Trust, Transparency and Control Labs

Data transparency and control in XR and the metaverse

Early UX explorations with people in APAC

This report presents the key findings from a series of exploratory co-design workshops facilitated by the Trust, Transparency and Control Labs team at Meta in Singapore and South Korea.

Meta

In collaboration with

INFOCOMM MEDIA DEVELOPMENT AUTHORITY

pdpc PERSONAL DATA PROTECTION COMMISSION SINGAPORE

AIIS Artificial Intelligence Institute Seoul National University

CraigWalker

What you'll find in this report

Foreword

The metaverse is becoming more of a reality than ever. Advancements in immersive media and wearable technologies have made interactions and data flows between the physical and virtual realms increasingly ubiquitous. Underpinning these interactions are data-driven innovations that seek to build persistent, synchronous and highly personalized experiences for users, enabling new social and business collaborations and opportunities in the digital world.

As we delve deeper into the metaverse, it is essential to remember that data protection and privacy concerns become even more apparent as users interact with virtual environments and share more intimate body-based information in new ways. As international conversations on responsible data use in the metaverse progress, countries and international organizations have started to look into principles and guidelines to foster trust in the metaverse through data transparency and control.

The Infocomm Media Development Authority (IMDA) and Personal Data Protection Commission (PDPC) are excited to be partnering Meta in delving deep into exploring Data Transparency and Control in the Metaverse in the 4th season of our ongoing collaboration. The program this season is built on some of our existing foundational guidelines and principles on data transparency and control. For example, the PDPC's *Guide to Notification* illustrates good notification practices for organizations. As you scroll through the pages of this report, you will find prototypes and solutions that take concepts such as notice, dynamic consent and transparency — similar concepts found in our guide. *The Personal Data Protection Act (PDPA)* recognizes that there are times when companies may need to use personal data for legitimate and reasonable purposes to safeguard the interests of the individuals, such as monitoring their services to detect abusive conduct. At other times, personal data may need to be processed in order to enhance performance to improve the user experience. For such cases, businesses may explore leveraging the *PDPA*'s exceptions to consent, such as the Legitimate Interests Exception and Business Improvement Exception, to support their innovation and product development in the metaverse while protecting individuals' personal data.

A policy is only as good as its implementation. As such, we are excited to work with Meta and the startups in the Design Jams to translate key concepts of transparency and consent into the prototypes, design patterns and methodologies in this report.

This journey has been a rewarding experience for all of us — from startups, to design mentors and everyone else who has been part of this journey. We hope our practical, ground-up approach can be a positive contribution globally to the development of a responsible metaverse.

Mr. Yeong Zee Kin

Assistant Chief Executive
Deputy Commissioner

Personal Data Protection Commission

INFOCOMM MEDIA DEVELOPMENT AUTHORITY

pdpc PERSONAL DATA PROTECTION COMMISSION SINGAPORE

Foreword

As XR-based and related technologies continue to advance, our interactions with others and our surroundings will change, opening new economic opportunities and venues for individual and professional fulfillment. At the same time, these technological advancements will also raise concerns about our privacy and safety, which we must address.

While some may be eager for the arrival of a mature metaverse, this will require additional and sustained investment in infrastructure, content, devices and experience. Rather than being discouraged, we should take this opportunity to consider what we want as a society when it comes to privacy and safety in the metaverse, and how industry and government can meet those expectations. Recent calls for a moratorium on emerging technologies, while debatable, nevertheless highlight the need for collective reflection on the use of new technologies, including those related to the metaverse. We still have the chance to build the metaverse in a way that respects expectations of privacy and control over personal data, and this report provides insights to achieve such an outcome. I would like to commend the Trust, Transparency and Control Labs team at Meta for their initiative in organizing these insightful Design Jams and express my gratitude towards the participants from Singapore and Korea who invested their valuable time and effort to think about these issues and come up with innovative solutions.

I hope that this report will inspire discourse that contributes to the development of technology and governance structures that protect our privacy and safety in the metaverse. This is essential to ensure that we fully leverage the potential of XR technology while safeguarding our integrity and wellbeing. The Artificial Intelligence Institute (AIIS) at Seoul National University (SNU) will continue to build on this momentum through its collaboration with Meta on the XR Hub-Korea initiative. Our hope is that XR Hub-Korea provides a space where stakeholders in the APAC region can come together to share their perspectives and ideas on building the metaverse and serves as a catalyst for continued collaborative efforts to build a safe and enjoyable XR experience for all.

Prof. Yong Lim

Director, SNU AI Policy Initiative
Affiliated Faculty, Artificial Intelligence Institute
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Foreword

Immersive XR technologies have the potential to transform the way we interact with technology and with each other, creating a more human-centered, inclusive and accessible interface between people and the digital experiences that are ever-more integrated into our lives. Based on insights from our programs of early UX exploration with people in APAC, this report provides a forward-looking view of the key design considerations and opportunities for data transparency and control in XR and the metaverse. Through this exploration, it highlights the critical role and opportunity for co-design and collaboration, bringing together the perspectives of regulators, industry experts and end users to ensure that as we build out these experiences, they are fluid, effective and user-friendly.

Reflecting the need for new methods to help us design for the opportunities and challenges of user experience in XR, the Trust, Transparency and Control Labs team and our partners piloted a new set of tools, the XR prototyping kit and the XR prototyping zone for this program. These new tools allow participants to move from 2D user interface sketches and storyboards to prototyping in three dimensions in the real world, and encourage them to capitalize upon the immersive nature of XR technologies to generate unique means of explaining data use and controls.

The range of insights, the creativity of the prototypes and the sheer breadth of knowledge generated from this year's program gave a clear sign of the potential of these technologies, as well as how much will continue to evolve in the coming years. While there are many questions about how data will be used and shared as these technologies develop, our experience through this process suggests that existing legal and regulatory frameworks provide a robust privacy foundation to support the development of a wide range of possible applications for immersive tech. Through collaboration and a flexible approach, we can at once ensure that XR product makers are using data responsibly, building upon the best UX privacy practices learned through the mobile era, as well as encourage this new and exciting ecosystem to flourish.

We would like to extend our sincere gratitude to our partners at SNU and the PDPC for their valuable contributions and ongoing support for this initiative. Both institutions continue to demonstrate global leadership in their embrace of collaborative design and policy prototyping methodologies, and their expertise has been instrumental in shaping this program of work.

Co-design encourages us to bring empathy to the exchange of ideas, knowledge and best practices, leading to better outcomes and more impactful results. It facilitates a holistic approach to emerging technologies where iterative and open attitudes produce the best outcomes. In today's rapidly evolving technological landscape, co-design and collaboration are key tools for all organizations — building together can help ensure that new technology is designed in a way which aligns with the best interests of people and, in doing so, realizes its fullest potential.

Dr. Dan Hayden

Director of Data Strategy, Meta
Co-lead of Trust, Transparency & Control Labs

Meta

1 Introduction

Getting clear on terminology

Metaverse

The metaverse is an evolving set of interconnected digital spaces, including immersive 3D experiences, facilitated by XR devices, platforms, and products and services.

