Fundação
para a Ciência
e a Tecnologia

/signo/

Acronym:	Signo
Name:	Value systems in digital health technologies
Call:	Call for Exploratory Research Proposals under the Carnegie Mellon Portugal Program - 2022
Contract nr:	2022.15724.CMU
Start date:	01 January 2024
Duration:	12 months

Deliverable 2.1: Exploratory prototypes, scenarios and visual vocabulary for value elicitation.

Deliverable 2.2a: Exploratory prototypes.

Deliverable 2.2b: Report on prototype assessment.

Due date: M10 (2.1), M12 (2.2a), M12 (D2.2b)
Date of delivery: M15
Partners involved (leader in bold): **FhP**

Authors: Inês Silva (FhP); Joana Couto (FhP); Ricardo Melo (FhP)

Partner list

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Revision history

Rev.	Date	Partner	Description
1	31.03.2025	FhP	First version of deliverable

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1. Prototype exploration through participatory design

1.1. Preparation

Building on the findings from the first workshop, the preparation for the second workshop began with a clear objective: to have each of the three groups work with different sets of values and, through speculative design, develop ideas for future technologies that would embody these values in the context of glaucoma treatment, diagnosis, and/or screening.

Based on our analysis, we decided to use the three clusters previously identified. However, to enrich the exercise, we expanded each cluster by incorporating additional values that were closely related to them, as identified in the analysis of value relationships.

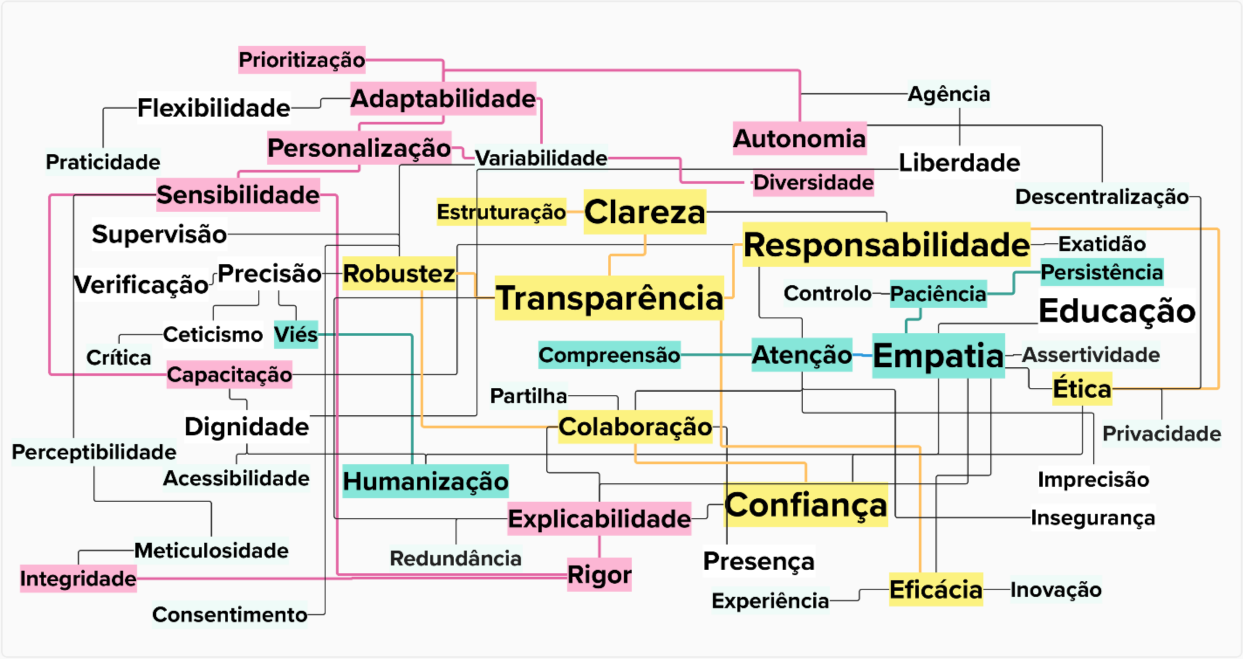


Figure 1: Value relationships and groups.

As a result, the three groups shown in the image above were formed: Responsibility (yellow), Humanisation (blue), and Inclusion (pink).In addition to the core values, additional values were introduced by the researchers, expanding each group with both positively and negatively connoted values to allow more exploration of how different aspects of these values influence technology and patient care.

The final groups were structured as follows:

Group 1: Responsibility

Core values: Responsibility, Robustness, Ethics, Transparency, Clarity, Trust, Efficiency, Structuring, Collaboration;

Added values: Imprecision, Intolerance, Insecurity

Group 2: Inclusion

Core values: Autonomy, Personalisation, Diversity, Empowerment, Sensitivity, Integrity, Adaptability, Explainability, Rigor, Prioritization

Added values: Inclusion, Ambiguity, Imprecision, Standardization, Luck, Equity

Group 3: Humanisation

Core values: Humanization, Empathy, Attention, Persistence, Bias, Patience, Understanding

Added values: Care, Courage, Detachment, Indifference, Disconnection

With these clusters prepared we then started planning the workshop itself (Workshop Planning.docx). This three-hour workshop was intended to use speculative design to explore future technologies for glaucoma care. Participants would adapt to a future scenarios (Storyboard and design brief template.pdf) and with the key values provided prototype a technology that embodied them. Instead of just designing interfaces, the intention was for the group to focus on interaction flows, illustrating how technology could shape patient and doctor experiences.

1.2. Results

1.2.1. Responsibility

(Main value: Responsibility; Values chosen by the participants: Transparency, Ethics, Robustness and Trust)

The discussions on responsibility in glaucoma care 20 years onwards revealed a complex interplay between patient autonomy, healthcare system integration, and emerging technologies. Participants explored the potential of self-monitoring tools, such as portable devices like "magnificent glasses" as a means to empower patients and enable early detection. While some viewed at-home monitoring as a logical evolution in healthcare ("They might do maintenance at home... I don't find that absurd" – M1), others questioned whether patients would proactively act on the results without systemic support (" I don't know if all the people who do this self-monitoring are available to take the first step... " – F4). A recurring theme was the need for bidirectional monitoring, where self-testing devices would automatically alert healthcare providers to ensure follow-up, balancing patient initiative with clinical oversight.

Accessibility and integration into existing healthcare systems emerged as critical factors. Proposals included opportunistic screenings at primary care centers for at-risk populations (e.g., those over 40 or with a family history), with automated referrals for positive cases ("When the glasses turn green for disease, the patient is summoned" – M1). However, concerns were raised about equity, as not all patients have equal access to healthcare resources (" From the point of view of my personal responsibility, I want to go to a health facility and take an opportunistic exam. Because I may not have access to insurance, to a health center or I may never be called there. " – T1).

The role of responsibility itself was debated, whether it primarily lies with the patient (e.g., adhering to self-monitoring and treatment) or requires shared accountability with healthcare systems. Some questioned if the patient responsibility should extend beyond mere compliance ("Does it exhaust itself in adherence to therapy?" – F4), while others emphasised the need for structured pathways to guide patients from detection to treatment ("This will have to be tracked by whoever provided it " – M1). The discussions underscored that successful implementation of new technologies depends not only on their clinical utility but also on addressing practical barriers, ethical considerations, and disparities in access.

Ultimately, the workshop not only conceptualised an emerging technology in the form of smart glasses for glaucoma monitoring but also co-designed a realistic scenario (through group discussion and role-play) that mapped how this technology would integrate into the patient journey.

"For example, the health center has that kind of historical, like, genetic information... age, and then the person... when there's an alert it says 'look, go to a pharmacy, go somewhere that has those glasses'... The smart glasses detect if the person has something and say 'look, maybe you should talk to an ophthalmologist'... Then in that case, the person would talk to a doctor in person after that referral, and then they would have access to those glasses at home to do the monitoring." -D1

Figure 2: Co-design workshop Group 1.

1.2.2. Inclusion

(Main value: Inclusion; Values chosen by the participants: Integrity, Autonomy, Empowerment, Ambiguity)

The discussions on inclusion 20 years onwards revealed deep concerns about how emerging technologies might shape access to glaucoma care in the future. Participants envisioned both promising possibilities and troubling trade-offs between innovation, equity, and personal freedom.

One perspective focused on maintaining traditional healthcare access points. Some argued for community-based screening locations, like health centers, as essential for ensuring no one gets left behind. "Going to a place, maybe a health center... outside the home" (M2) reflects this view, suggesting physical spaces remain important for equitable care. The idea of multipurpose check-up centers ("a center where people could get a full check-up, not just for glaucoma" - M2) and a future dominated by corporate-controlled healthcare appear in the discussion as "By 2044, insurance companies will be even stronger monopolies... more tied to technology" (F2), painting a picture where constant health surveillance becomes unavoidable. This vision included small, always-on health monitors (possibly embedded in the body) that would continuously track medical data. A detailed scenario described "Mr. José" being scanned at 3 AM by an AI system that detects an eye irregularity and automatically schedules his follow-up care (F2).

The group identified serious ethical dilemmas in these technological approaches. While such systems might improve early detection, they could also create new forms of exclusion. As one participant stated, "This isn't inclusive, it's mandatory. You are in this society, live in this country, you have to have this" (M2). Others questioned whether these innovations would respect basic human dignity, with one sarcastically noting that "the most 'inclusive' scenario" might simply mean notifying people at 7 AM instead of 3 AM about health issues (F2).

These discussions brought to light the darker side of inclusion, revealing three critical challenges for achieving truly inclusive glaucoma care. First, the tension between high-tech solutions and the need to maintain human-centered points of care. Second, the risk that healthcare, when dominated by corporate interests, could prioritise surveillance over genuine accessibility. Third, the importance of safeguarding patient autonomy in the face of increasingly pervasive monitoring technologies.

Ultimately, the workshop led to the conceptualisation of emerging technologies in the form of a wearable device and a scanner for monitoring glaucoma and other health conditions. Through group discussions and role play, participants co-designed a realistic scenario that explored how these technologies could be meaningfully integrated into the patient journey.

“So, Mr. José is asleep at 3 in the morning. There's an update from the machine that scans Mr. José and says, ‘the bladder issue is still ongoing, etc... But the real problem is here in the eye, I’ve detected an irregularity in the eye.’ It’s the first time, so he immediately gets a yellow alert. He should be seen tomorrow by proper professional equipment. He then goes to that space because he has a certain number of days, so an appointment is scheduled right away... And from that point on, another machine performs a more specific scan. And I believe that ultimately he will then have follow-up care with a health professional.” -F2

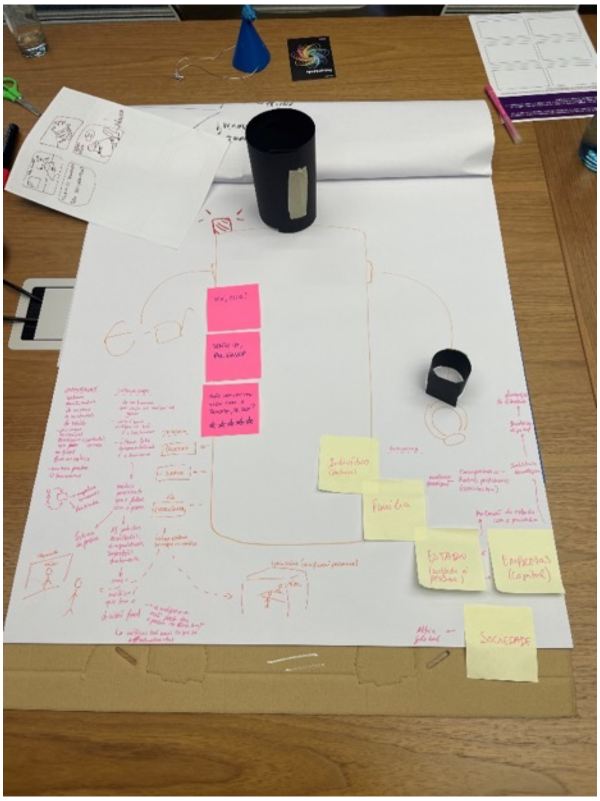


Figure 3: Co-design workshop Group 2.

