So That Oma May See

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This essay presents a fictionalized world in which smart technology, including AI-enhanced eyeglasses and at-home assistive robots, is designed specifically for the needs of the aging population.

Spanning 25 years, the story follows a young engineer and her grandmother, Oma, through the young engineer's diary. Each entry captures a snapshot of the same day, February 9, every five years from 2025 to 2050, tracing how the world changes as product design companies, government agencies, and the healthcare system respond to the growing proportion of people over 60.

The essay explores how product design can either fail or support users, how the choice between open- and closed-source AI models will determine who can afford state-of-the-art technology, and how the rise of AI contributes to increased energy consumption. It also examines the technological advancements and decisions needed to balance innovation with environmental protection.

Additionally, this essay investigates the relationship between caregivers and AI-based assistive devices, highlighting areas of synergy as well as workforce concerns, and drawing from existing research in robotics and healthcare. Through the young engineer's role as a product designer, this essay proposes that insurance policies, strategic business partnerships, and public pressure will shape the accessibility and affordability of these devices. The essay also addresses data privacy challenges in a world where assistive technology relies on perception, cameras, and sensors.

Ultimately, this essay follows the evolving lives of the young engineer and Oma over 25 years. In doing so, it explores how, with compassion and a willingness to listen, humans can build technology that empowers people to live independent and fulfilling lives for many years.

February 9, 2025

Oma got back from visiting uncle Drew and the cousins in California. She's back just in time for us to celebrate her 75th birthday with her next week! I've framed a photo she took, the one of the heron on the lake. I hope she'll like the gift. Oma was showing me more photos from her trip today, ones of bright cactus flowers, pelicans that always line the dock, Oma and my little cousins at Ocean World.

But something seemed off. I had to pry, but I got to it. Oma had been so excited to see the platypus exhibit at Ocean World - her first time seeing a platypus in real life. Well, it turns out they are nocturnal, and to Oma, the exhibit was nearly pitch black.[1] It was so dimly lit. Oma said she tried to get close and at least read the exhibit placard but could barely see the writing. She let my cousins stay to admire the duck-billed anomaly, and she went toward the exit where it was brighter, subtly following along the wall as a precaution. She joked to me "I didn't want to seem like I needed help, but I certainly wasn't going to fall for the sake of pride!"

Even joking it off, I know it hit home. Oma's eyesight has been going for a while now… I think that's why she has been taking so many photos. It helps her capture the beauty, and later she can zoom in and see it even better. But her eyesight has impacted parts of everyday life too.

Oma and I have talked about the tiny print used for instructions on cake-mix packages, or having to use her phone flashlight to read the menu in a particularly dimly lit restaurant.[2] It hurts when it feels like the world was not designed for you. These things seem small, but they are not always. My friend's dad recently misread the small font on his medication bottle, and if it hadn't been for quick thinking he could have been seriously hurt. Now that I look for it, I even notice when public seating is too low for people to easily sit down or get up.

The world is aging. I was researching it after our talk, and the World Health Organization projects that "by 2030, 1 in 6 people in the world will be aged 60 years or over… By 2050, the world's population of people aged 60 years and older will double."[3] It seems to me that we have not designed a world fit for this reality.

It makes me consider my grad research, the intersection of product design with computer vision and language models. We're finding new ways to perceive and interact with the world. Just the jump in language model capabilities from "Attention is All You Need" introducing transformers in 2017,[4] DeepSeek R1 competing with OpenAI's GPT-o1 in reasoning tasks has happened in less than a decade. My lab is abuzz with open-source models, assistive robots, augmented reality, and AI-agents. There is a wave of change. I wonder, can this help?

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[1] Jackson, G R et al. "Aging and dark adaptation." *Vision research* vol. 39,23 (1999): 3975-82. doi:10.1016/s0042-6989(99)00092-9

[2] Hou, Guanhua et al. "How to design font size for older adults: A systematic literature review with a mobile device." *Frontiers in psychology* vol. 13 931646. 1 Aug. 2022, doi:10.3389/fpsyg.2022.931646

[3] World Health Organization, Ageing and Health Site, Published October 1, 2024

[4] Vaswani, Ashish, et al. "Attention Is All You Need." *Advances in Neural Information Processing Systems*, edited by I. Guyon et al., vol. 30, Curran Associates, Inc., 2017

February 9, 2030

It's 11:53 pm, and I just got home. Today was a long one. Most days at the startup have been, but it feels electric.