Augmented reality (AR)

Augmented reality is the real-time use of information in the form of text, graphics, audio and other virtual enhancements integrated with real-world objects.

Virtual reality (VR)

Virtual reality is a digitally rendered 3D environment that people can interact with in ways which either closely or loosely approximate the physical world, depending on the application.

Extended reality (XR)

Extended reality is a catch-all term to refer to augmented reality and virtual reality, and is used interchangeably with 'immersive technology'.

User experience (UX)

User experience is how a person interacts with and experiences a product, system or service.

Human-computer interaction (HCI)

Human-computer interaction refers to the study of the design and use of computer technology by humans.

Interaction design (IxD)

Interaction design is the practice of designing the services, systems and products — both digital and physical — with which humans interact.

Why data transparency in XR and the metaverse?

> For decades, experts in industry and academia have been developing augmented, virtual and mixed reality technologies with the goal of enabling powerful experiences that can enhance human connection, learning and productivity.

With investment in this space increasing in recent years, we are now at a point where these technologies are transitioning out of the lab and into the hands of consumers at scale. Already, devices with capabilities in augmented reality (AR) and virtual reality (VR) — together known as extended reality (XR) — are delivering immersive and engaging experiences for people in their homes, communities and workplaces. These developments point to a near future in which XR technologies will be affordable, accessible for all and available in a range of form factors. Like most of the technology that has become commonplace in our lives in the past 20 years, these technologies rely on data and inputs from users and the natural environment to function.

These technologies will also underpin the metaverse[1], so asking questions about the use of data and how consumers can be empowered with meaningful control over their data is timely and will equip us well for the future.

> The metaverse will be unlimited by physical geography — a place where people from all walks of life will experience education, entertainment, work and social interaction together with a real feeling of social presence.

And it is an exciting future, presenting a range of new opportunities. However, as we think about the broader adoption of XR and onwards to the creation of the metaverse, it is crucial for device and app makers to continue to think about — and design for — responsible data use. Digital privacy is a headline priority for people, and it is incumbent on product and policymakers to ensure that people understand that these new technologies will run on various types of data that are not generally required for two-dimensional web and mobile-based applications. In particular, to realistically render a person's form and location within three-dimensional virtual space, XR systems will need to collect spatial information, as well as data about the physical characteristics and movements of the person using the device.

Data about the dimensions of our bodies, our gestures and our voices could be utilized in order to allow for a compelling feeling of presence in these digital spaces — whether we want our avatars to be true likenesses of ourselves, or more creative and non-naturalistic. It is important for people to understand how these data types will be collected and safely processed, as well as the ways they can control and access their data. It is likewise crucial that product makers ensure they are employing the best privacy practices in their products.

[1] You will find various definitions of the metaverse in academia and popular culture. Meta defines it as: 'A set of digital spaces, including immersive 3D experiences, that are interconnected'. The defining quality of the metaverse will be a feeling of presence — like you are right there with another person or in another place.

In terms of user experience (UX) and content strategy, many of the paradigms we held in the age of 2D mobile applications may need to be expanded and adapted for three-dimensional interactions. We are now on the journey of reimagining how humans interact with computers as something much more fluid and immersive.

Industry, in partnership with civil society and policymakers, must explore the central question: 'How might we build trust in XR products and the metaverse, and what role do data transparency and control play in this?'

- In what ways are people naturally interacting with — and in — 3D environments?
- How might we harness the opportunities for transparency and control presented by these 3D interactions to help people understand how data is being processed to power them?
- Are there country-specific or regional differences in how people will interact with 3D spaces and experiences?

With these questions in mind, this report presents Meta's first attempts at applying co-design methodology to XR prototyping, sharing what we have learned from collaborative work in this space and how people are thinking about data use and privacy in XR. We hope that the work will inspire others with practical tools and frameworks for ensuring people are at the heart of the product design process for XR.

Specifically, the Privacy and Data Policy and local country policy teams at Meta ran two unique co-design programs in Singapore and South Korea aimed at gathering foundational knowledge about how people might interact with and understand these emerging technologies. These programs looked specifically at the type of data collection that might power future XR experiences, as well as how we might leverage XR's novel capabilities to enhance people's agency through transparency and accessible controls.

The first program, Data Transparency and Control in the Metaverse, was the fourth season of an ongoing collaboration between Meta and the Singapore Infocomm Media Development Authority (IMDA) and Personal Data Protection Commission (PDPC). We were honored that the IMDA and PDPC partnered with us for another year, for what proved to be a fascinating deep dive into co-designing novel 3D experiences and optimizing them for transparency and informed consent.

As in previous years, we worked with a cohort of digital companies based in the Asia-Pacific region (APAC) to workshop and co-design digital transparency ideas alongside technology and privacy experts from academia, society and industry. The majority of co-design work was completed across two full-day Design Jams in Singapore where we gathered perspectives from participants and co-designed potential UX solutions to privacy questions formulated by the participating companies. We cannot thank these companies enough for the energy and commitment they gave to the program — generously bringing their product ideas and offering valuable questions and perspectives as inputs. All of the companies in the program are currently developing XR experiences or planning to offer services in the metaverse in the near future. They were all keen to learn from their peers and help shape best practices in privacy and UX. You can find their details in **Appendix B**.

An area of particular interest for all developers of XR technology as we move forward is the use of data generated from the human body to power enhanced immersive experiences. This includes data types such as voice and vital signs, as well as physical movements. As XR and metaverse experiences become more commonplace, there is a growing need to help people understand how these data types are being used, as well as offering them meaningful and intuitive control over these data.

We were fortunate enough to be able to explore data controls more deeply with the support of our partners at the Artificial Intelligence Institute (AIIS) at Seoul National University (SNU) via a day-long Design Jam with students and lecturers. In parallel with our work in Singapore, we ran this Design Jam at SNU to learn more about how people currently understand XR and what type of data controls they would like to be able to access in a series of hypothetical XR experiences focused on entertainment, retail, education and travel. This effort is part of the larger XR Hub-Korea Program. The aims of this program are to support the responsible development of XR technologies and the metaverse by:

- Generating policy research and insights
- Encouraging and supporting responsible product development
- Creating a global network of XR policy researchers
- Sharing research and best practices between industry, government and academia.

These two programs were motivated by the desire to discover insights that can help product and policymakers create people-centered approaches to designing XR experiences and the metaverse. Both programs produced insights, design patterns and tools that support this objective — and we are excited to present these outputs together in this report. We hope these early explorations will be a useful starting point for product makers and policymakers across the globe in exploring the role of transparency and control in building trust in XR and a people- and privacy-focused foundation for the metaverse.

Why Singapore and South Korea?

The Asia-Pacific region (APAC) has long been acknowledged as dynamic and world-leading when it comes to the development and adoption of new technologies. XR is no different.

Singapore has established itself as a hub for innovation and research and development, providing companies from around the world a robust platform for growing their businesses and products in the region and beyond. Singapore's success in fostering innovation can partly be attributed to its strong commitment to research and development, driven by support from the government and its partnerships with the private sector.