1.2.3. Humanisation

(Main value: Humanisation; Values chosen by the participants: Care, Bias, Detachment)

The discussions on humanisation in glaucoma care 20 years into the future revolved around the evolving role of artificial intelligence (AI) in creating a more empathetic, educational, and patient-centered healthcare experience. Participants envisioned a future where AI not only enhances medical efficiency but also deepens the human connection between patients and providers through adaptive, multimodal interactions.

A central theme was the shift toward human-centric AI, which means, a systems capable of understanding the broader context of a patient’s life, medical constraints, and even emotional needs. As one participant described, "Human-centered AI will know more than it does today about the patient’s reality, the doctor’s challenges, hospital limitations, and private life” (T3). Participants also highlighted its potential for multimodal interaction such as "All aspects of generative AI, not just text-based but multimodal... audio, screens, conversations between systems..." (T3) to interact with humans.

The group also explored changing roles for doctors (although they continue on the loop of care), with AI handling routine diagnostics and early interventions, freeing physicians to focus on complex cases. ""By 2044 I think we will have, we will be able to make a shift in the doctor's role... Where there will continue to be a very strong medical presence is in the treatment part. That is, in intervention. We will be able to diagnose earlier, prevent more diseases, or at least prevent more serious diseases, we will have more tools to treat earlier what we need to treat. And then we will be more free let's say to better treat the most serious cases which are the cases that need surgery or that need treatment that is a bit more multidisciplinary and more complicated." (M3).

Ultimately, the workshop led to the conceptualisation of an AI-driven virtual assistant where “the type of conversation and the type of interaction it has with the patient, it's much more in an educational sense, follow-up, but it's not policing." (T3). Through group discussions and scenario-building, participants co-designed a system where AI acts as a proactive yet empathetic guide not only for glaucoma care as participant M3 said “I didn't just think about glaucoma, I thought in terms of doctor-patient interface...There should be a platform where the patient can keep inputting information they think is necessary but also other information they don't think is necessary but which is necessary for us. And it has to be something intuitive, it has to be something with little figures, writing a text 'today ate two grams of fat plus 0.5 milligrams...'...”.

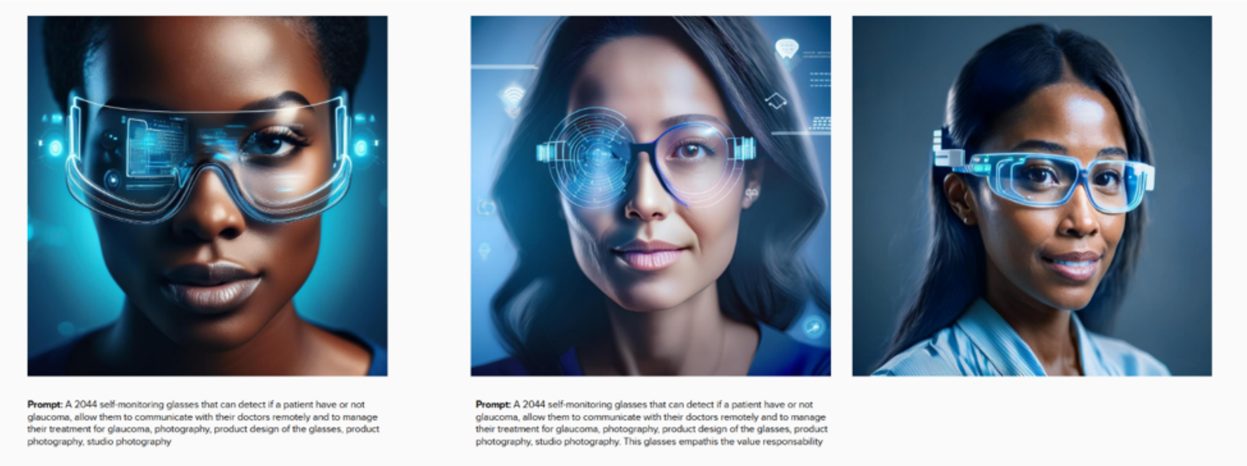
“…As soluções a nível da inteligência artificial vão evoluir mais na parte de AI ativa, agente, etc. Ou seja... A capacidade da inteligência artificial não só ser treinada para fazer uma função mas ela ter a capacidade de recorrer a outros mecanismos de inteligência artificial para decidir aos que vai recorrer e aprender com isso e propor ativamente... “se calhar é melhor ir falar com o doente”, “deixa cá ver como é que ele anda a tomar as gotas”. ” -T3

Figure 4: Co-design workshop Group 3.

2. Prototype assessment and framing of project outputs

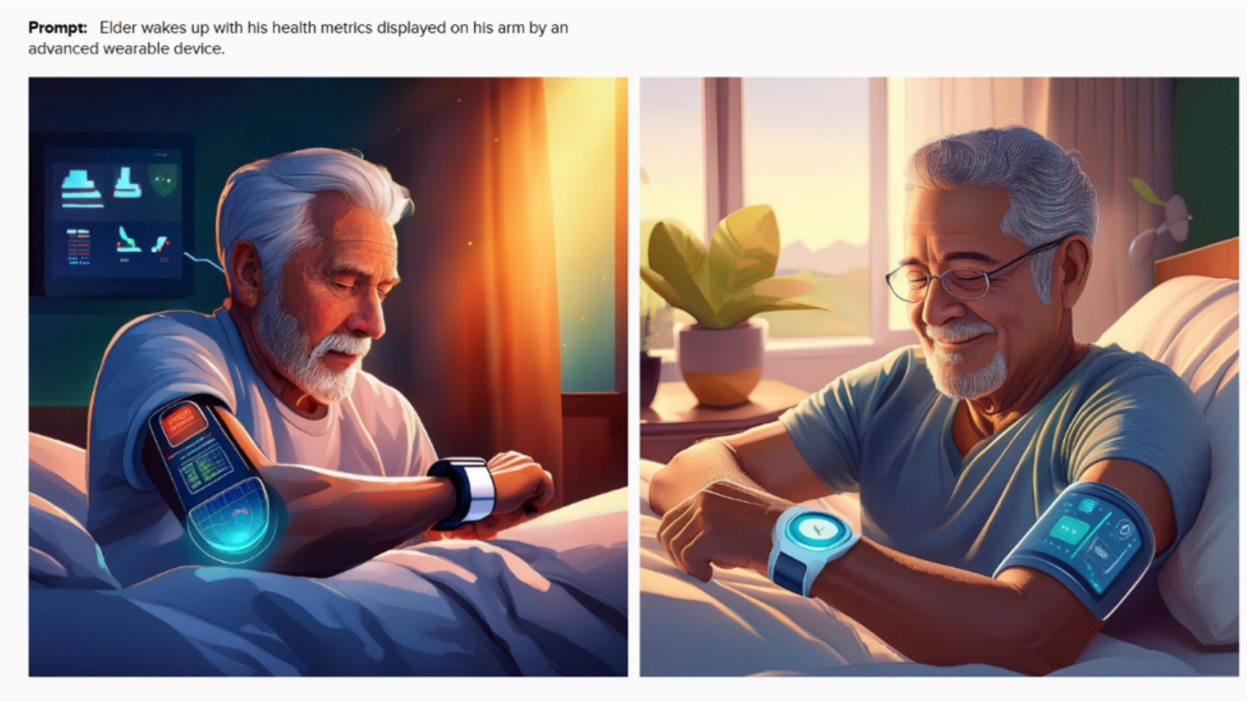
2.1.1. Preparation

To better visualize the technologies proposed across the three workshops, we used Adobe Firefly and ChatGPT's image generator to create AI-generated representations of the envisioned solutions. These visualisations helped ground abstract discussions in tangible form for the research group.

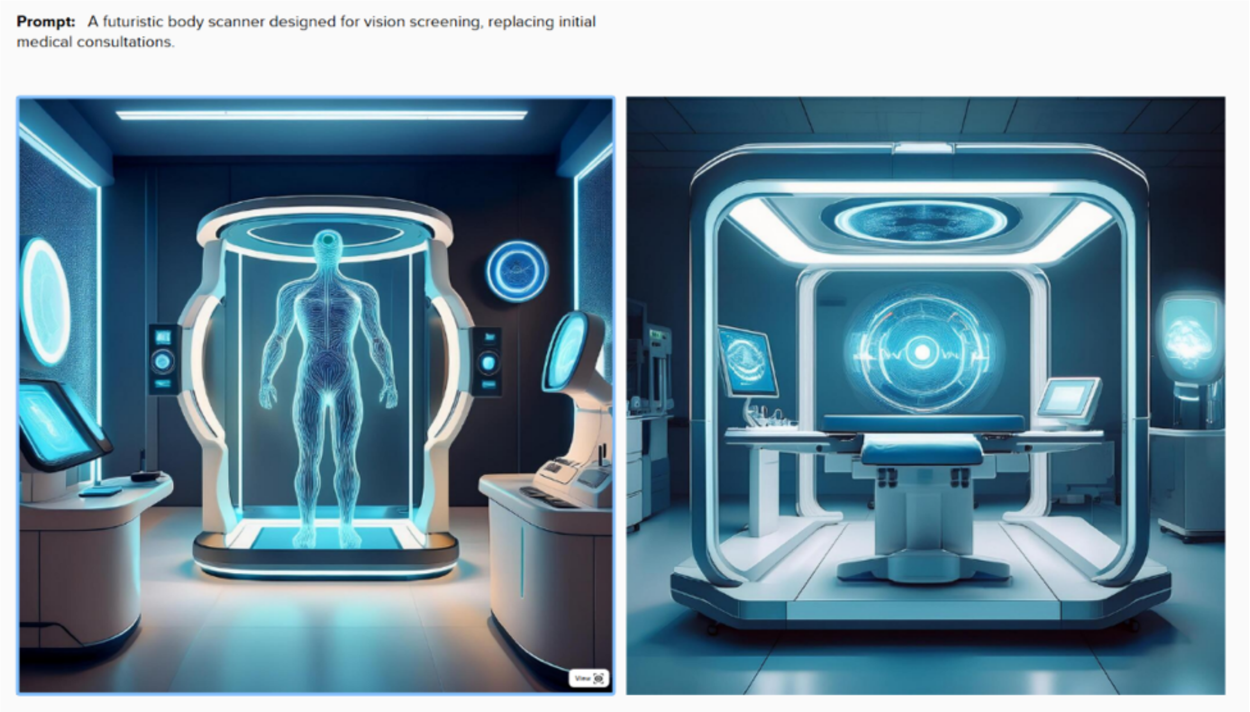


Prompt: A 2044 self-monitoring glasses that can detect if a patient have or not glaucoma, allow them to communicate with their doctors remotely and to manage their treatment for glaucoma, photography, product design of the glasses, product photography, studio photography

