

Mathland

Mixed Reality Learning

IDEO Proposal
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Learning and play are usually considered disjoint experiences - learning happens in a classroom whereas play in a playground. I envision a world where students can learn during play, and play as they learn. It's a world where as you are playing catch with your friends, you could see the speed and position of the ball as a colorful trail. Where you could rewind to a moment in the past and change the motion and trajectory of the ball. Where you could remove all the gravitational forces or even add virtual forces, e.g. towards a point so that the ball orbits that point like the Earth revolves around the Sun. This is a world where kids could learn about mathematics and physics while playing with the mathematical and physical properties of objects around them.

My project, Mathland, aims to bring the world of mathematics and physics to life in Mixed Reality (MR). MR enables embodied learning as the users interact with the virtual objects like they interact with the real objects in their environment, and embodiment has been shown to be a powerful underpinning of cognition (Lindgren et al, 2013). MR creates a sense of presence and immersion for the user, and allows for learning experiences with higher flow (Ibáñez et al., 2014) as well as situated learning. Moreover, research shows that placing virtual objects in real environments allows learners to visualize complex spatial relationships and abstract concepts, which makes MR a powerful medium for learning mathematics and physics (Arvanitis et al., 2007).

Seymour Papert, one of the founders of MIT Media Lab, said, "If they grew up in France, they'd learn French perfectly well....If we all learned mathematics in mathland, we'd learn mathematics perfectly well". New MR devices, such as the Hololens, offer technologies like head-tracking, gesture recognition, head-mounted cameras and spatial mapping, all of which make it possible to create a completely immersive Mathland experience. As users observe, modify and explore mathematical concepts in MR, they learn mathematical concepts in Mathland as naturally as they would learn French in France. Joi Ito, Media Lab's current director, said, "Education is something that is done to you. Learning is something you do for yourself." Mathland embodies the spirit of learning and seeks to complement the current physics and mathematics education.

I have developed an initial prototype of Mathland. Here is a quick glimpse: <https://www.youtube.com/watch?v=gJAOiNb4V44>. I aim to make Mathland an experience that not only transforms people's learning and playing experiences, but also one that changes the way people look at the world around them. By demystifying mathematics and physics, I want to empower a generation of builders, tinkerers and scientists with key mathematics and physics insights. I shall decompose the basic concepts of mathematics and physics and design use cases that will allow people to develop a good intuition for those concepts. I want Mathland to do for mathematics and physics what LEGO Mindstorms and Scratch did for programming, and thus, human-centered design is indispensable. It would be my utmost honor to work with IDEO's design gurus to refine the future of mathematics and physics learning for people of all ages.

References:

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