Our partner, the IMDA, supports a complementary approach — policy prototyping — which has the objective of promoting the responsible use of data and supporting businesses' data innovation while building consumer trust. The IMDA works closely with industry, supporting companies through policy prototyping and data regulatory sandboxes. Meta is now in its fourth year of collaboration with IMDA in these endeavours.

This approach is in line with what the IMDA aims to achieve: to deepen regulatory capabilities for a converged infocomm media sector that safeguards the interests of consumers and fosters pro-enterprise regulations. The IMDA also supports data protection and innovation in Singapore through its Personal Data Protection Commission (PDPC), boosting public confidence in how personal data is used in the private sector.

This approach shows the Singaporean government's commitment to both data protection and innovation and is reflected in government policies and programs. We are honored to be partnering with them on these early explorations into data transparency for the metaverse as a continuation of our long-standing collaboration to support data innovation and responsibility.

South Korea has a flourishing domestic VR industry ecosystem and a government that is supportive of developing the metaverse. The South Korean government has developed an ambitious 58.2 trillion-won (US$44.6 billion) plan to transform its economy and embrace new technologies, called the 'Digital New Deal'. Part of this investment package includes 223.7 billion won (US$171.6 million) earmarked to help South Korea become ranked fifth among the most metaverse-adopted countries in the world by 2026 — up from its current place at number 12.

The country's Ministry of Science and ICT announced a pan-governmental strategic blueprint to lead industry in responding to the economic and social changes that will be brought by the metaverse and prepare for the future. South Korea laid out four major goals:

- Activating the ecosystem for metaverse platforms
- Nurturing professionals
- Fostering companies
- Setting up a safe environment for all metaverse users.

In September 2022, South Korea's National Data Policy Committee announced that it would develop regulatory amendments specific to the metaverse, and in November, the Ministry of Science and ICT released a new set of non-binding ethics guidelines for metaverse services.

The South Korean government aims to nurture 40,000 professionals and 220 companies specialized in metaverse technology to achieve its goal of becoming the fifth largest country in the global metaverse market by 2026. In this, the government is preparing not just for metaverse technologies and industry development, but also the development of ethical and regulatory frameworks, and is being rightly applauded for this proactive work, providing clarity for both technology users and developers.

Co-designing the metaverse and thought leadership in Asia

> The innovation and technology policies of the Singaporean and South Korean governments make these countries ideal locations in which to engage in product and policy research, including the co-design of people-centered user interfaces and policies.

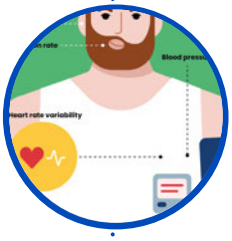
While industry is still in the early stages of defining XR technologies and what the metaverse will be, it is useful to begin the discussions around how we will use these technologies in our daily lives now. This includes consideration of the ways the economic and social opportunities they provide can be fully harnessed at the same time as we develop ever-improved methods of protecting people's privacy.

Co-design is the practice of bringing together people from different backgrounds and disciplines who do not normally work together to explore questions in depth and collaboratively design new ideas and solutions as a group. The Trust, Transparency and Control Labs team at Meta has been leading digital co-design efforts with government, academia and civil society around the globe for over six years. During this time, Trust, Transparency and Control Labs have produced UX insights and design guides published as publicly available reports on important topics such as notification, consent and disclosure in digital services and people-centric AI explainability, as well as ways of working with teens and guardians to develop appropriate online supervision mechanisms.

By working with experts and product users we can better understand the challenges and opportunities in any given problem space, and harness the empathy and creativity that emerges in group situations to design new ways of interacting with technology. When we apply this collaborative and empathetic approach to designing new privacy pathways for the metaverse, the possibilities are endless, as you will see from the XR design patterns that have been developed through this work (see the **Co-Design Findings** section of this report).

Through co-design efforts such as those demonstrated in these programs, Singapore and South Korea are indicating their respective commitment to an inclusive and people-centric metaverse, leading the way for other countries to adopt and build upon these methods.

The scope of human-computer interaction in this report



The metaverse is the next evolution in social technology and the successor to the mobile internet.

From telegrams and early faxes replicating the written word to the transmission of speech and conversation via telephone, radio and video, the history of communication technology is one of ever greater connection over distance.

As effective as these technologies are at transmitting words and concepts, they do not create a sense of physical connection and presence between the people communicating. The metaverse will be the next phase in this journey — eliminating the feeling of distance and creating a sense of 'togetherness', wherever people are in the world.

The technologies that will underpin the metaverse are in large part already in existence. In terms of technology, this report considers the interfaces through which people will experience the metaverse, rather than the underlying hardware and software infrastructure we will use to access and create the metaverse. We are primarily interested in finding out how people will interact with — and in — the metaverse, and what that means for product and policymakers who want to ensure that individuals are well-informed and in control of their data and digital activities.

To that end, we were focused in these programs on experiences that may possibly be accessed through wearable AR-enabled and VR devices in the future. Within the scope of this exploratory work, we have prioritized consideration of particular types of data that could hypothetically be collected:

- Facial data, including eye movement data
- Vitals data
- Neural or EMG data
- Voice data
- Movement and limb-tracking data.

We have focused on these data types because they are most likely to be utilized by a broad range of product developers in near to midterm devices. In the case of some of these types, such as voice and vitals data, some people will be familiar with their collection and use in voice-activated virtual assistant technologies and health-trackers. Data types such as movement tracking will be less familiar. However, the scale and nature of their use may change in the metaverse given the new use cases that are appearing in education, entertainment, healthcare, gaming and other areas.

You can find more information about how we have defined these data types for the purposes of the programs in Singapore and South Korea in **Appendix A**. Please note these working definitions are not intended to be comprehensive, nor do they represent the only way to classify and describe the kinds of data that are likely to be collected and processed by XR devices to render immersive experiences.

2
Approach and methodology

What is co-design and how is it relevant to policymaking?

Co-design is a collaborative practice that encourages diverse stakeholders to work together to develop product, service or policy solutions.

Co-design represents a spectrum of participatory research approaches for engaging with multiple stakeholders — from the people who will use a product or service to policymakers, civil society groups, academics and product makers. The aim is to draw on a range of perspectives to inform and guide the design process. As a research methodology, co-design is founded on three principles: action, inclusivity and transparency.

As the metaverse grows and evolves, important questions around data use, transparency and control are starting to emerge. One meaningful way to address these questions and develop best practice is through collaboration, ensuring that we collectively incorporate multiple viewpoints and design the metaverse inclusively.

For our projects in Singapore and South Korea, the Trust, Transparency and Control Labs team brought together digital companies, policymakers and representatives from academia and civil society to deep-dive into theoretical scenarios and real-world products. In collaborative workshops known as 'Design Jams', participants brainstormed and co-designed a series of experimental data notification and consent concepts for XR and metaverse products and immersive experiences.

Based on learnings from across the globe, we adapted our co-creation approach to reflect the respective focuses of our work in Singapore and South Korea, accounting for key cultural and regional differences as well as the specific participants in each program.

What is a design jam?

Design Jams are interactive co-design workshops.