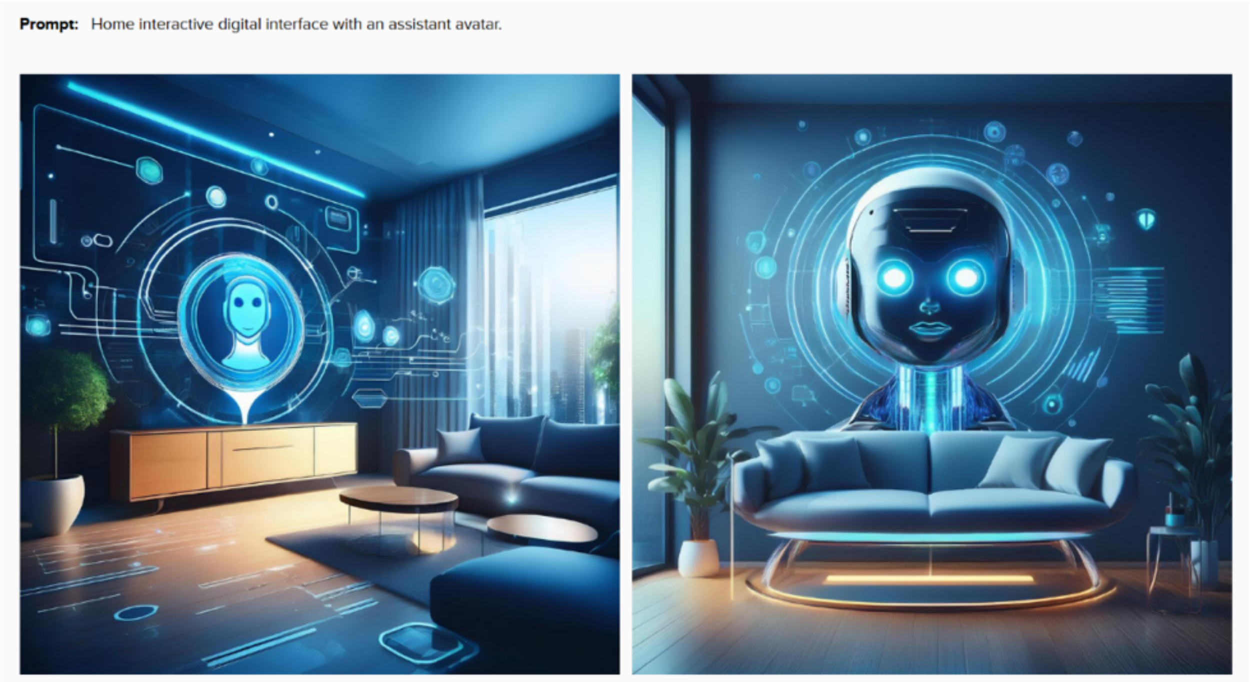
Prompt: A 2044 self-monitoring glasses that can detect if a patient have or not glaucoma, allow them to communicate with their doctors remotely and to manage their treatment for glaucoma, photography, product design of the glasses, product photography, studio photography. This glasses empathis the value responsability



Prompt: Elder wakes up with his health metrics displayed on his arm by an advanced wearable device.



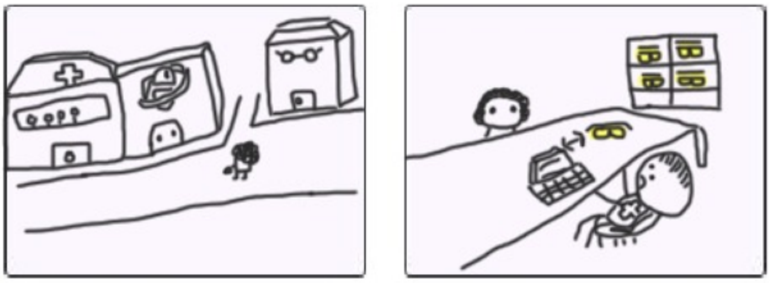
Prompt: A futuristic body scanner designed for vision screening, replacing initial medical consultations.



Prompt: Home interactive digital interface with an assistant avatar.

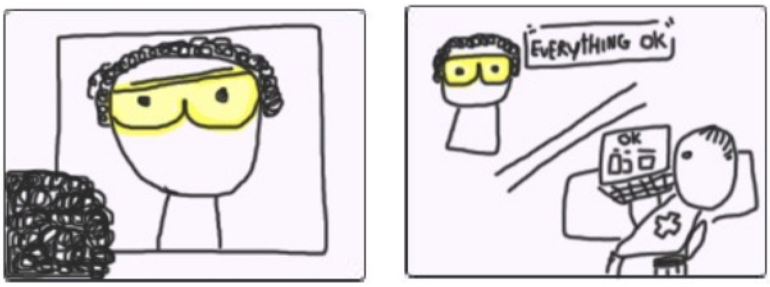
Following the AI-generated illustrations, the research team concluded that embedding these technologies within a storyboard scenario would better capture their real-world implications. The visual narrative merged workshop outputs (Workshop2 discussion and vision) with deliberate provocations to fuel future dialogue. For example, the storyboard would try to be exaggerated intrusive features, reduce user agency and put the technology available to all. By situating devices in mundane settings, the storyboard highlighted tensions to start future discussions.

2.1.2. Group 1 “Responsibility” Storyboard:



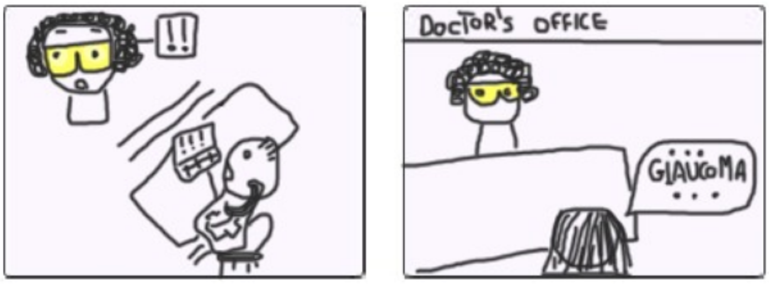
Adel quer monitorizar a sua saúde visual e está indecisa entre ir ao centro de saúde, ótica ou à farmácia ter uma opinião profissional.

Dentro da ótica, Adel é aconselhada por um profissional a adquirir os Glaucoculus, uma tecnologia emergente que permite a telemonitorização da saúde ocular.



Adel vê-se pela primeira vez com os Glaucoculus que acabou por comprar.

Com o uso regular dos Glaucoculus, Adel vai recebendo feedback consistente pelos óculos de que a sua visão está estável e sem alterações. À distância, um técnico também acompanha os dados recolhidos pelos óculos.



Um dia, os Glaucoculus detetam um problema ocular e notificam automaticamente um profissional de saúde, que entra em contacto com Adel para marcar uma consulta.

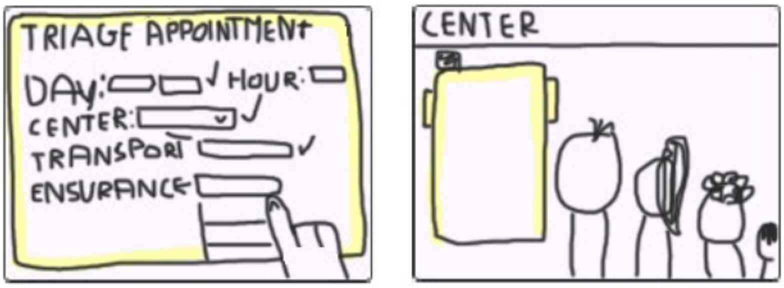
Na consulta presencial, Adel é informada pelo médico de que tem glaucoma. O profissional explica os próximos passos para o tratamento com os Gaucoculus a fazerem parte do tratamento.

Figure 5: Responsibility storyboard.

2.1.3. Group 2 “Inclusion” Storyboard:

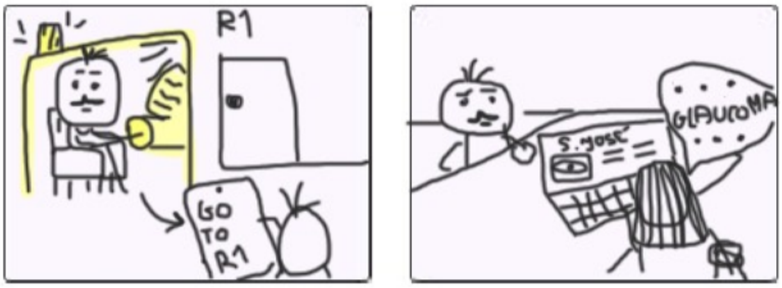
O Senhor José é acordado de manhã pelo alarme do wearable que tem no seu braço.

Ao levantar o braço, o Senhor José vê no ecrã um relatório com o check-up da sua saúde. Ele repara num aviso sobre uma invariabilidade detetada na sua visão.



Pelo wearable, o Senhor José consegue marcar rapidamente uma triagem, recebendo toda a assistência necessária para conseguir comparecer.

No dia da triagem o Senhor José encontra-se a ter de ir para uma fila para realizar uma avaliação detalhada através de um scanner avançado.



O Senhor José conecta o seu wearable ao scanner e segue os passos indicados pela máquina. No final do exame, é notificado para se dirigir a uma sala.

Dentro da sala, o Senhor José encontra-se com uma médica. Após analisar os dados recolhidos, ela informa-o de que foi diagnosticado com glaucoma e explica os próximos passos para o tratamento.

Figure 6: Inclusion storyboard.

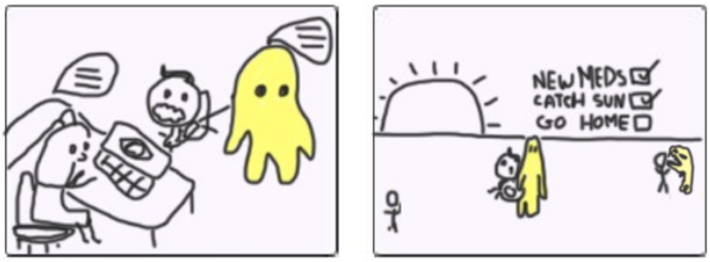
2.1.4. Group 3 “Humanisation” Storyboard:

Dave chega a casa e conecta o seu telemóvel às interfaces inteligentes integradas nas paredes. De imediato, o seu assistente virtual, SS, é ativado, e vários dados sobre a sua saúde e bem-estar surgem projetados na parede.

SS analisa os dados recolhidos e informa Dave que a medicação está a acabar. Pergunta se pode encomendar mais. Dave faz um gesto de "fixe" com a mão, que SS interpreta como um sim e prossegue com a encomenda.

Enquanto analisa os dados, SS identifica que algo na saúde de Dave não corresponde aos valores anteriores. O assistente pede permissão para agendar uma consulta médica para investigar o problema.

SS orienta Dave, passo a passo, na utilização do telemóvel para enviar ao oftalmologista informações sobre os seus olhos, utilizando uma aplicação específica.



Durante a consulta virtual, SS assume o papel de narrador por Dave, que prefere que o assistente fale por ele. SS descreve o estado de saúde de Dave e comunica ao médico, que decide ajustar a medicação atual para glaucoma.

Após atualizar a lista de medicação interna, SS leva Dave a apanhar sol, cumprindo uma tarefa da checklist de saúde. De seguida, planeia levá-lo para casa, assegurando que a rotina de bem-estar de Dave está concluída.

Figure 7: Humanization storyboard.

To further interrogate the nuances of these storyboards, the team adopted a parallel storyboarding method: alongside the researcher-crafted narrative, we used ChatGPT to generate alternate script descriptions of the same scenarios, which were then visualised through DALL·E. This produced two distinct storyboard versions: one grounded in researcher’s interpretation and provocation, the other shaped by AI’s implicit biases and narrative conventions.

