

# Seeing is Believing

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## Introduction

This essay explores the potential future uses of smart contact lenses. Smart contact lenses have come up a few times in the news since at least 2016, with major players like Mojo Vision, Samsung, Google, and Sony. Lighter, more compact, and more seamless than smart glasses like Google Glass, the appeal of making smart lenses makes sense. This story takes the form of a documentary or interview series with different characters: Jason, a high school student, Alison, a detective for her local county department, Maura, a college student, Todd, a middle-aged man, and Eli, a new engineer at Holo.

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## Jason

My parents got me my first pair of Holo lenses when I was in middle school, after I did an eye exam at school and apparently I was nearsighted. It was really straightforward - we literally just walked into like any normal store where you could buy techy stuff, and got one right off the shelf. When we got home, my parents downloaded the app that came with the lenses, and we started setting it up. There's really no super complicated process, like I just put in the lenses, and you calibrate some things in the app until your vision is clear. I take the lenses out when I sleep just so I can charge them overnight, but I've also slept with them in a couple times and I've felt totally fine. The first couple years I had them, I remember having to get a new pair every half year or so, but recently it's extended to a year, and I think the next version can go even longer without needing a new one. Now, I've done this whole calibration process so many times that my parents trust me with new lenses and the app, so I pretty much take care of them on my own. I really can't believe that people used to have to get measured in a doctor's office, and physically try different lenses just so they could see clearly. And having to actually wear something on your face all the time? You would get bullied SO hard in high school.

## Alison

Once Holo lenses were officially approved and on store shelves, the department was really quick to adopt them. We were already using body cameras when out on any case, but body cameras can get obstructed, knocked off, or turned off. The main difference is, Holo lenses capture what you're actually *seeing*. Whereas body cameras give you some shot of the scene and you can tell what's going on if you're lucky, with these lenses you can actually see where the officer is looking at what they're paying attention to, at any given moment when they're out on a job. This has worked both against and for us sometimes: there was a really bad case a few years ago where one of our officers was responding to a mental health call, and somehow he ended up in a tussle with the person having a crisis, and they were shot. The officer told us that

the victim started trying to pry his gun out of his hands and shot themselves in the process, but the recording from his Holo lens told a different story. The video was pretty crystal clear. The victim did approach him and initiated the physical fight, and it was a very close-quarters, rough fight, but at the end of the day, it was our officer who had the gun in his hands and pulled the trigger. Had we used a body cam, I'm not actually sure we would have gotten the truth, since it was such a physical fight and sometimes limbs were everywhere. A body cam would have easily been obscured for most of it. We terminated him immediately, and released this section of lens footage along with our official press statement. We usually don't monitor the lens recordings of all of our officers, but we do require every officer to have their lens actively recording when they're on the job, so that we have the ground truth whenever we do need it. We're also pretty strict about following the rules: if your Holo lens is turned off at any point while you're on a case, you will be immediately asked to turn it on, and if you don't within a certain amount of time, we get alerted and we will immediately terminate you. These lens are such an easy way and surefire to maintain our reputation and honesty to the public - it really just doesn't make sense to try to hide anything.

### **Maura**

I love my lenses! Now, I can relive all of the nights out, vacation trips, and core memory moments that I've made with my friends over the past few years. Don't get me wrong, I still love taking photos and take a TON whenever I can, especially with my film camera because I really like that kind of older aesthetic, but none of those can really capture the first-hand experience of actually living in that moment. A video of a concert is just not the same as seeing it in my eyes again ya know? I've also always thought that some things really just look better in your eyes than on a camera, like the night sky, and when I play my lens recordings again I can see constellations just as if I'm actually lying under the stars. Some of my favorite recordings to revisit are from spring break in Puerto Rico last year. My friends and I went snorkeling, and we saw a sea turtle right near the shore! We also went clubbing in the old city, where we all tried a drink for the first time ever, and later talked for hours on the roof of our Airbnb. Whenever I'm bored or need something to cheer me up a bit, I can watch the moment a sea turtle swam right up to us, or all of our faces after that first sip of a margarita, or when we just started hysterically laughing on that roof. See, lenses enable an authenticity that just isn't possible with a camera. If I had taken videos or photos at any of those moments, we would've started posing, acting different, being worried about how we would look in these photos or videos. We just wouldn't be acting authentically, and we would be pulled out from living in that moment. With lens recordings, you can just live your life and act like normal without having to worry about doing anything to capture the moment. My friends and I also share our recordings with each other so that we can see favorite moments of what someone else saw, and get like a full picture. I personally think it's been the best thing for my social life. I live much more in the moment instead of pulling out a phone, and I get to authentically capture the joy, excitement, and energy of my life, and relive it again whenever I want to.

### **Todd**

I didn't really understand the appeal of lenses too much until I had my daughter, Anna. When my wife Lea was pregnant, we watched Anna get bigger and bigger in the ultrasounds,

and at some point it hit me that she was going to grow very, very fast. I wanted to hang onto all of the moments of her life, from the first time she opened her eyes as a newborn, to elementary school performances, and eventually to big events like graduations. Lea and I decided to get ourselves some lenses before Anna was born, and we made some special recordings of us talking to Anna in Lea's stomach. It seemed a little crazy back then, but the idea is to eventually give Anna a collection of these recordings from different moments in her life, and hopefully she can see how much we love her by watching herself through our eyes. Anna's currently in middle school, and we'll probably keep this up at least through high school, and maybe gift these recordings as a high school graduation gift. I think we've been extremely diligent! She'll be able to see her first words, her first steps, her first birthday party, first trip abroad, and so on. We used to watch her like a hawk to make sure we get recordings of these important moments, and it definitely does help that lenses are right in your eye, so we don't potentially miss anything in the process of getting a phone or camera. To be honest, I think I've also been a bit selfish with some of the recordings. I like recording some of just the mundane moments too, like our father-daughter play dates, walks in the park, or just the conversations we have when she gets back from school. This way, I'll always be able to look back on these little slices of life and put myself right back into that time.