They are output-oriented sessions that bring together diverse experts to co-design innovative solutions to data privacy challenges. In a Trust, Transparency and Control Labs Design Jam, multidisciplinary teams work to generate potential solutions to challenges or realize opportunities by focusing on the experience of people using the product.

Through hands-on rapid product prototyping, these interactive and fast-paced workshops use the design thinking method to enable people to quickly gather perspectives on a problem and suggest thought-provoking solutions over the course of a single day. Working towards the creation of a UX prototype helps the teams work through even very detailed aspects of the problem they are trying to solve, encouraging them to move from the abstract and theoretical into the actual experience of using the product through the process of physical making. The prototypes these teams develop can be based on real digital products and services or fictional scenarios standing in for real situations.

Design Jams create an environment that fosters collaboration between different stakeholders and encompasses diverse perspectives. No single person has all the answers, and these sessions provide a valuable opportunity to experiment in a judgment-free way: sketching, storyboarding, wireframing, bodystorming, scripting, acting and designing are all part of the process.

The outcome of a Trust, Transparency and Control Labs Design Jam is a set of design patterns and prototypes that seek to foster increased trust in digital products through designs which could provide people with meaningful transparency and control.

We use Design Jams to:

- Help product makers and policymakers take a people-centric approach to data privacy challenges and co-create innovative UX solutions
- Innovate upon and prototype data privacy policies in collaboration with product makers and people to make them more user-friendly
- Validate and refine design guidance or policy with product makers
- Provide policymakers with an understanding of the challenges that policy changes may create for industry, together with the opportunity to develop and test solutions to these challenges
- Understand how product makers are approaching particular privacy challenges
- Create frameworks and toolkits for industry and policymakers, including design patterns for user interfaces and interactions

Over the last 5 years, the Trust, Transparency and Control Labs team has used Design Jams to explore people-centric approaches to:

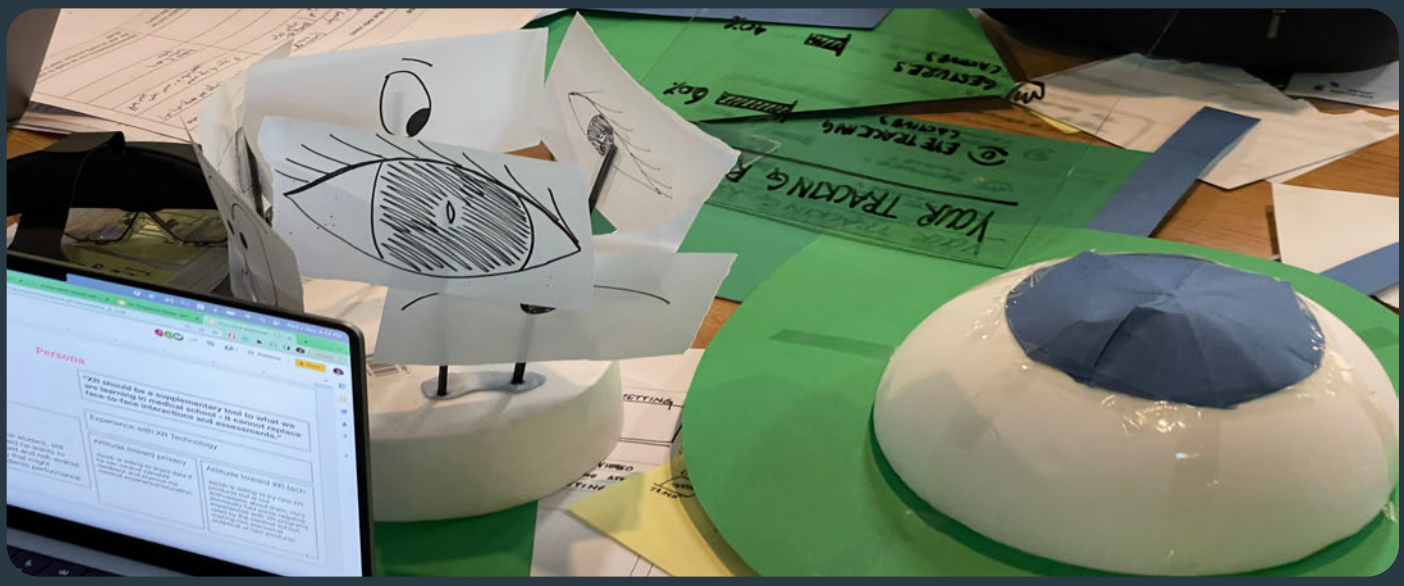
- Notice, consent and disclosure
- Designing with and for young people
- AI explainability and algorithmic transparency

Prototyping for XR

The particular qualities of metaverse experiences — depth and perspective, real-time interactions, multiple users — demand a new approach to prototyping.

Where previous Design Jams have focused on screen-based user interfaces (UIs) and two-dimensional UX, the Singapore and South Korea workshops required a methodology that would allow participants to design and prototype in three dimensions.

To facilitate this, we developed the XR prototyping kit and XR prototyping zone. These tools enabled the participants of both projects to bring their sketches and storyboards to life. Using props, scripts, bodystorming techniques and phone cameras, teams were able to develop and document embodied and immersive XR prototypes.



XR prototyping kit

To represent different interface elements and XR interactions, teams utilized and adapted a range of objects and materials, from cardboard and clear perspex to goggles, polystyrene shapes and a three-meter weather balloon.

The purpose of this kit is to enable Design Jam participants to move beyond a screen-based approach and think in three dimensions.

XR prototyping zone

The groups then used items from the XR prototyping kit to bodystorm their solutions in the XR prototyping zone marked out on the floor.

Each team used this space to stage and refine their transparency and control solutions, showing how people would interact with different interface elements and navigate their privacy concerns.

XR prototypes

The primary outputs of both the Singapore and South Korea Design Jams were the XR prototypes developed by the respective teams.

To bring these prototypes to life, each team made a video that detailed their specific solution and the interface designs they developed.

Find further guidance on XR prototyping and building your own **XR prototyping kit** in Appendix A

Singapore

Approach to data transparency and control in the metaverse

The focus of our Singapore program was a group of metaverse products and services offered by a cohort of APAC-based digital companies.

We worked with these companies to identify use cases based on the types of services they would potentially want to offer in the metaverse in the future, then to develop design challenges around these use cases. We also worked with them to create personas — fictional representations of people based on their users — to ensure the design process remained focused on people's needs.

Across two full-day Design Jams, these companies workshopped and co-designed privacy solutions to these challenges in collaboration with external privacy experts from academia, government and industry.

Following the theme of data transparency and control in the metaverse, the goal of these workshops was to explore how current best practices in data transparency might apply in XR experiences. Central to this was understanding where the unique aspects of the metaverse experience might offer new techniques and methods for giving people control over their data and empowering them to make informed decisions.

Singapore

Tools and methodologies

We used a range of exercises, methodologies and tools in the Singapore Design Jams to help participants engage with their design challenges.

Singapore

Input > use > value template

What it is

A simple model for articulating data inputs and their uses, allowing product makers to identify and explain the value that particular inputs create for people using a product — as distinct from the value they derive as the product maker.