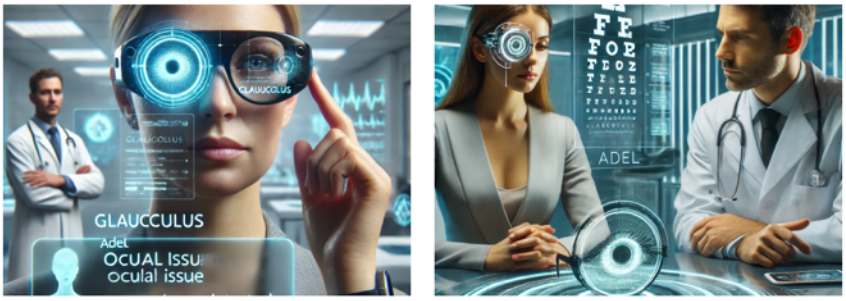
2.1.5. Group 1 “Responsibility” AI Storyboard:

Adel quer monitorizar a sua saúde visual e está indecisa entre ir ao centro de saúde, ótica ou à farmácia ter uma opinião profissional.

Dentro da ótica, Adel é aconselhada por um profissional a adquirir os Glaucoculus, uma tecnologia emergente que permite a telemonitorização da saúde ocular.

Adel vê-se pela primeira vez com os Glaucoculus que acabou por comprar.

Com o uso regular dos Glaucoculus, Adel vai recebendo feedback consistente pelos óculos de que a sua visão está estável e sem alterações. À distância, um técnico também acompanha os dados recolhidos pelos óculos.



Um dia, os Glaucoculus detetam um problema ocular e notificam automaticamente um profissional de saúde, que entra em contacto com Adel para marcar uma consulta.

Na consulta presencial, Adel é informada pelo médico de que tem glaucoma. O profissional explica os próximos passos para o tratamento com os Gaucoculus a fazerem parte do tratamento.

Figure 8: AI generated storyboard of Responsibility group.

2.1.6. Group 2 “Inclusion” AI Storyboard:

O Senhor José é acordado de manhã pelo alarme do wearable que tem no seu braço.

Ao levantar o braço, o Senhor José vê no ecrã um relatório com o check-up da sua saúde. Ele repara num aviso sobre uma invariabilidade detetada na sua visão.

Pelo wearable, o Senhor José consegue marcar rapidamente uma triagem, recebendo toda a assistência necessária para conseguir comparecer.

No dia da triagem o Senhor José encontra-se a ter de ir para uma fila para realizar uma avaliação detalhada através de um scanner avançado.

O Senhor José conecta o seu wearable ao scanner e segue os passos indicados pela máquina. No final do exame, é notificado para se dirigir a uma sala.

Dentro da sala, o Senhor José encontra-se com uma médica. Após analisar os dados recolhidos, ela informa-o de que foi diagnosticado com glaucoma e explica os próximos passos para o tratamento.

Figure 9: AI generated storyboard of Inclusion group.

2.1.7. Group 3 “Humanisation” AI Storyboard:

Dave chega a casa e conecta o seu telemóvel às interfaces inteligentes integradas nas paredes. De imediato, o seu assistente virtual, SS, é ativado, e vários dados sobre a sua saúde e bem-estar surgem projetados na parede.

SS analisa os dados recolhidos e informa Dave que a medicação está a acabar. Pergunta se pode encomendar mais. Dave faz um gesto de "fixe" com a mão, que SS interpreta como um sim e prossegue com a encomenda.

Enquanto analisa os dados, SS identifica que algo na saúde de Dave não corresponde aos valores anteriores. O assistente pede permissão para agendar uma consulta médica para investigar o problema.

SS orienta Dave, passo a passo, na utilização do telemóvel para enviar ao oftalmologista informações sobre os seus olhos, utilizando uma aplicação específica.

Durante a consulta virtual, SS assume o papel de narrador por Dave, que prefere que o assistente fale por ele. SS descreve o estado de saúde de Dave e comunica ao médico, que decide ajustar a medicação atual para glaucoma.

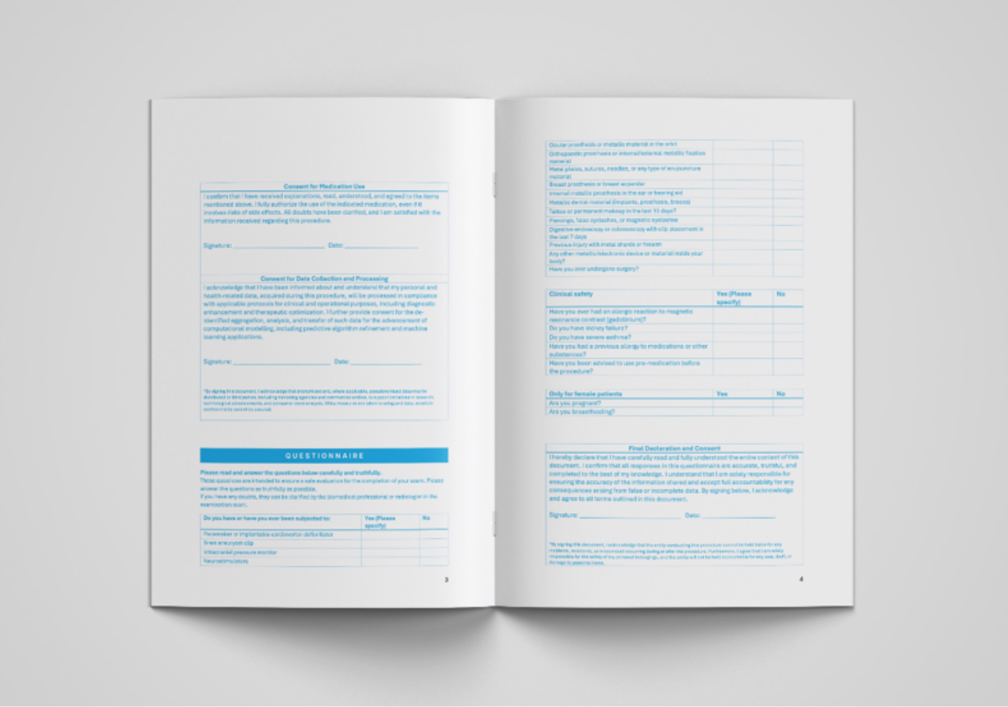
Após atualizar a lista de medicação interna, SS leva Dave a apanhar sol, cumprindo uma tarefa da checklist de saúde. De seguida, planeia levá-lo para casa, assegurando que a rotina de bem-estar de Dave está concluída.

Figure 10: AI generated storyboard of Humanisation group.

To deepen participant engagement and critical reflection, we also designed tangible artifacts mirroring the bureaucratic and experiential realities of each group's proposed technology. These materials served as speculative probes to materialise ethical and practical dilemmas:

- For the **Responsibility** group, a *"Smart Glasses User Manual"* outlined opaque responsibility policies, subtly exposing tensions between corporate liability and users.

- The **Inclusion** group grappled with a dystopian *"Informed Consent Form"* for full-body scanning with buried clauses about data being sold for marketing/research, alongside intrusive personal questions.



Consent for Medication Use

I confirm that I have received explanations, read, understood, and agreed to the items mentioned above. I fully authorize the use of the indicated medication, even if it involves risks of side effects. All doubts have been clarified, and I am satisfied with the information received regarding this procedure.

Signature: ____________ Date: ____________

Consent for Data Collection and Processing

I acknowledge that I have been informed about and understand that my personal and health-related data, acquired during this procedure, will be processed in compliance with applicable protocols for clinical and operational purposes, including diagnostic enhancement and therapeutic optimization. I further provide consent for the de-identified aggregation, analysis, and transfer of such data for the advancement of computational modelling, including predictive algorithm refinement and machine learning applications.

Signature: ____________ Date: ____________

QUESTIONNAIRE

Please read and answer the questions below carefully and truthfully.
These questions are intended to ensure a safe evaluation for the completion of your exam. Please answer the questions as truthfully as possible.
If you have any doubts, they can be clarified by the biomedical professional or radiologist in the examination room.

Do you have or have you ever been subjected to:	Yes (Please specify)	No
Pacemaker or implantable cardioverter-defibrillator		
Brain aneurysm clip		
Intracranial pressure monitor		
Neurostimulators		
Ocular prosthesis or metallic material in the orbit		
Orthopaedic prosthesis or internal/external metallic fixation material		
Metal plates, sutures, needles, or any type of acupuncture material		
Breast prosthesis or breast expander		
Internal metallic prosthesis in the ear or hearing aid		
Metallic dental material (implants, prosthesis, braces)		
Tattoo or permanent makeup in the last 15 days?		
Piercings, false eyelashes, or magnetic eyelashes		
Digestive endoscopy or colonoscopy with clip placement in the last 7 days		
Previous injury with metal shards or firearm		
Any other metallic/electronic device or material inside your body?		
Have you ever undergone surgery?		

3

Clinical safety	Yes (Please specify)	No
Have you ever had an allergic reaction to magnetic resonance contrast (gadolinium)?		
Do you have kidney failure?		
Do you have severe asthma?		
Have you had a previous allergy to medications or other substances?		
Have you been advised to use pre-medication before the procedure?		

Only for female patients	Yes	No
Are you pregnant?		
Are you breastfeeding?		

Final Declaration and Consent

I hereby declare that I have carefully read and fully understood the entire content of this document. I confirm that all responses in this questionnaire are accurate, truthful, and completed to the best of my knowledge. I understand that I am solely responsible for ensuring the accuracy of the information shared and accept full accountability for any consequences arising from false or incomplete data. By signing below, I acknowledge and agree to all terms outlined in this document.

Signature: ____________ Date: ____________

4

- The **Humanisation** group received a *"Virtual Assistant Quickstart Guide"* that the tone would promote dependency by framing the AI as a constant companion 24/7 always available where the person was to assist.

Integration in Smart Home

How to Interact With ST

Voice Commands
Speak naturally to communicate with the assistant by simply calling for ST.
"ST, what's the weather like today?"

Wearable Integration
Interact using wearable devices, such as smartwatches or fitness bands.

Text Messages
Send written instructions or questions through the ST mobile app.
"ST, schedule me an appointment with my family doctor as soon as possible."

Pop-up Notifications
Respond directly to pop-up notifications you set ST to ask.

Set Up your ST

1 Have your Wi-Fi password handy
Make sure you also have your log in information for any supported Streaming and video services providers you want to watch with ST.

2 Plug in your SSensor
Plug in your SSensor into an outlet. Wait a few minutes until the display will turn on and ST will greet you.

3 Set up
Follow the on-screen setup instructions. During setup, once you are connected to the Wi-Fi you can access ST via other smart technology around the house.

4 Say hello to ST!
After setup, say 'SS' to wake your assistant. Customize its avatar, communication style, tasks, and privacy settings, or choose a pre-defined setup. Interact via voice or the ST mobile app.
*Many avatars to choose from!

With all materials prepared for the workshop, we structured the session into three key phases. First, we presented hand-drawn scenarios; then, we would introduced values and physical probes like consent forms and user manuals and finally, we compared these with AI-generated versions and held a devil's advocate debate. The full plan is available here: Workshop 3 Planning.docx.

2.2. Results

2.2.1. Responsibility results

In this group, the values of responsibility, robustness, transparency, and trust were selected for analysis, while ethics was not chosen. Participants identified moments in the storyboard and probe where these values were either represented or where there was a lack of representation, or even a misrepresentation, of them.

Responsibility

- **Demonstrated in:** Ensuring the patient uses the instrument as instructed, adhering to protocols, and not ignoring warnings. Highlighting the technology's role in establishing and enforcing these protocols.
- **Not demonstrated in:** "Free access to all, without barriers" as unrestricted access without safeguards may undermine responsibility.