We wrapped up customer analysis and user case studies with our smart glasses today. Funding is tight, but I'm leading product development for the glasses, and I pushed hard for a diverse set of users in our pilot studies. That part of my product design qualifying exam will never leave me, the absolute necessity of observing representative users interacting with our product in a real-life use-case.[5]

It paid off. We uncovered so many latent needs. For one, we outfitted the original glasses with augmented reality to magnify small fonts immediately, but it became clear that some users with very low vision preferred text to be read to them. So optical character recognition must be perfect. Other users preferred being able to switch between the two options via a button. Users indicated that they wanted mainly mechanical controls or haptic feedback. Something simple and intuitive.

Before our trials I had also asked Oma what she would want most. She said "Mobility, independence, and affordability. Get that right, and you're halfway there."

Some days, I feel overwhelmed heading the product design team, but I know we all have to wear many hats in these first few years. I can't believe that when I first started I was the only one working on the computer vision algorithms for our glasses. Luis joining has been a huge push forward.

Luis graduated from the Human Computer Interaction Institute at Carnegie Mellon in 2028, the same year I defended my PhD thesis at MIT. It felt like everything changed that year.

- The University of Maryland's Ethics in Data Lab released EverySet, a tool that evaluates datasets for bias.
- Using this as a constraint, the Technical University of Munich generated the largest distilled training dataset with a 99.8% non-bias rating, but this time it was multimodal.
- At NeurIPS 2028, OpenAI released GPT-XI, the most modality-agnostic foundation model yet. Text, image, video, audio, and 3D scans could all be inputs in a unified model.
- At the same time hyper-efficient supervised fine-tuning resulted in smaller and smaller reasoning models: 250 million parameters. One of these was actually part of my thesis.
- The biggest news of all? Pressure from the public and competing models from abroad meant open-source models had become the norm.

With algorithms being largely open-source now, more and more differentiation in this market lies in user experience and accessibility. The landscape of this market is fierce.

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[5] Ulrich, K.T., Eppinger, S.D. and Yang, M.C. (2020) Product Design and Development. McGraw-Hill Education.

The Ray-Ban Meta has come a long way from voice commands and a built-in camera. Their incorporation of mixed reality visuals and social-media integration have made them a staple among gen beta. But, that being their market, they've neglected many features that older people need. Our research shows that being able to lighten entire scenes when in a dark room, or perform instantaneous image segmentation to identify uneven flooring or obstacles during a walk at dusk are more important Meta-integration. We've known for a while now that privacy is a top concern for adopting any assistive technology,[6] so having secure servers, clear limitations on data access, and not being associated with a tech-conglomerate are *our* top concerns.

One thing they absolutely got right was the need for a low price point. Most smart glasses for people with low-visibility start at a price-point of $2,000. That's just not feasible for many people.

Many of our users expressed concerns about the cost during the customer analysis. Our team pored over economic studies on assistive technology adoption. The plan as of now: streamline production and partner with nonprofit organizations to subsidize costs for lower-income individuals.

Now, I'm off to bed. We've got another big day ahead of us.

[6] Salifu Yusif, Jeffrey Soar, Abdul Hafeez-Baig,Older people, assistive technologies, and the barriers to adoption: A systematic review, International Journal of Medical Informatics, Volume 94, 2016 ,Pages 112-116 ,ISSN 1386-5056

February 9, 2035

The kids are taking a nap, so I am writing while I have the chance.

To do:

- Follow up with the rep. from the Service Employees International Union
- Meet with Luis and Megha about sensor integration between Homebot and OmniSight glasses
- Confirm we can get a pilot of the Homebot for Oma's birthday
- Buy 85 birthday candles, or maybe just the "8" and "5"?
- Schedule an on-site demo with Harmony Senior Living Home executive director

The company has come so far in just six and a half years. We're no longer just an ambitious startup—we're making real change. We are still focused on building assistive technologies for the elderly, ensuring accessibility, independence, and dignity, but we've expanded our team and our vision.