How it was used

This template helped participating companies clarify and rationalize the data required in their product use cases and design challenges. It promoted data minimization as well as transparency around the use of people's data and the benefits to them arising from this use.

Template with example data input

	Input	Use	Value to user	Value to product maker	Alternative inputs
EXPLANATION	What is the data input?	How is the data used?	What value does it give to the person sharing that data?	What value does it provide to the product maker?	Are there any alternative inputs that could be used instead?
EXAMPLE	*Eye-tracking is the input.*	*Eye-tracking is used to infer items of interest to the user.*	*Recommendations are tailored to the user's interest.*	*Increased user engagement with product.*	*Like button to assess interest.*

For more detail on the **Input > Use > Value Template** and how it was used in the Design Jams, see **Appendix A**

Singapore

User journey of consent

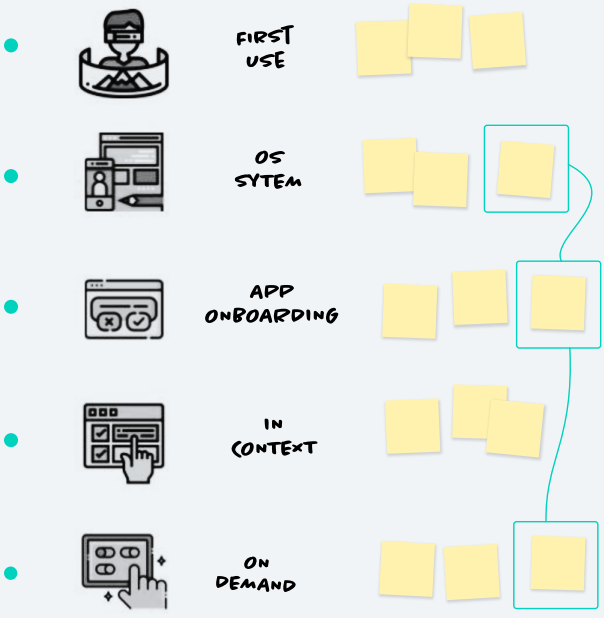
What it is

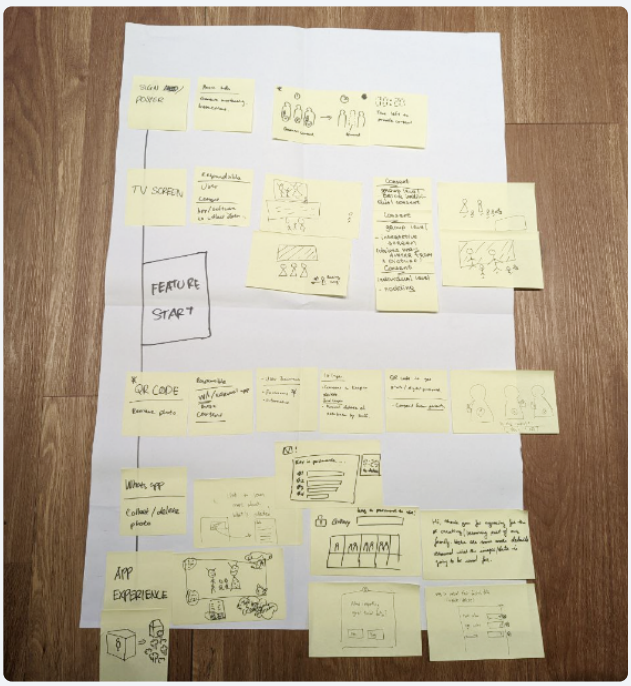
Extending the typical model of upfront, in-context and on-demand interactions, this expanded User Journey of Consent exercise helps people map permissions to specific stages within a user's experience, including device and system-level touchpoints.

How it was used

The User Journey of Consent exercise encouraged participants to consider the broader consent ecosystem in determining when to request permissions for different data types and identifying specific moments to prototype in their solutions.

The User Journey of Consent in practice





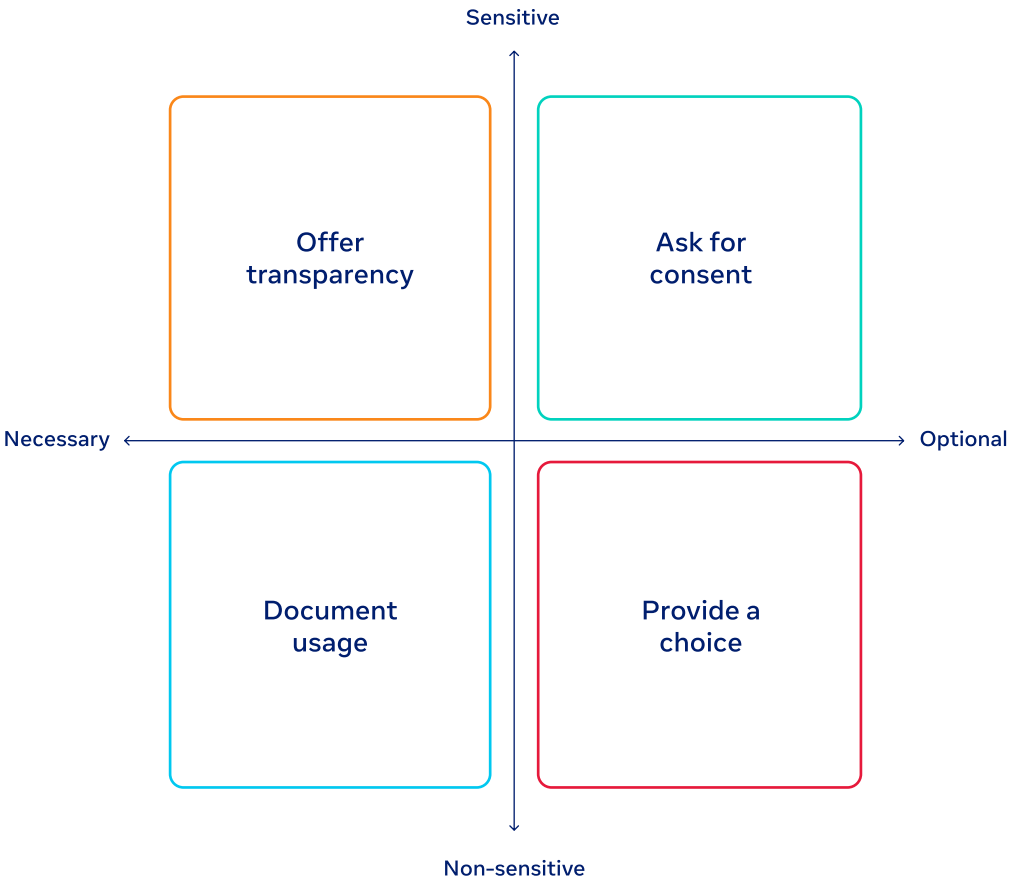
More guidance for the **User Journey of Consent** is in **Appendix A**, together with our observations on their application during the Design Jams

Singapore

Transparency and consent graph

What it is

An easy-to-use tool for helping workshop participants consider the kinds of transparency and consent notifications that might be appropriate in a given situation, based on the necessity of the data being collected and processed, and its potential sensitivity.