Trust

- **Demonstrated in:** Trust being placed not in the technology itself, but in the doctor who prescribed it.
- **Not demonstrated in:**
  - Lack of trust in the optician and pharmacy staff. Participants stated they would only trust the device if prescribed by a doctor.
  - The limitation *"24 hours with the glasses crosses the line"*, indicating distrust in excessive monitoring.
  - The requirement that *"the doctor needs to check the data first before sending warnings or results to the patient"* reduced trust in the storyboard (happened the opposite).
  - Additional distrust was provoked by:
    - Spelling incorrect a term in the manual probe.
    - The need for the manual to clarify what *"well-positioned"* and *"not well-positioned"* mean, or for the glasses to provide direct feedback.

Robustness

- **Demonstrated in:** Features designed to ensure effectiveness (avoiding misleading results) and equipment durability/resistance.

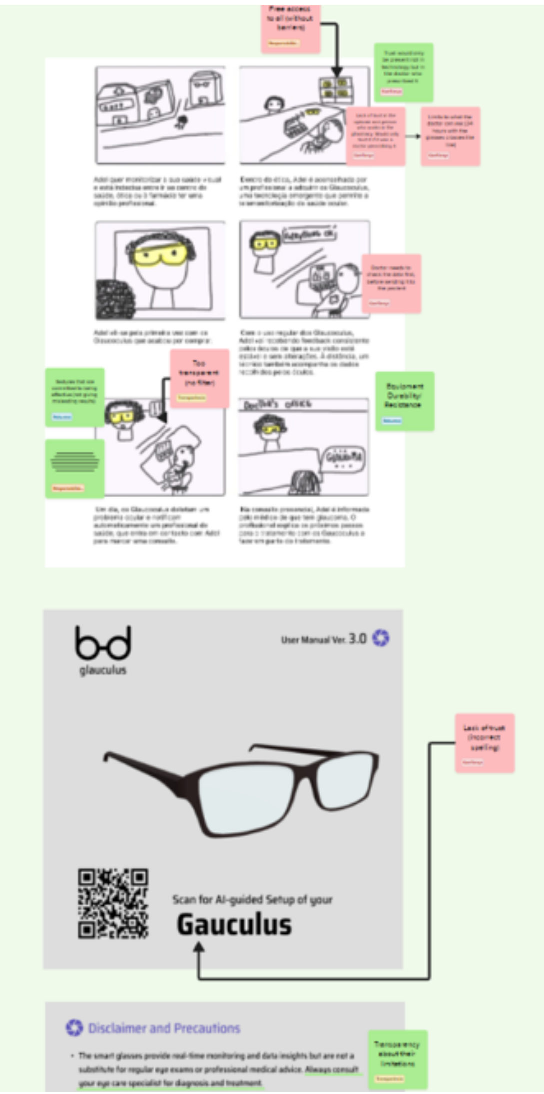
Transparency

- **Demonstrated in:**
  - The manual probe, which provided transparency about the technology's limitations.

  - Clear explanations on how the glasses should be properly positioned, along with the disclaimer: *"Always consult your eye care specialist for diagnosis and treatment."*
- **Not demonstrated in:** The storyboard segment where the doctor delivers an alarming warning without filtering the message, frightening the patient (*Too transparent, no filter*).

The group concluded that the relationship between values and the product is compromised by:

- **Excessive transparency without filtering** (causing distress).
- **Lack of consistent feedback** from the device.
- **Distrust due to lack of responsiveness** (requiring human intervention for reassurance).
- **Unrestricted access (*"Access to all"*)** without proper safeguards.



- The smart glasses provide real-time monitoring and data insights but are not a substitute for regular eye exams or professional medical advice. Always consult your eye care specialist for diagnosis and treatment.

The group also engaged in a critical angel/devil debate to examine the dual nature of the Glauculus wearable glasses. On the negative side, skeptics argued the technology addresses an infrequent need, since eye exams are rarely required, making the glasses seem unnecessary as a routine solution. Participants further emphasised technology's inherent limitations, noting it cannot fully function responsibly without human medical oversight, while raising concerns about ambiguous data interpretation and potential misuse.

In the other side, participants countered with several key benefits: the system could alleviate pressure on healthcare infrastructure by handling mild cases autonomously, while strict medical device regulations would ensure manufacturer accountability through rigorous approval processes. Advocates also stressed that collected health data's protected status as medical information prevents irresponsible destruction and guarantees adherence to standards.

2.2.2. Inclusion results

In this group, the values of inclusion, autonomy, empowerment, and ambiguity were selected for analysis, while integrity was not chosen. Participants identified moments in the storyboard and probe where these values were either represented or where there was a lack of representation, or even a misrepresentation, of them.

Inclusion

- **Not demonstrated in any form** for the group. Major usability issues with the wearable solution (screens, text, and technology) were highlighted as exclusionary.
    - The technology’s promotion of dependency on treatments and services was also deemed **non-inclusive**, particularly for those unwilling to adopt this lifestyle, further marginalizing them.

Autonomy

- **Demonstrated in:** Keeping the person informed to support decision-making.
- **Not demonstrated in:** The creation of dependency on technology for accessing information and services.

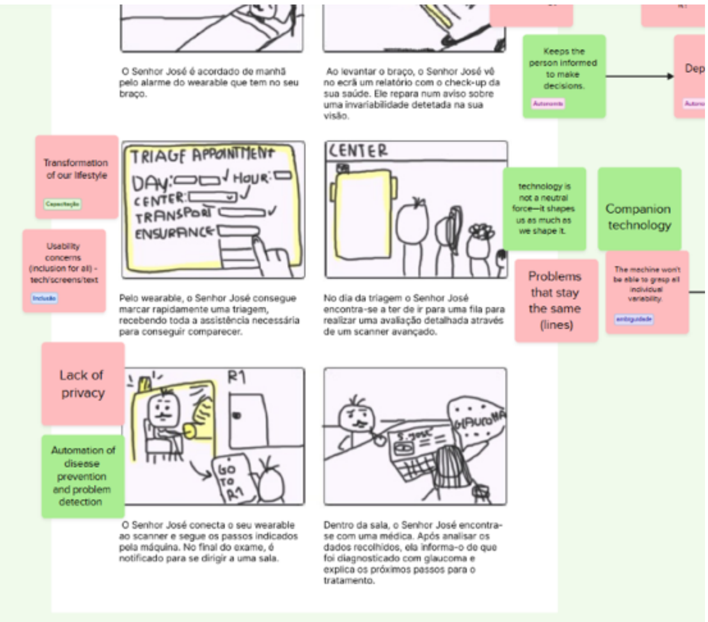
Empowerment

- **Demonstrated in:** Human agency, like having the information to decide whether to follow treatment, seek help or not.
- **Not demonstrated in:**
    - The transformation of lifestyle into constant monitoring, fostering reliance on technology.
    - The loss of real capacity and choice, as users become "hostages" to the system, with no option beyond signing an evasive informed consent.

Ambiguity

- **Not demonstrated in:** The statement *"The machine won't be able to grasp all individual variability"*—highlighted by the critique: *"We can’t all be lumped into the same category."*

The group concluded that this scenario represented a significant lack of control. One participant remarked, “This is too much for the situation at hand... It may detect things the person themselves wouldn’t want revealed... It’s unethical,” highlighting deep concerns around privacy, especially for individuals who might be forced to live under such a system. Despite these worries, it was also noted that “People will love this,” reflecting a broader societal trend toward increasing dependence on quantified self-tracking, where individuals turn to technological metrics for validation, motivation, and support in making decisions.



O Senhor José é acordado de manhã pelo alarme do wearable que tem no seu braço.

Ao levantar o braço, o Senhor José vê no ecrã um relatório com o check-up da sua saúde. Ele repara num aviso sobre uma invariabilidade detetada na sua visão.

Pelo wearable, o Senhor José consegue marcar rapidamente uma triagem, recebendo toda a assistência necessária para conseguir comparecer.

No dia da triagem o Senhor José encontra-se a ter de ir para uma fila para realizar uma avaliação detalhada através de um scanner avançado.

O Senhor José conecta o seu wearable ao scanner e segue os passos indicados pela máquina. No final do exame, é notificado para se dirigir a uma sala.

Dentro da sala, o Senhor José encontra-se com uma médica. Após analisar os dados recolhidos, ela informa-o de que foi diagnosticado com glaucoma e explica os próximos passos para o tratamento.

This group also engaged in a critical angel/devil debate to examine the dual nature of the wearable and scanner. Devil’s advocates argued that the system erodes human connection, painting a dystopian image of individuals standing isolated in long queues, interacting solely with machines, devoid of empathy or compassion. They raised serious concerns about over-monitoring, suggesting that constant surveillance would heighten stress, accelerate health decline, and represent an extreme invasion of privacy ("Soon it’ll be reading our thoughts"). On the other hand, angel’s advocates highlighted the technology’s potential to democratise healthcare, emphasising that by then, users would be well-informed about its transparent and voluntary use. They pointed benefits like Sr. José’s case: real-time health data enabling proactive care, immediate intervention, and a sense of empowerment over one’s well-being. Advocates also noted that human workers would still play a role (although a reduced one given the optimised systems), and that the technology would free people from time-consuming health management, allowing them to focus on their lives. The debate ultimately centered on weighing the promise of streamlined, data-driven care against the risks of dehumanization and excessive reliance on technology.

2.2.3. Humanisation results

In this group, the values of bias, humanisation, care, and explainability were selected for analysis (with one participant advocating for explainability to be included). The value of detachment was ultimately not used in the analysis. Participants identified moments in the storyboard and probe where these values were either represented or where there was a lack of representation, or even a misrepresentation, of them.

Explainability

- **Demonstrated in:**
    - The agent’s communication style with both the doctor (providing summaries) and the patient (adaptable/personalised explanations).
    - The option for users to seek additional information: *"The person has a small option to click if they want to know more—or they can ignore it and just follow the assistant’s guidance."*
    - Explanations as a follow-up reinforcement rather than direct answers to "why" questions.
- **Not demonstrated in:**
    - The agent’s silent actions taken on behalf of the patient without justification, *"If I were Dave, I’d want to understand why it’s telling me to get sunlight.".*

Humanisation

- **Demonstrated in:**
    - Human participation in decision-making, balancing autonomy and guidance.
    - Configurable system thresholds for intervention, tailored to user preferences and needs (e.g., adjusting levels of involvement).
    - The agent’s potential formats (invisible, visible, ghost-like, etc.) and adaptability for diverse users (e.g., people with dementia).
- **Not demonstrated in:**
    - Dave’s login experience, which overwhelmed him with personal metrics displayed on walls, potentially causing anxiety and control issues.
    - Lack of user agency *"Show more options. Show that the person has a voice, and must retain it, along with decision-making power."*