I'm leading the OmniSight smart glasses *team* now, and Luis and Megha are leading Homebot, an at-home assistive robot.

Megha has been a huge addition to the team, bringing a wealth of psychology knowledge. Our goal with the Homebot and the OmniSight glasses is to combine perception, assistance, and psychology. Homebot can provide help with everyday tasks, but also levels of companionship.

We started working closely with the Service Employees International Union (SEIU), which represents caregivers. This was the single best decision we have made.

Working with SEIU created a straight line to partnering with senior living homes, where we have truly found our niche. Our affordable assistive technology (subsidized by the homes themselves, local governments, or non-profits) integrates with caregivers who already understand the needs and routines of the residents.

Our technology is just one piece of a broader ecosystem dedicated to providing elderly individuals with respectful and dignified care. SEIU members were concerned about protecting caregiver wages and ensuring that demand for their work remained strong, and rightfully so. Through open discussions, we found areas of synergy rather than conflict.[7,8]

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[7] S. Moharana, A. E. Panduro, H. R. Lee and L. D. Riek, "Robots for Joy, Robots for Sorrow: Community Based Robot Design for Dementia Caregivers," *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, Korea (South), 2019, pp. 458-467, doi: 10.1109/HRI.2019.8673206.

[8] Wang RH, Sudhama A, Begum M, Huq R, Mihailidis A. Robots to assist daily activities: views of older adults with Alzheimer's disease and their caregivers. *International Psychogeriatrics*. 2017;29(1):67-79. doi:10.1017/S1041610216001435

The assistive devices can help ease the burden of care during difficult hours, offering support when caregivers aren't present.[8] They can also lower the emotional burden of caregivers by delivering some of the information that the residents don't want to hear, like diet or medication reminders.[7]

Residents at higher risk of dementia benefit greatly from a companion like the Homebot. But the type support changes with time. In earlier stages of dementia, caregivers prefer the Homebot to stay in the background, but in later stages it is useful for it to be in the foreground.[7] The senior living homes are able to afford multiple Homebots, enough to provide substantial support.

My ultimate goal is for Homebot, OmniSight, and other assistive devices to be covered by insurance. Financial constraints should never stand in the way of access.

February 9, 2040

Life moves pretty fast these days. The kids are back in school from winter break. My parents are staying with us for the week and then we're heading up to Oma's this weekend for her birthday. Work has been crazy, good, but crazy.

The goal of carbon neutrality is just a decade away now. 2050, as enshrined by the Paris Agreement of COP21 and reaffirmed in the Zagreb Agreement of COP38.

It feels serendipitous that this is all happening now. OmniSight and Homebot have had commercial success and just yesterday I had a brief with the legal team. It seems like there is real promise of our assistive devices becoming classified as durable medical equipment (DME) so that they would be covered by insurances like Medicare. This would be a massive step in accessibility for all. Already, we are seeing sales to individuals expand.

But all of these AI-based devices require constant computation and a lot of processing power.

The strides over the past years have been incredible. Increased compute efficiency is just the start. Improved HVAC systems for data centers, mandatory carbon capture at power plants, and the mass-adoption of renewable energy as a way to power data centers all had to come together, hand in hand. And it has not been easy, but it has been worth it.

It took a lot of pressure from the public to get some of these mandates written into law.

I remember when the first set of federal tax incentives for AI-efficient processing came through. It was a game-changer. Startups and tech giants alike scrambled to re-engineer their architectures to meet the new efficiency standards, researchers reopened the discussion around neuromorphic computing, and within two years, the energy consumption of AI-driven operations had nearly halved. The latest chips from QuantaSys were leaps beyond anything we had imagined just a decade ago. Homebot, which once required constant cloud connectivity, could now process most of its tasks locally, dramatically reducing its carbon footprint.

For us, local computation also increases data privacy, which remains a top priority of all AI-based companies.

Still, the fight isn't over. Just last week, I sat in on a panel discussing the ongoing risks of e-waste from obsolete devices. We've collectively reduced AI-driven power consumption, but materials sourcing and device longevity remain challenges. I brought up our own roadmap for OmniSight, how we introduced a fully modular design in our 2035 release, ensuring that rather than replacing an entire unit, users could upgrade specific components as needed.