How it was used

In the Design Jams, the Transparency and Consent Graph helped participants identify data types in hypothetical XR and metaverse scenarios and consider multiple ways of offering transparency and control.

For more detail on the **Transparency and Consent Graph** and how it was used in the Design Jams, see **Appendix A**

Singapore

Consent considerations

What they are

The Consent Considerations are an experimental framework, currently in development, which aims to support designers as they make decisions on data use.

How they were used

The Consent Considerations were used as a decision-making and design aid throughout the workshops, posing questions that helped teams think through the design of their prototypes.

> **These considerations are not validated or endorsed by legal experts in any jurisdiction, and are not intended to be a source of legal guidance. They are simply a set of design statements aimed at prompting discussion and thought.*

Decision
To guide ***when*** you seek consent


1. Reduce risk and minimize collection


2. Build individual and community value


3. Respect expectations


4. Be selective to support a journey


5. Let people change their minds

Design
To guide ***how*** you seek consent


6. Ensure accessibility


7. Make consent requests with clarity


8. Be fair


9. Be consistent


10. Group thoughtfully

Guidance for the **Consent Considerations** is included in **Appendix A**, together with our observations on their application during the Design Jams

South Korea

Approach to body-based data privacy in XR

Our collaboration with South Korean policymakers and academics, as facilitated by SNU, took as its focus five types of physically derived data that may be used in XR, specifically: facial, motion, vitals, neural and voice.

What are the privacy implications of using the data generated by a person's body to power their metaverse and XR experiences? How can product makers design transparency and appropriate controls into their products — enhancing people's trust while providing valuable new experiences?

To explore these questions we developed four high-fidelity XR scenarios. Each scenario contemplated a different context — education, live entertainment, shopping and travel — and was accompanied by a different persona. Each with their own characteristics, these fictional representations of people ensured proposed designs addressed the needs of a diverse group of users.

To learn as much as possible through these explorations, we took care to adapt our approach to the specific cultural context of South Korea. This involved collaborating with local designers to translate workshop materials and facilitating exercises in Korean with the help of a local design studio.

During a full-day Design Jam, four teams of participants worked to design and prototype XR experiences that responded to one of the provided scenarios. Immersing themselves in their particular scenario through VR headsets, the teams were able to develop considered, resolved solutions to questions around privacy and transparency of body-based data use in XR, exploring new functionality and suggesting ways they would like to be in control of their data and experiences.

South Korea

Tools and methodologies

We used a range of exercises, methodologies and tools in the South Korea Design Jam to help participants approach their scenarios and develop possible solutions.

Designed to help participants engage with their scenarios and collaborate around practical solutions, the workshop materials combined existing tools with methodologies developed specifically for this program. In collaboration with local designers, we then translated these materials and their accompanying guidance into Korean, ensuring the South Korean policymakers, academics and students were able to actively participate in and contribute to the Design Jam.

South Korea

Body-based data cards

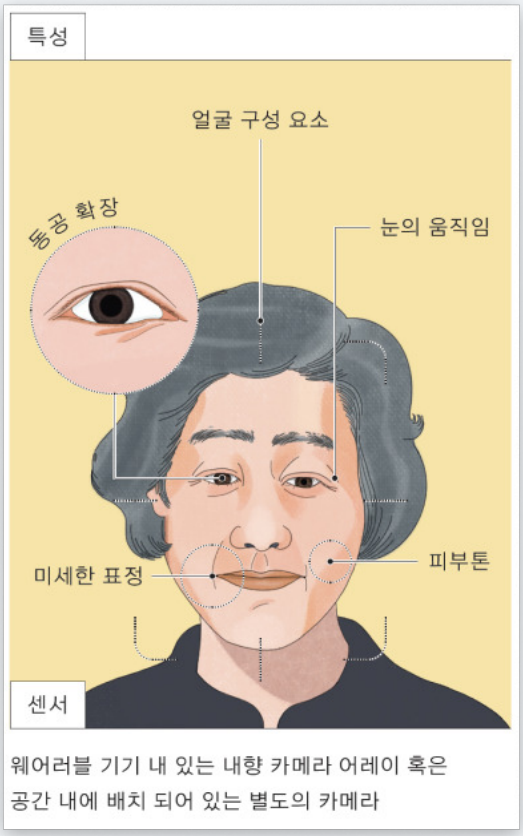
What they are

A set of five reference cards providing an overview of the main body-generated data types we focused on for the Design Jam: facial, motion, vitals, 'neural' (see **Appendix A**) and voice.

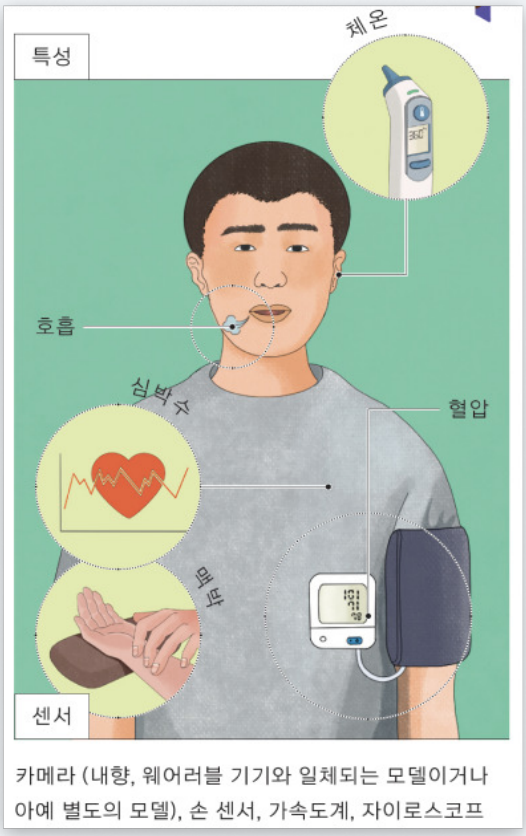
How they were used

The Body-Based Data Cards were used throughout the workshop, providing a quick reference for participants to consider the different data types in terms of benefits and concerns for their specific persona and scenario.