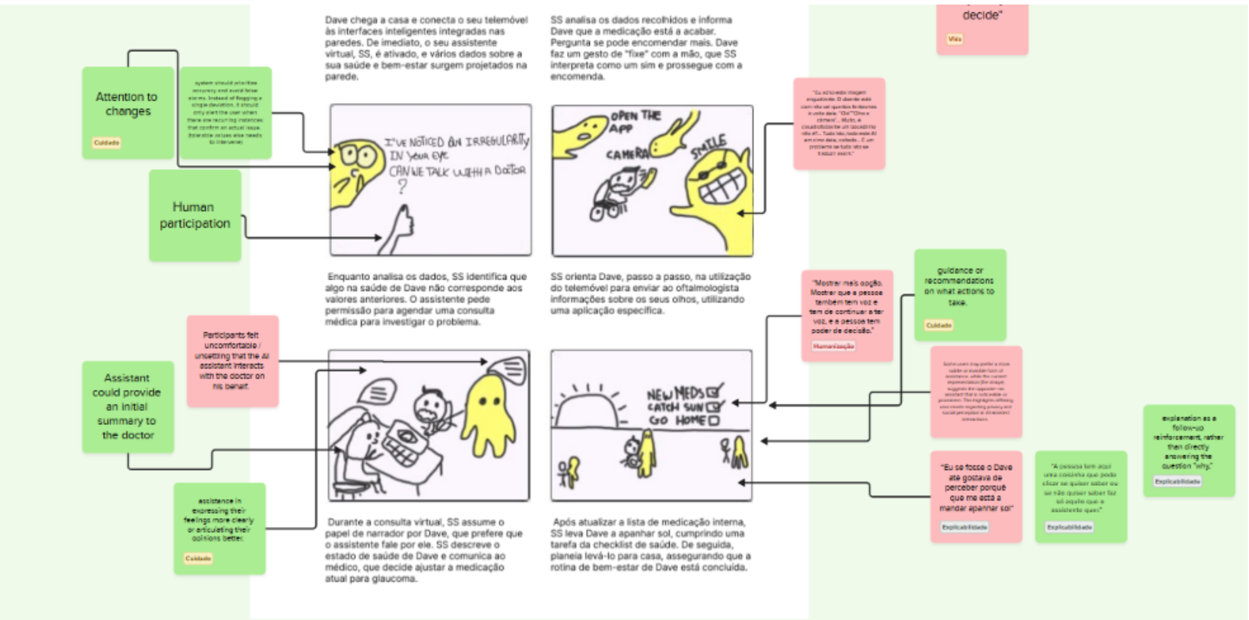
Care

- **Demonstrated in:**
    - Guidance/recommendations for actions and support doing these actions.
    - Health data awareness as a form of care: *"Creating awareness [of health data] can be caring."*
    - Linked to humanisation and personalisation (example: dementia adaptations and balanced autonomy-guidance dynamics).
- **Not demonstrated in:**
    - Ambiguous gestures in communication, which risked misunderstandings.

Bias

- **Observed in:**

- The decision-making hierarchy: *"The doctor must decide first during programming..."*
- Concerns about data generalisation and over-reliance on automation: *"It's always the machine deciding."*



Dave chega a casa e conecta o seu telemóvel às interfaces inteligentes integradas nas paredes. De imediato, o seu assistente virtual, SS, é ativado, e vários dados sobre a sua saúde e bem-estar surgem projetados na parede.

SS analisa os dados recolhidos e informa Dave que a medicação está a acabar. Pergunta se pode encomendar mais. Dave faz um gesto de "fixe" com a mão, que SS interpreta como um sim e prossegue com a encomenda.

Enquanto analisa os dados, SS identifica que algo na saúde de Dave não corresponde aos valores anteriores. O assistente pede permissão para agendar uma consulta médica para investigar o problema.

SS orienta Dave, passo a passo, na utilização do telemóvel para enviar ao oftalmologista informações sobre os seus olhos, utilizando uma aplicação especifica.

Durante a consulta virtual, SS assume o papel de narrador por Dave, que prefere que o assistente fale por ele. SS descreve o estado de saúde de Dave e comunica ao médico, que decide ajustar a medicação atual para glaucoma.

Após atualizar a lista de medicação interna, SS leva Dave a apanhar sol, cumprindo uma tarefa da checklist de saúde. De seguida, planeia levá-lo para casa, assegurando que a rotina de bem-estar de Dave está concluída.

Participants felt uncomfortable / unsetting that the AI assistant interacts with the doctor on his behalf.

Assistant could provide an initial summary to the doctor

assistance in expressing their feelings more clearly or articulating their opinions better.

"Mostrar mais opção. Mostrar que a pessoa também tem voz e tem de continuar a ter voz, e a pessoa tem poder de decisão."

guidance or recommendations on what actions to take.

"Eu se fosse o Dave até gostava de perceber porquê que me está a mandar apanhar sol"

"A pessoa tem aqui uma coisinha que pode clicar se quiser saber ou se não quiser saber faz só aquilo que o assistente quer."

explanation as a follow-up reinforcement, rather then directly answering the question "why."

This group also engaged in a critical angel/devil debate to examine the dual nature of the digital agent. Devil's advocates raised concerns about social inequalities in system parameterization. While users should control some settings (like data visibility and notification preferences), excessive physician control could enable harmful overreach ("doctors might dominate patients"). Data privacy emerged as a key worry, with questions about access ("if I die, who keeps accessing my data?"). Opponents also warned about the system's universal approach lacking personalisation, potentially creating hypervigilant users obsessively monitoring data to the point of developing psychological pathologies ("should they really have 24/7 access to all health metrics?"). In the other side, angel's advocates highlighted significant advantages such as the technology's ability to gather more comprehensive, faster and more secure health data than current methods. They cited examples like step-by-step patient guidance for medical tests, creating more interactive and user-friendly experiences compared to traditional manuals. This tension predicted while the system could offer unprecedented data collection and guidance capabilities, its implementation risks creating dependency, privacy violations, and psychological stress if not carefully balanced with human oversight and customisable parameters.

2.3. Emergent technologies proposed

Emergent healthcare technologies proposed by these three groups presents transformative benefits but also raise significant ethical and practical challenges. On the positive side, these innovations promise to reduce strain on healthcare systems by efficiently managing mild cases, empowering patients through greater access to their health data, and enable better monitoring for early interventions. Workforce optimisation and time savings are additional advantages, with streamlined processes allowing human workers to focus on complex cases while technology handles routine tasks. This proposed technologies also enhanced data collection methods offering faster and more comprehensive insights and improving patient-technology interactions (such as step-by-step exam guidance).

However, concerns were raised. Participants question the necessity of ubiquitous technology for infrequent medical needs, emphasising that devices like smart glasses may be superfluous for most users. The irreplaceable role of human doctors underscores technology's limitations in providing empathetic care, a deficit starkly illustrated by dystopian visions of patients isolated in queues, interacting solely with machines. It was also pointed in multiple groups the excessive monitoring risks exacerbating stress and privacy invasions, with some fearing surveillance could escalate to "mind-reading" levels. Social inequalities loom large, from unequal access to technology to posthumous data ownership dilemmas. Moreover, one-size-fits-all solutions may foster hypervigilance or psychological distress among users obsessed with constant health tracking.

AI's representation of the storyboards and technology was also a big discussion between all groups. While futuristic interfaces and visual technology and scenarios intrigued participants, many found them confusing or unsettling, citing information overload, blind trust in algorithms, and accessibility gaps for vulnerable groups like the elderly. Privacy breaches and displays of socioeconomic disparity, such as lavish health-tech setups contrasting with modest living conditions, highlight unresolved tensions between innovation and equity.

2.4. Values presence and meaning

2.4.1. Trust

What we learn from the first workshop is that Trust is a central value in the doctor-patient relationship and is strongly linked to empathy. For patients, a doctor's transparency and clarity are essential in building trust. When doctors explain well and convey confidence, it directly impacts their relationship with patients.

In the last workshop session, we found that:

- Trust is closely tied to the recommendation of a medical professional. Participants trust their doctor's advice but are skeptical of technology promoted by non-specialists (e.g., opticians, pharmacies).
- While participants trust their doctor to recommend using the device, they resist constant surveillance and reject excessive use.
- Trust also depends on transparency about limitations: they want to know when and where the technology might fail.
- Participants emphasise that technology alone cannot provide reassurance, as they need human confirmation. A lack of feedback from a doctor would make them doubtful over time.
- Human supervision remains essential; no matter how advanced the technology is, it requires oversight to maintain trust.

Represented in technology: Doctor prescribing it, having an understanding with doctor about the prescription

Not Represented in technology: Misspelling words, not explaining fully concepts important to use the technology (e.g. what is well-positioned?), Lack of response from technology (needs feedback - from a person preferably), doctor needs to check first data (not fully believe in AI).

2.4.2. Responsibility

From the first workshop we discover that Responsibility is seen broadly, covering different stakeholders: the patient is responsible for following medical guidance, the doctor for providing proper treatment and advice, and technology developers for creating transparent and risk-free solutions. Responsibility also implies ethics, empathy, and accuracy in medical practice.

In the last workshop session, we found that:

- Responsibility is linked to access and regulation. Participants believe there should be guidelines on who can use the technology (e.g., not suitable for children) to prevent misuse.
- Users have a duty to follow proper usage guidelines, respect alerts, and not silence warnings.
- Responsibility is shared. Users must follow instructions, but the company must ensure proper education and transparency about the tool's limitations.

Represented in technology: Technology must establish protocols to be followed: instructions, use, warnings.

Not Represented in technology: Free access to all.

2.4.3. Transparency

In the first workshop we learned that Transparency is not just about not hiding information but also about knowing how and when to communicate it. Clear medical explanations are essential for patients to trust and understand their situation. Additionally, technology should be transparent so that doctors and patients can assess whether it is functioning as expected. Patient transparency is also crucial since withholding information can compromise their own treatment.

In the last workshop session we found that:

- Transparency is valued, but it needs to be carefully managed. Participants appreciate clear explanations but recognise that too much raw information can be overwhelming or anxiety-inducing (some information should be carefully filtered to avoid unnecessary panic.).
- The way information is communicated matters. Not just in written form but also verbally, ensuring it is accessible and digestible.
- Transparency should help users make informed decisions without causing distress, striking a balance between openness and emotional sensitivity.

Represented in technology: Transparency about their limitations (Manual), How to proper use technology (position glasses)

Not Represented in technology: Warning when something wrong is detected and communicated (Without filter)

2.4.4. Robustness

In the first workshop session we learned that Robustness was understood as the ability of technology to adapt to different needs, anatomies, and conditions over time. It also involves recognising and communicating where technology is not robust. Additionally, human supervision remains crucial to validating the technology's results and ensuring its reliability.

In the last workshop session we found that:

- Robustness is about durability. Participants expect the device to last and function reliably over time.
- It also refers to accuracy and consistency. The technology must perform its intended function effectively, providing precise and reliable data.
- A truly robust system should be capable of detecting subtle changes in disease progression, without delivering incorrect results or inconsistent feedback.
- If the device stops providing clear, consistent feedback, its reliability is questioned.

Represented in technology: Technology durability/resistance, give accurate results

Not Represented in technology: Lack of consistent feedback

2.4.5. Empowerment

In the first workshop, Empowerment was about co-responsibility in managing one's health. Patients are encouraged to take an active role, such as following treatment instructions (like eye drops) and attending regular appointments. The technology should empower patients to feel responsible for their own care, with clear instructions and guidance to ensure they can manage the disease effectively.

In the last session we discovered that:

- Empowerment is seen as paradoxical: while technology can enhance autonomy and capacitation, excessive reliance may erode essential skills.
- Participants express concern that overuse of technology could negatively impact social, physical, and physiological well-being. (Some technological solutions may not truly improve quality of life.)

Represented in technology: Deliver of information

Concern in technology: Constant monitoring and reliance on technology (make us hostage to it, leading to a loss of capacity.)

2.4.6. Inclusion

In the first session, Inclusion focused on accessibility. If technology wasn't understandable or usable, it became a barrier, excluding those who struggle to engage with it. Participants pointed out that complex language and excessive technical jargon prevent certain groups from fully participating in the process, potentially leading to inequalities. True inclusion would mean ensuring technology is clear, simple, and available to everyone, regardless of literacy or technological literacy.

In the last session with participants it was discussed that:

- Inclusion is tied to accessibility. Participants highlight that if information is too complex, it becomes a barrier rather than a bridge.
- Poor usability and excessive technical jargon create inequalities, leaving some people unable to engage with or understand the system.
- A truly inclusive technology must consider real-world application, ensuring that all users: regardless of education or background: can interact with it meaningfully.