## Eli

I have absolutely loved Holo since their first ever lenses came out. Working here has quite literally been my dream job since that happened, and I'm really, really happy to be here now. I think it's just the coolest place you could possibly be - we're literally changing the world! Honestly, though, it's been a really, really long journey for us. I remember augmented reality and virtual reality never really took off, even with all the Metaverse hype in the early 2020s. Stuff like Google Glass epically flopped, and the products just never seemed able to actually live up to the hype that they generated. The main problem was that these things were *clunky*. Strapping on some heavy goggles was too jarring to most people to ever feel like some version of reality, and if it doesn't easily feel like reality, why even use it? Holo built off of a lot of gradual development over years and years, from old companies like Mojo Vision or Sony. There's still nothing else like smart lenses - those regular contact lenses work in an entirely different manner since they don't have any electronics, and there's literally just nothing else that sits on your eye. So, all of this tech had to be created from the ground up - the world's smallest microLED display, custom small accelerometers and gyroscopes to track eye movement, medical-grade batteries, a wireless battery, tiny cameras, and so on. The lens is an extremely small space, and on top of that, all of this technology had to be safe for the eye. So you can see how long it took to just get to a state where we had a viable prototype, and then it was the rounds of FDA trials and iterations we improved on. Our first target was clinical uses - correcting myopia, hyperopia, and astigmatism. Traditional lenses focused on distorting the light coming in so that it hits different parts of the retina, but we figured out that once you knew what kind of correction had to be applied, you could just directly change the image that the lens receives so that the person can see normally. Figuring out the corrections was actually the easiest part of everything, since it was really just math, and trial and error. Manipulating the pixels on the LED display to show the correctly manipulated image was a bit harder, but it was worth it. We eventually got to the point where the whole process was automated - we could detect what kind of correction needed to be

done, and the user could interactively change their lens to their liking. These clinical uses were what really helped Holo take off and build trust, since it was doing what existing lenses already did, just with more control, and eventually cheaper as well.

People were a bit spooked when we introduced recording and playback possibilities. There was a lot of paranoia about being constantly surveyed, having recordings posted online, or us keeping recordings in our databases. As for keeping recordings, Holo has never done that and never will do that. All recordings from a user's lens are kept in a local database on whatever device the user connects with their account, and we never keep a copy. To be honest, I'm not sure we could even keep a copy of all the recordings out there - there's just so many hours that we can't even store all of them if we wanted to. In terms of people being recorded without their consent, our official recommendation is to always tell others when you're recording, or don't record if someone doesn't consent. However, we also implemented a small blinking light while recording, and a face blurring feature, where your stored recordings will automatically have all faces blurred. The face blurring is something that users can toggle on and off, and hopefully will alleviate some fears about being recorded without consent. I've been following Holo's journey for a while, and it's really been inspiring to see what the lens looks like today.

### **Maura**

Although I'm a big fan, using the lens hasn't come without some drama. We had to establish some ground rules among our friend group about always saying when we were recording, after some nasty situations of people recording gossip about others behind their backs and then using it as blackmail or just leaking directly to the person that was being shit talked. For a while, we almost refused to even talk to each other in case someone was lying about recording with their lens, and we ended up all over campus social media for saying something dumb. We got over it eventually though, and I think we're all pretty honest with each other now. This might sound like a hot take, but my boyfriend and I actually actively use it when we have arguments with each other. We can both get a bit short-tempered, and we decided to make Holo recordings of our fights so that we could be held accountable for our behavior afterwards, when we were both more level-headed. It was weird at first, to be confronted with your own behavior, but we've learned to be mindful of what we say in the moment, and it helps us remember what was said without emotions.

### **Jason**

Some of the other kids claim they've found ways to jailbreak the lenses by downloading software that does weird things, like make everything look red, or automatically turn faces into clown masks, and so on. I'm really skeptical of their claims because it seems really hard to download any non-Holo software onto the lenses. I've tried, if I'm being honest. That's why I want to upgrade my current lens, to get one that can actually do more than just fix my nearsightedness. Now they have software that can like outline edges of buildings or stairs to help with depth perception, or label faces in your vision with names, and so on. I don't really need any of this, but I think it'd be cool to be able to experiment with this stuff. Some of the kids have fancier Holo lens and already spend class laughing in the back at whatever they see that no one else can, and some other kids just totally rig their lens so that their vision is extremely

blurry or extremely farsighted, and basically totally tune out of class. Our school has already banned recording in classes, but vision modifications like that are a bit harder to catch.

### **Todd**

In addition to recording Anna, I also record some aspects of my own daily life for her to watch if she's ever interested. I can tell her what I do day to day, but I figure it would also be fun for her to see what I do and figuratively step into my shoes. I think it'd be an interesting log to start for potentially generations to come, and each future generation can experience life from the perspectives of previous ones. Maybe in the future, she'll be interested in seeing what dad does all day at work.