Example Body-Based Data Cards



웨어러블 기기 내 있는 내향 카메라 어레이 혹은 공간 내에 배치 되어 있는 별도의 카메라



카메라 (내향, 웨어러블 기기와 일체되는 모델이거나 아예 별도의 모델), 손 센서, 가속도계, 자이로스코프

English-language versions of the **Body-Based Data Cards** can be found in **Appendix A**

South Korea

Analyze transparency in context (XR)

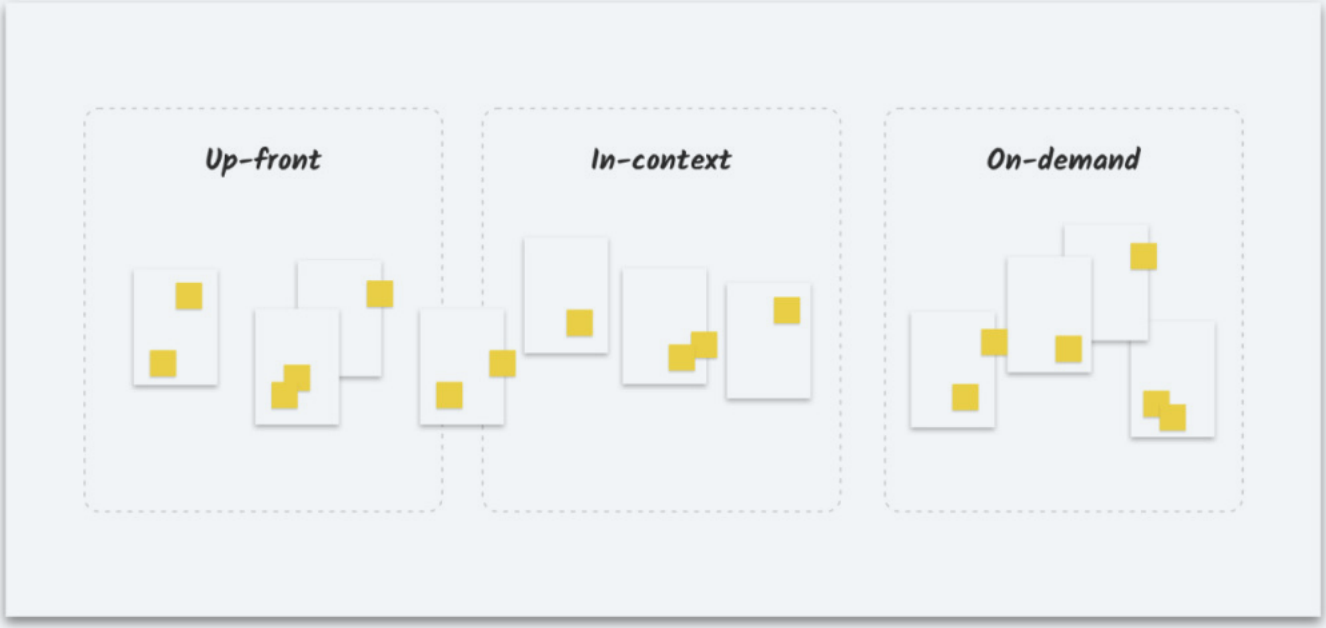
What it is

Adapting an existing TTC Labs Toolkit exercise for XR, this activity helps people analyze how data-use notices provide transparency in different contexts and at different points in the UX journey.

How it was used

Participants were provided with a range of data-use notice examples for a fictional car-sharing service — ChariotXR — then asked to consider where each notice might occur in the user experience and the most appropriate way they should be presented.

Analyze Transparency in Context



Guidance for the existing **Analyze Transparency in Context** exercise can be downloaded from the **TTC Labs Toolkit**

South Korea

Introducing personas

What it is

A warm-up exercise to introduce people to personas (fictional representations of real users) helping workshop participants account for diverse needs, attitudes and behaviors in their designs.

How it was used

Teams were allocated a persona together with their XR scenario, grounding their discussions and solutions in the needs of a specific user.

Persona Cards

We created this set of XR personas specifically for the South Korea Design Jam.

More detail on these **XR personas** can be found in [Appendix A]

3 Co-design findings

Co-design findings

The outputs from these two programs offer valuable learnings around the evolving opportunities for transparency and control in immersive technologies and responsible data use in the metaverse.

3 themes

Three overarching themes for new user experiences emerged from our explorations — each identifying spaces for inquiry and questions for platform providers, product makers and policymakers.

6 insights

We synthesized six main insights from the XR prototypes created during the Singapore and South Korea Design Jams — capturing the key ideas emerging from the two programs and highlighting opportunities to help people navigate data use in the metaverse.

17 design patterns

Based on the XR prototypes created during the Design Jams, we developed 17 UX design patterns to demonstrate different applications of the insights — providing helpful prompts for platform providers and product makers.

How to read this section

Unique elements of each program

While the design inputs, approaches and, subsequently, outputs of the two programs differed in key ways, we have grouped the UX design patterns by insight rather than country — as shown on the previous page. The aim of this structure is to help readers of this report easily navigate the content. However, it is worth noting that there were unique elements within each program which produced a discernable difference in focus among the design patterns generated from the workshops in each country.

Firstly, the participants for each program differed in terms of their familiarity with the technology and policy landscape. The group who were co-designing with the participating companies in Singapore were predominantly early and mid-stage career professionals from a variety of privacy-relevant backgrounds. We were also fortunate enough to benefit from the participation of graduate students from the National University of Singapore and the Lee Kuan Yew School of Public Policy at the Design Jams. This group was well-versed on the policy considerations surrounding the development of such technology. They were very interested in thinking about the full journey of a user through an immersive environment, and how policy supports this journey.

We also spent more time with the group in Singapore, and this naturally meant that we were able to cover more ground in terms of the types of experiences and opportunities people may have in the metaverse. As a result, the designs from this program are well-considered especially from the perspective of the overall journey and are well-optimized for providing transparency to users as they move into and between experiences.

The group we worked with at SNU were generally undergraduate and postgraduate students who are part of the university's XR Association, many of whom are already developing applications for XR, and as such were familiar with the technical and experiential aspects of the technology. This enabled us to quickly focus on the privacy and policy elements of the discussions which took place during the morning of the Design Jam. This group — being familiar with XR and product development — was keen to spot opportunities for new features and services which could be offered to users and which would enhance their experiences in the metaverse.

The design prototypes produced by the South Korean participants tended to focus in a more direct way on the ability to control data and provide feedback to the system about the data being collected. They also seemed very comfortable with taking recommendations from the AI system they envisaged in each of their respective scenarios, and this could potentially be due to the fact that this group have grown up with technology as a natural part of their daily lives.

The differences in the demographics, background and amount of time spent with each group have shaped the outcomes of each program in ways which are highly complementary. The patterns produced are equal in inventiveness and quality, and the two sets provide a great deal of inspiration for anyone interested in UX design and these nascent technologies.

THEME 1

New data types and uses

New data types and uses

As the sensing capability of connected devices evolves, product makers may leverage a host of novel body-based data types to create the foundational experiences of the metaverse.

Through our work with external experts in these programs it became clear that not everyone will be comfortable sharing body-based data types right away. Given the newness of the technology, people may have particular concerns around passive data collection and inferences made from inputs like facial expressions, eye movements and vital signs — instances where a person is not intentionally sharing their data.

In part this is because the experiences these kinds of data can enable are still taking shape. Few people have had the chance to experience them first-hand, so the value proposition is not always clear.

> At this early stage of metaverse development, there is a tension between the capabilities that new body-based data types enable and the sense of uncertainty they elicit.

As XR technology develops and grows in familiarity, people are likely to become more accustomed to sharing body-based data. Until such a time, the companies and experts participating in our co-design workshops felt it was the responsibility of platform providers and product makers to provide transparent explanations and appropriate controls around personal and potentially sensitive data types — whether these are required to provide a baseline service or enhanced personalization.

Being transparent about the collection and use of these new data types will help to build people's trust in these emerging technologies.