Represented in technology: In the form of tech/screens/text (needs to be adaptable to all)

Not Represented in technology: If we cannot do it without it (need to give multiple alternatives to access care)

2.4.7. Autonomy

According to the first workshop, for autonomy to be truly meaningful, technology must offer control without causing dependency. Patients should feel confident that they are using the technology correctly and that their decisions are not dictated by it. There is a desire for empowerment, where both the patient and the doctor are active agents in their use of technology, rather than being dependent on external technical assistance.

In the last workshop session we learned that:

- Information is a key driver of autonomy, allowing individuals to make informed decisions about their health.
- Participants recognise that technology can both empower and constrain autonomy, offering choice while also creating dependencies.
- The balance between guidance and control is crucial. If technology dictates rather than informs, it limits personal agency rather than enhancing it.

Represented in technology: Keeps the person informed to make decisions.

Concern in technology: Dependency

2.4.8. Ambiguity

Ambiguity was discussed in more detail in the last workshop were participants concluded that:

- Ambiguity arises when technology appears precise but fails to accommodate individual variability.
- Participants are skeptical of systems that present themselves as infallible, fearing that a one-size-fits-all approach could lead to misinterpretations or errors.
- Machines may struggle to capture nuances in human health, and overconfidence in automated systems could result in overlooking important individual differences.

Concern in technology: Same exact procedure to all

2.4.9. Explicability

Based on the first workshop discussions, explicability is based on the importance of healthcare professionals providing clear and understandable information to patients about their conditions and treatments. This not only builds trust but also helps patients better understand what is happening and why certain decisions are being made.

Explainability is seen as a tool to strengthen the doctor-patient relationship, especially in diagnostic and follow-up situations, such as with glaucoma, where there is a need to be sure the patient understands the risks and treatment.

From the last workshop, explicability for participants was based on:

- Explicability refers to the need for users to understand why certain actions or recommendations are made by the technology.
- The technology should not only provide instructions but also the reasoning behind them. For some, a simple "how-to" approach may suffice, while others prefer deeper explanations.
- Explicability can also serve as an educational tool, enhancing health literacy and empowering users to make informed decisions. However, there is a recognition that not all users want detailed explanations, and the technology should offer various levels of interaction depending on the user's preference.

Represented in technology: explanation as a follow-up reinforcement.

Concern in technology: Not communicating the reasoning behind it, if wanted.

2.4.10. Humanisation

According to the first workshop, technology in healthcare is seen as something that should respect the person in their entirety, considering their emotional history and individual needs. Humanisation goes beyond simple technical care, aiming to integrate in a way that not only addresses the pathology but also respects and considers the human experience.

Based on the last workshops participants concluded that:

- Humanisation in technology refers to making interactions feel more personal and less mechanical.
- Participants highlight the importance of showing empathy and acknowledging that not all individuals are the same. (Health advice should be personalised to reflect the unique health profile of each person.)
- Participants also express the importance of maintaining interpersonal relationships where necessary, recognising that some aspects of care, such as empathy and trust, are best conveyed by human interaction.
- Humanisation involves more than mimicking human behaviour. It's about making the system feel supportive and trustworthy, similar to the way humans interact with each other in healthcare settings.

Represented in technology: Show human-decision power, Personalisation and adaptation (level of technology intervention).

2.4.11. Care

Based on the first workshop, for autonomy to be truly meaningful, technology must offer control without causing dependency. Patients should feel confident that they are using the technology correctly and that their decisions are not dictated by it. There is a desire for empowerment, where both the patient and the doctor are active agents in their use of technology, rather than being dependent on external technical assistance.

On the last workshop it was discussed that:

- Care in this context is about technology's role in promoting well-being through awareness and guidance, without being intrusive like gently reminders about health actions, like sun exposure or eating habits, but they also stress the importance of respecting boundaries.
- Technology should not be overbearing but should serve as a reminder and a tool to enhance health awareness. Care is also reflected in how the system provides users with valuable information, creating consciousness about their health status and encouraging proactive behaviour.

Represented in technology: Guidance or recommendations on what actions to take. Assist user in expressing their feelings more clearly or articulating their opinions better. Technology being aware to changes. Create awareness.

Concern in technology: Dependency

2.4.12. Bias

According to participants in the first workshop, Bias is the concern regarding the interpretation and application of tests, such as glaucoma exams. Bias can manifest when the parameters and expectations for a patient are not adjusted to their real conditions, like in cases where patients change their behavior just to "pass" exams, or when there are limitations in how tests are designed for different population groups.

From the last workshop we learned that:

- Bias arises when technology makes generalized decisions that may not account for individual differences.
- Concerns about systems that make decisions for patients based on a one-size-fits-all approach. There is a need for systems to be tailored to individual medical needs, with decision-making customised by healthcare professionals.
- Bias can also be a concern when interpreting data. Participants stress that technology should interpret health metrics with sensitivity to individual baselines, not simply flagging changes without understanding the context.

Represented in technology: Doctors final decision

Concern in technology: Generalisation of shown data; Machine-decision overpower

2.4.13. Descentralisation

According to the first workshop, clinical decision-making and care shouldn't rely solely on a centralized healthcare management model.

Based on the last group discussion:

- Disengagement emphasises the importance of a balanced role for healthcare professionals in the management of patient data and interactions with technology.
- The technology should not be entirely autonomous; healthcare providers should be involved in the initial setup and programming of personalized health data parameters. This ensures that medical decisions are made by professionals who have access to the complete medical history and context. Once this foundation is laid, the technology can act as a supportive tool for ongoing monitoring.
- Disengagement stresses the importance of human oversight, maintaining a clear boundary between patient autonomy and professional control.

Concern in technology: Same exact procedure to all

2.5. Design Dilemmas

In the end of the participatory workshops and process, we noticed there were many tensions and dilemmas regarding some of the values. Participants were unable to reach an agreement towards some specific pairs of values. For instance, a participant said that patients should have agency all the time, and others said that sometimes the machine should be able to take the control to take care of that patient. Despite opinions diverge depending on the context and scenario, we noted these dilemmas and confronted participants with them, to see what would be their stance.

2.5.1. Dilemmas analysis

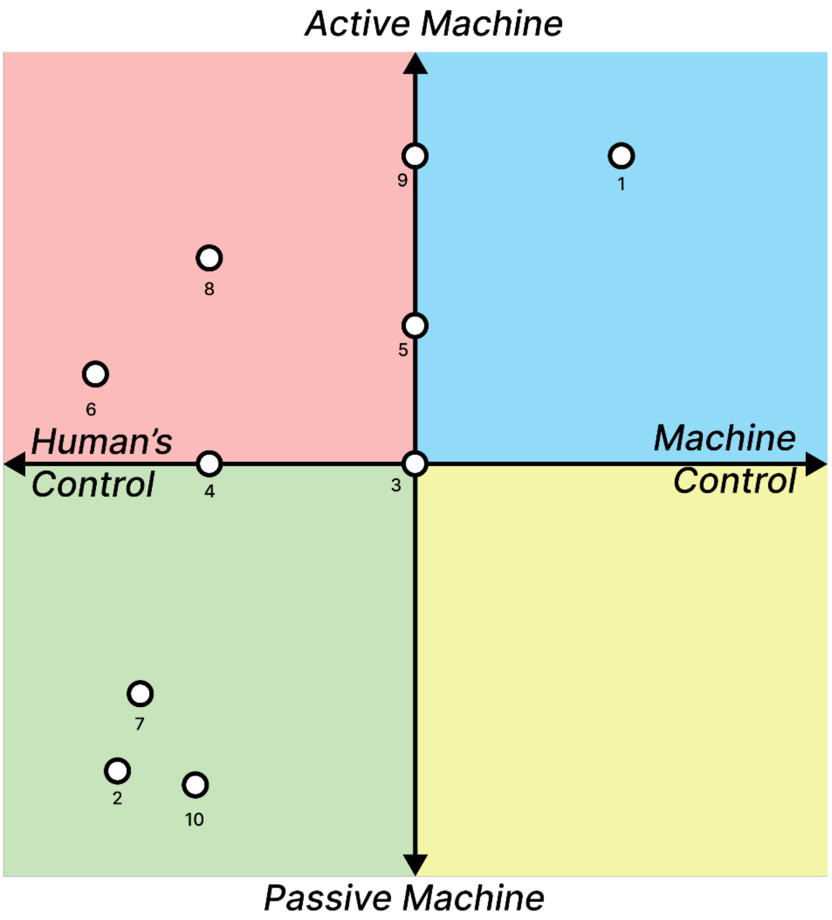
To evaluate the participants' responses, ...

1. Dilemma 1: Should we uphold the patient’s agency, preserving their autonomy to act upon the technology, or should we relinquish control to the technology, allowing it to act on the patient’s behalf, through a lens of care?

We used a two-dimensional map with the following axes:

Degree of Patient Autonomy (X-axis): Ranging from Full human control (left) to Full technology control (right).

Degree of Technology Role (Y-axis): Ranging from Technology as a passive tool (bottom) to Technology as an active decision-maker (top).



○ Participant
X-axis = Patient Autonomy
Y-axis = Role of Technology

Participant ID	Opinion
1	Prioritise technology but insists on patient explanation.
2	Advocates for human individuality; technology as a passive reminder.
3	Depends on use case and organization (no fixed position).
4	Patient agency with customization of technology.
5	50/50 balance, but only if tech is medically certified.
6	Prioritizes patient choice but allows some delegation.

7	Questions if the dilemma is real—people don’t want to lose control.
8	Patient autonomy with technology as guidance.
9	Coexistence; tech takes active role in technical decisions.
10	Patient autonomy must always be preserved.

Findings:

- Most participants (IDs 2, 4, 6, 7, 8, 10) lean toward human control, emphasising free will and fear of losing agency.
- Many (IDs 2, 7, 10) see technology as a passive aid (low on Y-axis), not an independent decision-maker.
- Some (IDs 1, 5, 9) accept greater tech involvement, but only if it’s certified, transparent, and well-explained.
- ID 9 argues that forcing compliance via technology is ineffective—behavioral change requires patient understanding.
- ID 7 suggests the dilemma may be artificial, as people inherently resist losing control.

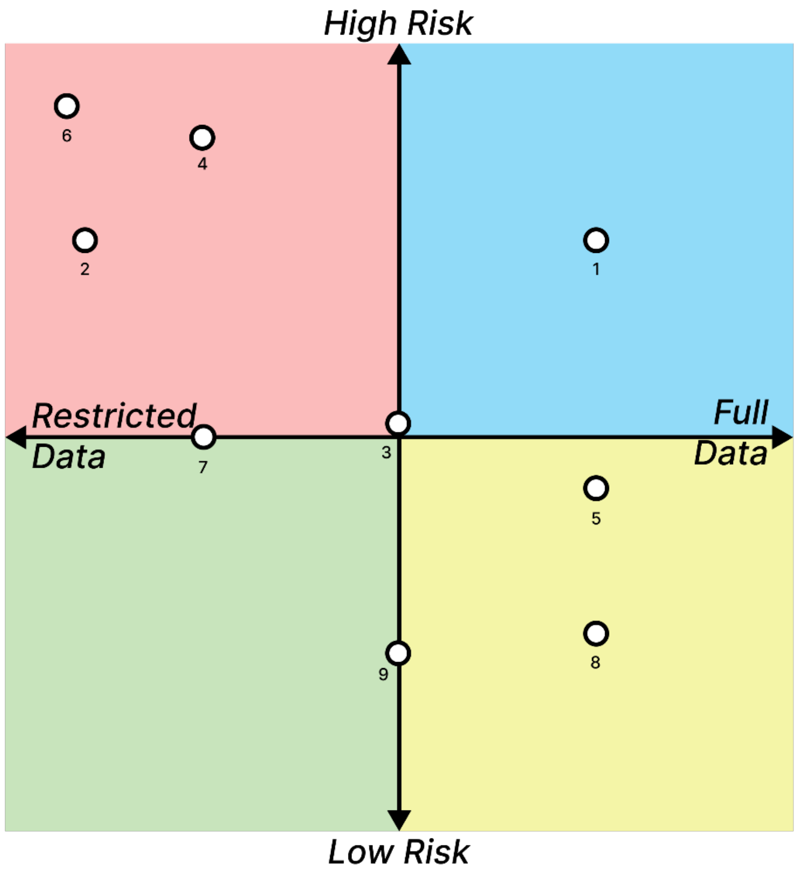
The responses reveal a preference for preserving patient agency, with technology playing a secondary, assistive role. According to participants, Trust in technology increases when it is: Transparent (explained to the patient), Customisable (allowing patient input), and Certified/reliable (e.g., as a medical device). There is also a strong resistance to full automation in healthcare decisions, reinforcing the idea that human judgment and autonomy remain paramount.

a. Dilemma 2: Should we design for complete access of health data, as a means for care and awareness, or do we risk creating a burden, fostering hypervigilance?

