on the verge of another life-changing event

– the reality explosion: a point beyond which we cannot predict anything, since reality can be anything imaginable. To put it another way, what if we could no longer tell the difference between a physical item and a digital one?

This experience is called Mixed Reality.

On the most basic level, physical and digital experiences are already merging for all of us. Most everyday activities, from talking with people to shopping, are becoming a tangle of on- and offline activities. As long as we manage to buy that shirt or talk to that person, offline or online doesn't matter anymore. Imagine a city center where some buildings are digital and others are physical. Imagine also that you neither know nor care which is which, since you can't tell the difference anyway [1].

AR and VR are popular technologies that currently make it possible to mix digital experiences into physical reality. VR provides a safe virtual environment to explore and interact with by tracking the movements of your head and corresponding them to the screen display creating a seamless link between your physical movements and the appropriate responses of your screen character which leads to a realistic and immersive experience. If the sensory synchronicity is just right you feel like you're actually present in the environment. But VR has even expanded beyond this with some experiences offering the extension of special treadmills and gloves to further stimulate the senses.

However, VR faces some problems due to its high cost. This is where AR technology comes in. Since it's available on almost all mobile devices, the general public will have easy access to the MR technology. Just imagine an architecture student presenting their final project in AR, where professors can look at the building in its true size and glory; or a museum, where you can look at any artwork in the world up close using just your mobile phone!

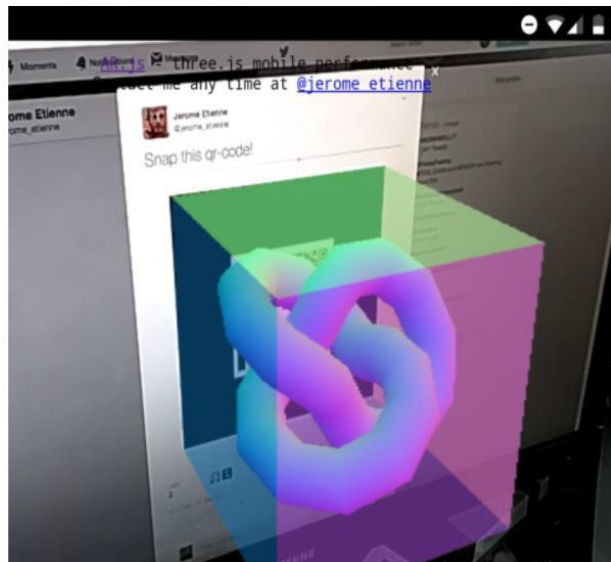


Figure 1 – In this picture, you can see an example of an AR-Code that you can scan using your mobile phone. As a result, a funky moving figure will appear in front of it. While it's not very useful, it gives you a good example of how AR technology works.

We've come a long way in the development of these technologies, and what's a better way to see our progress than through video games?

VR games existed even back in 2000, though due to the extremely high prices and badly developed products they weren't as successful at the time. Now, however, there are hundreds and hundreds of VR and AR games all over the market, some of the most popular ones being "SUPERHOT", "Beat Saber" and, of course, new "Half-Life: Alyx", that shocked gamers all over the world with amazing graphics and one of the most immersive experiences so far. Another example of how far we've come is "Boneworks", a full-featured, multi-hour physics modelling based adventure. It adds a unique feature; the modelling of push-back. By this I mean that you are pushed backwards in the digital space if you push too hard forward on something that won't budge. In Boneworks push-back physics are applied not only to movement but also to the weight of objects, creating a new level of realism and immersion.

As these new technologies are being spread and implemented, we are to expect lots of changes in our society, but what exactly should we expect? How will mixed reality influence our day-to-day life and even ourselves?

Whether it's workforce training, day-to-day productivity, or immersive customer experiences, mixed reality offers the opportunity to redesign business without the limiting factor of distance. Using a headset, employees can connect with each other and collaborate to solve problems, the productivity will be augmented through new MR tools. This also allows new workers to gain skills and experience, which will reduce the potential risks at the workplace.

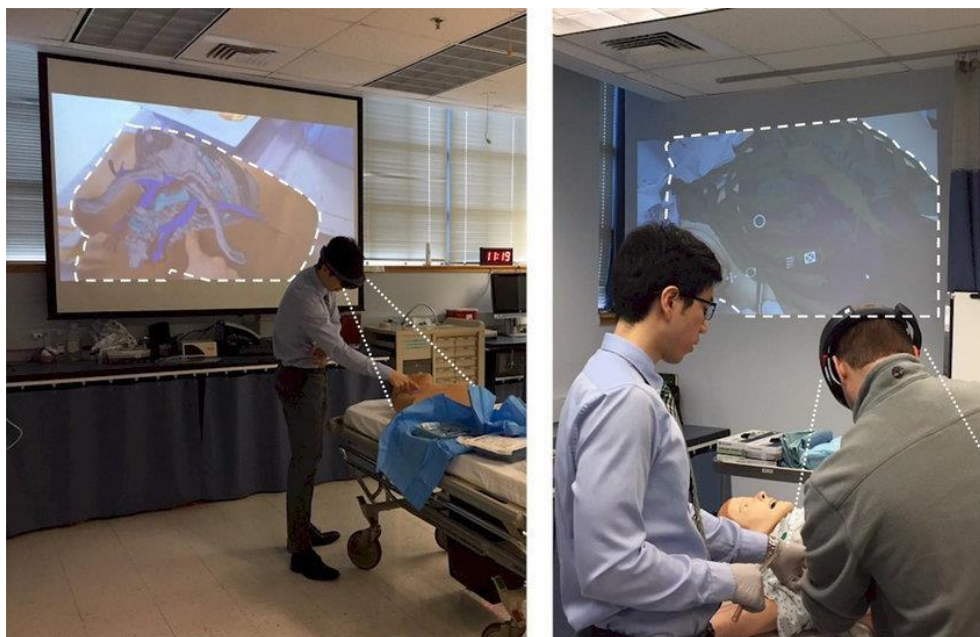


Figure 2 — Left image: Wireless broadcasting of augmented reality/mixed reality (AR/MR) headset first-person-view videostream for shared anatomic visualization during central venous line training. Right image: AR/MR-enhanced tube thoracostomy training [2]

However, mixed reality presents new, under-explored risks. There are already many questions about data ownership, usage, consent and protection. This will only intensify in the era of immersive experiences. Feelings, behaviors, judgments and physical likeness will all be exposed to potential cybertheft and manipulation. As personal data becomes more specific to the individual, privacy and data protection become more complex, and clarity around data ownership, usage and meaningful consent more urgent. In a future where many critical tasks and situations rely on MR tools, the risk of any technical error multiplies. Simply losing access to vital real-time information could put an immersive surgical operation or hazardous engineering procedure at risk, with disastrous or fatal consequences. What is more, the blurring of physical and virtual boundaries unearths urgent new questions around reality, trust and mental health. Our intimate feelings, behaviors and judgments may be captured as data for new uses—or misuses. The potential physical, mental and social costs of mistakes are too significant to try to fix retrospectively [3].

We live in a fast-paced world and it's hard to keep up with everything, but it doesn't mean the world is going to slow down any time soon. It's inevitable that people will eventually merge the boundaries of their lives and their fantasies. The day will come when we walk the streets of virtual cities and hang out with people from the other side of the globe or, perhaps, even different planets without having to travel anywhere. MR will give us many opportunities to improve the quality of life, the economy and the level of education. All we need to do is use it wisely and keep in mind what is real and what is not.

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