February 9, 2045

I'm glad I've been back in the habit of writing here. We had a big family lunch today, and then a walk around the lake, where Oma captured a perfect photo of a heron just as it took flight. Oma is about to be 95! She chose to move in with my parents, but more for the joy of it than the support, Oma is enjoying her independence more than ever.

She has created an online gallery of her photography, and I got Daniel to help her run the website - he has proudly taken on the duty as Oma's eldest great-grandson.

I've turned to Oma a lot recently for advice as a mother. Her wisdom is steady and simple, rooted in experience. She told me that patience and compassion are key. She says, the best thing I can do is be present and listen. It's funny, that's so similar to the advice I first received when entering into product development. Be compassionate and listen.

Sometimes you just need to hear it again.

I learned that lesson in a big way three years ago.

We had conducted our latest round of user interviews. Against the projected market trends, we found that the user's top priorities were the educational possibilities and the social engagement with their assistive devices.

Even though this hadn't been part of our next planned series, we decided to begin a design sprint to see how we could best incorporate the latest feedback.

Inspired by research on socially assistive robots and trust in human-robot interactions, Luis, Megha, and their team worked deftly to integrate new conversation-based elements, ensuring the Homebot did not just provide reminders but also meaningful engagement and learning activities, like holding beginner conversations in a new language or teaching a new recipe.

We wound up partnering with a team of researchers from the Broad Institute to study the efficacy of the technology. That is what made my dream come true.

The devices were finally classified as durable medical equipment (DME). They are covered by insurance.

Governments are recognizing that tools like ours don't just improve lives, they reduce healthcare costs. Studies out of the Broad Institute and the Cleveland Clinic on AI-driven fall prevention and assistive technology adoption in aging populations helped us make the case. Preventing falls, ensuring medication adherence, and maintaining mental engagement help older adults stay out of hospitals and nursing homes longer. This is a huge victory.

Sometimes, as Oma said, the best thing one can do is be present and listen.

February 9, 2050

Oma would have been 100 next Wednesday. She passed away two years ago at 98.

It's still hard to talk about - explaining it to the kids, staying strong for them. But I find solace in some things. Oma was so happy, right up until the end. She still went on walks, capturing photos of flitting birds and vibrant flowers, savoring the beauty around her.

I have a lot of those photos on our walls. I'm still grateful Oma moved in with my parents. Having everyone together to cook and share meals with each other, play card games, and watch movies. It meant a lot to all of us.

I like to think I had a part in making that happen. Oma was able to read the whole time, and her eye for art made her the fiercest competitor in Pictionary! I cherish those memories.

I will always admire her sharp mind.

It wasn't that long ago that living past 85 years meant that your odds of developing Alzheimers was 1 in 3.[9] Not anymore, thank God. I attribute some of that to Homebots. We have known for so long that loneliness is linked to Alzheimers[10], but it's not a simple problem. However, the Homebot really has been wonderful for Oma and my parents, just sharing the news in a conversational tone, chatting with them to help them learn new languages. My parents used that to learn some Portuguese before their big trip for their 75th! The glasses were a big help there - they read many street signs, and, more importantly, many menus.

Oma got to see her children live such happy lives. I think that's all she really wanted. Yup, mom and dad are nearly 80! As for me, the kids like to remind me and their dad that we've gotten old, but we've still got it! Yup, they've still never beaten us at pickleball.

I think my younger self paid it forward with that one. I do have the OmniSights to thank for my eyesight.

You can't go back in time and stop yourself from reading all of those papers in a poorly-lit apartment while getting your PhD, but you can at least make sure your PhD eventually helps your old eyes.

When the company was acquired a few years ago, I wasn't sure how I would spend my time. When I was in my twenties, I just didn't have a picture of this age.

But I'm here, and it is beautiful. It is true, I am aging. The world is aging. But we are adapting together. I have gotten to see the beauty of life for many years, and I plan to see it for many more. That is a gift.

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[9] (2022), 2022 Alzheimer's disease facts and figures. Alzheimer's Dement., 18: 700-789. https://doi.org/10.1002/alz.12638

[10] https://www.alzheimers.org.uk/