We used a two-dimensional map with the following axes:

Degree of Data Accessibility (X-axis): From Restricted access (left) to Full access (right).

Risk of Hypervigilance/Burden (Y-axis): From Low risk (bottom) to High risk (top).



X-axis = Data Accessibility
Y-axis = Hypervigilance Risk
○ ***Participant***

Participant ID	Opinion
1	Privacy is an ideal; hypervigilance can be user-chosen or harmful.
2	Access should be restricted to prevent misuse.
3	Dilemma isn’t unique to tech—MDs also struggle with disclosure.
4	Risk of burden; data should be filtered/explained (given example: "more info" buttons).
5	Hypervigilance isn’t wrong if data is well-presented.

6	Questions motives: Who benefits? Industry or patients?
7	Data should be given only when requested.
8	Advocate for ownership but with "healthy" design (gives example of layered access, like banking).
9	Tiered access (general, advanced, premium); Lets patients choose depth.

Findings:

- Most participants acknowledge data access is valuable but stress risks of misuse (IDs 2, 6) or overload (IDs 4). (IDs 4, 6) warn about anxiety triggers, especially with raw/unfiltered data.
- ID 8 and 9 propose balanced solutions: layered/tiered access to mitigate harm.
- ID 5 argues hypervigilance isn't inherently bad—poor data presentation is the real issue.

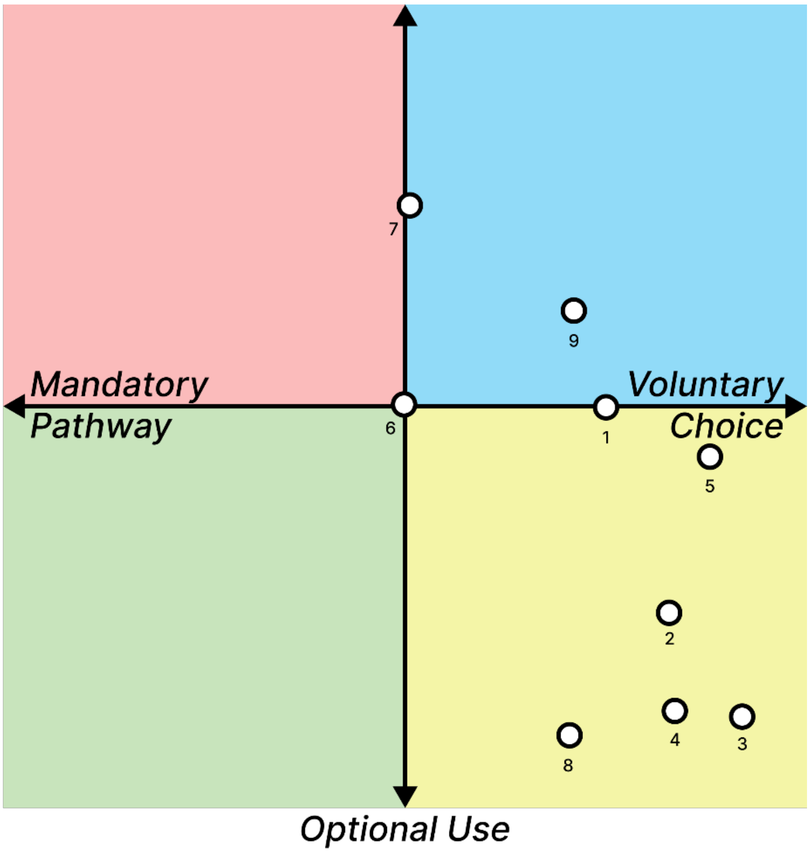
Perspectives are well-balanced between participants, with safeguards to prevent misuse/overload. Participants support patient ownership of data but emphasise thoughtful design to avoid harm. The banking analogy (ID 8) is a standout—progressive disclosure could balance transparency and well-being.

b. Dilemma 3: Should we preserve the patient's freedom, allowing them to choose whether to engage with technology, or should we cultivate a reliance on technology, viewing it as an essential pathway to care?

We used a two-dimensional map with the following axes:

Degree of Patient Freedom (X-axis): From Mandatory tech use (Left) to Full freedom (Right).

Perceived Necessity of Technology (Y-axis): From Tech is optional (Bottom) to Tech is essential (Top).



X-axis: Patient Freedom
Y-axis: Tech Necessity
○ ***Participant***

Participant ID	Opinion
1	Patients should choose but must understand risks/benefits.
2	Free choice must be prioritized as technologies may not suit everyone.
3	Questions the ethics of tech creators deciding patient freedom.
4	Against overreliance (practical issues) and forced adoption.
5	Patients should have opt-in/opt-out rights for tech-driven care.
6	Freedom has societal limits; blind tech reliance is risky.

7	Freedom should exist within tech mediation (not binary).
8	Individual freedom should prevail unless harming society. Long philosophical debate on tech's role in modern life.
9	Tiered tech involvement (patient selects alert thresholds).

Findings:

- Most participants (IDs 1, 2, 3, 4, 5, 8) lean right on the X-axis, emphasising freedom to reject technology.
- Notable exception: ID 7 argues for a middle ground where freedom is embedded in tech design (not an either/or choice).
- Few see tech as absolutely necessary (Y-axis stays popular in low/medium section).
- There were some ethical concerns about power dynamics mentioned: ID 3 critiques the dilemma's framing, warning against tech creators imposing choices. ID 8's also argues that freedom is sacred unless it harms collective well-being.
- ID 6 and ID 9 highlight context-dependent utility—e.g., tiered alerts (ID 9) or societal limits (ID 6).
- There was a dominant view on this dilemma: Freedom-first (right side of X-axis), with tech as a tool, not an obligation.

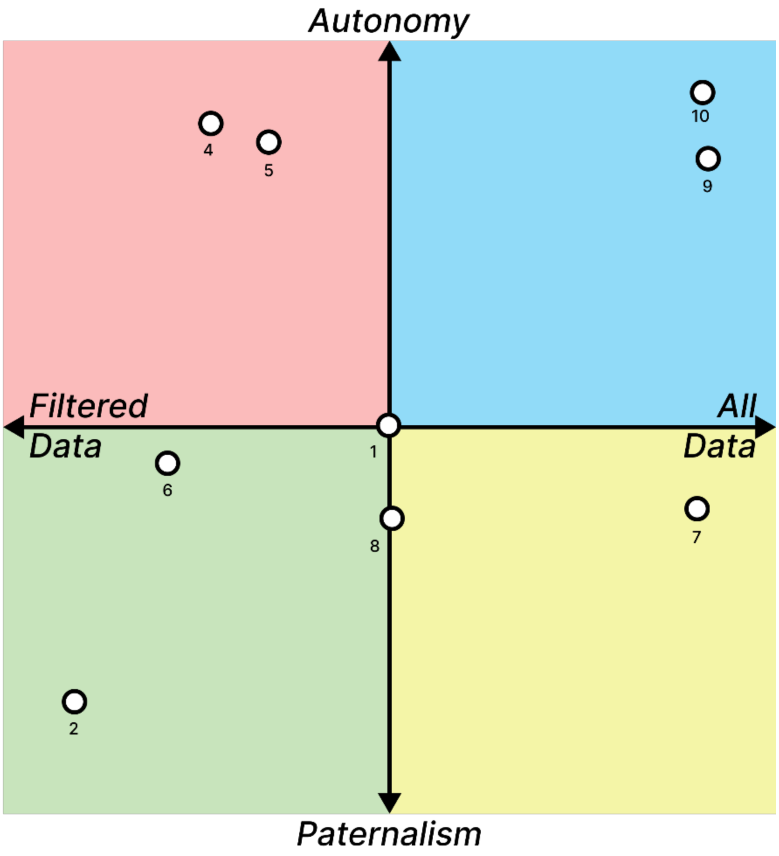
Participants overwhelmingly reject mandatory tech reliance but acknowledge its potential benefits if voluntary. Some solutions pointed include adjustable tech integration (ID 9), respect for cultural/practical barriers (ID 4) and patient's freedom to choose whether to use technology but fully informed about the consequences of their choice (ID 1).

c. Dilemma 4: Should we preserve the patient's freedom, allowing them to choose whether to engage with technology, or should we cultivate a reliance on technology, viewing it as an essential pathway to care?

We used a two-dimensional map with the following axes:

Degree of Transparency (X-axis): From Filtered data (Left) to Full data access (Right).

Approach to Patient Well-Being (Y-axis): From Protective paternalism (Bottom) to Autonomy (Top).



X-axis: Data Transparency
Y-axis: Well-Being Approach
○ *Participant*

Participant ID	Opinion
1	Tailor transparency to patient subjectivity (tech-assisted).
2	Filtering is essential to avoid anxiety; simplify messaging.
3	Confusion with another dilemma (excluded).
4	Filter by default but allowing full access upon request.
5	Tiered access; patients request deeper layers.
6	Shifted from full transparency to filtered + professional support.
7	Transparency requires mediators (experts, translators).

8	Layer data; default filtering but allow full access + guidance.
9	Truth must prevail; pair transparency with mental health support.
10	Full access to personal data, mirroring clinical practice.

Findings:

- Most participants (IDs 2,4, 5, 6) support default filtering.
- Extremes exposed: ID 2, 6 defend filter to avoid harm/protect, and ID 9,10 are defenders of truth at all costs (letting patients cope afterwards).
- Discussion of the critical role of mediation as transparency is useless without interpreters (ID 7), such as clinicians to help patients process data (ID 6, 9).
- Participants favor adaptive systems (layers/tiers), mediation to bridge understanding in transparency and ethical transparency (truth delivered with care, not omission).

Annex 4: Workshop planning and participants

Workshops Value Elicitation		
Workshop 1.1 - 18/10/2024	Workshop 1.2 - 23/10/2024	Workshop 1.3 - 24/10/2024
3 participants (Doctor, Designer, Philosopher)	4 participants (Doctor, Designer, Philosopher, Technologist)	4 participants (Doctor , Designer, Philosopher, Technologist)
Workshops Speculative Design		
Workshop 2.1	Workshop 2.2	Workshop 2.3
4 participants (Doctor, Designer, Philosopher, Technologist)	4 participants	3 participants
Workshops Prototype Assessment		
Workshop 3.1	Workshop 3.2	Workshop 3.3
4 participants	4 participants	4 participants

Annex 5: Workshop analysis