Questions for platform providers, product makers and policymakers

- How can product makers address people's uncertainties around the novel data types that power the metaverse?
- How can product makers help people understand the value these new data types enable?
- How can policymakers encourage product makers to implement data minimization practices around body-based data?
- What kinds of notification and consent are required around passive data inputs?
- Can we make use of default settings in XR experiences to help people manage their privacy and data?

1 INSIGHT Build trust by showing value

People don't provide body-based data if they don't know what it's for.

A person's lack of familiarity with XR technology can mean they don't inherently understand how different data types are used by various platforms and products. When the collection and processing of data is not transparent, body-based data can strike people as abstract and vulnerable to misuse. Connecting data types to features builds trust through transparency, and is key to demonstrating new value in immersive experiences.

People need to be able to connect the data being processed to a specific benefit in the context of its use. Seeing how their experiences respond to their data choices helps people develop their understanding over time.

This is particularly the case for products that respond to people's affective states. If someone doesn't connect the value of a service with its ability to assess and respond to their emotional state, they may not appreciate the need for these new data types.

In these instances, product makers should aim to help people understand the direct, real-time impacts of data processing on their experience, demystifying body-based data and minimizing the risk of misunderstanding.

In addition to data minimization practices, it is important that product makers design experiences that can adapt to a lower level of data collection and access, steering away from penalizing users if they don't want to consent to provide particular types of body-based data.

Questions for product and policymakers

- [ ] How can product makers better inform people of the connections between specific features and the data types they require?
- [ ] How can the sector as a whole foster greater understanding around the need for particular body-based data to enable enhanced experiences?
- [ ] How can policymakers promote these kinds of experiences now, knowing that people may become more comfortable with providing these data types over time?

INSIGHT 1

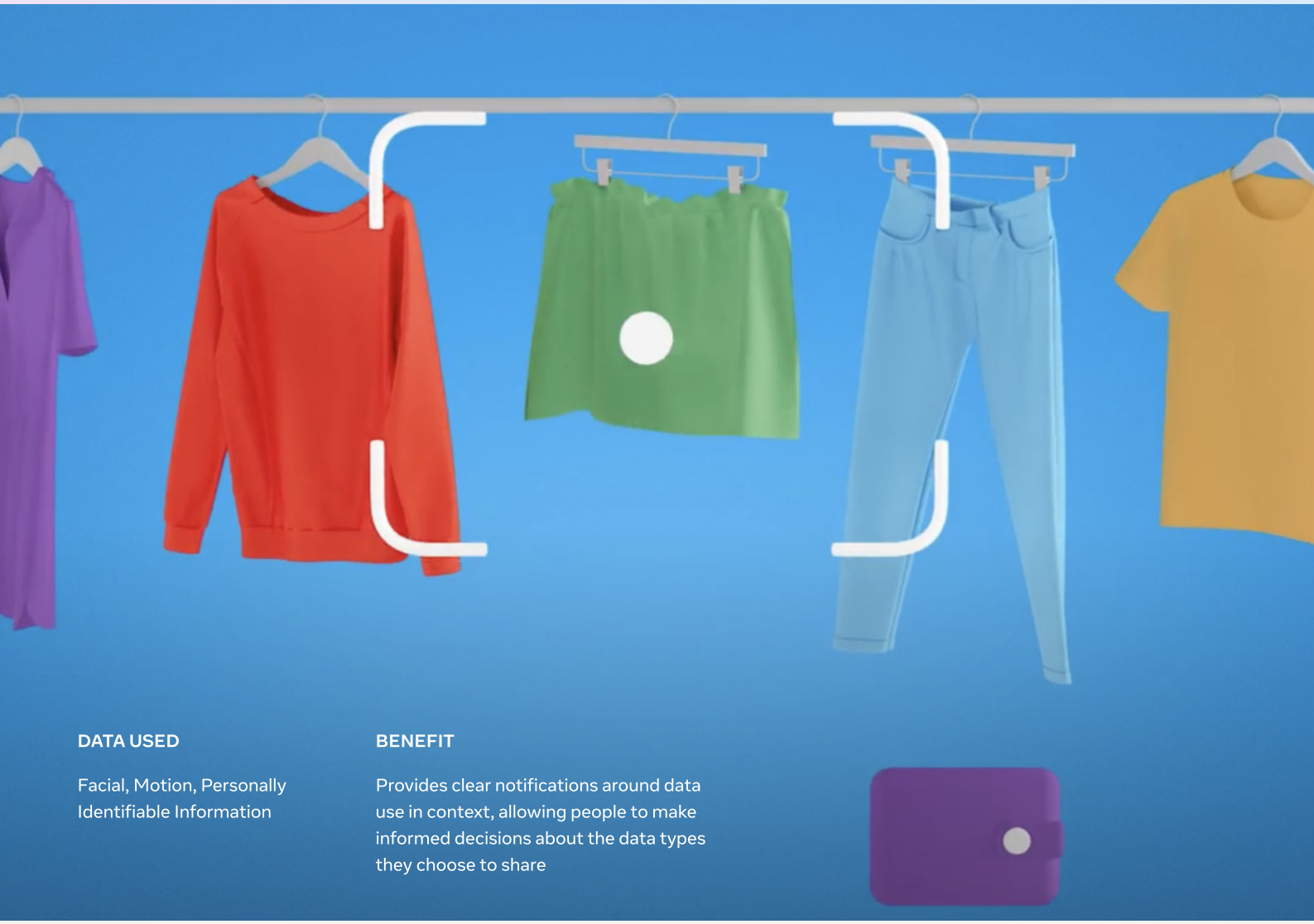
Build trust by showing value

Singapore

XR UX privacy patterns

Consent wallet

Watch the animation



DATA USED

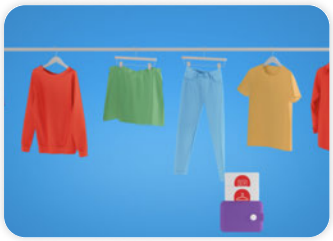
Facial, Motion, Personally Identifiable Information

BENEFIT

Provides clear notifications around data use in context, allowing people to make informed decisions about the data types they choose to share

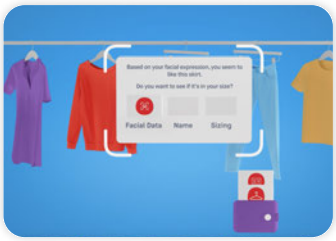
The **consent wallet** could allow people to share individual body-based data types within a specific moment.

Step 1



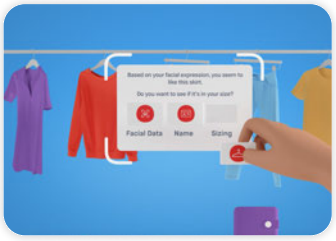
The Consent Wallet contains cards that represent different body-based data types that someone may use for clothes shopping, such as height and weight.

Step 2



When they see a skirt they like, a notification appears prompting them to share their body measurements to check if the skirt is available in their size.

Step 3



The person takes their body measurements from the consent wallet and places them on the notification. They are notified that the skirt is available in their size.

Description

This design pattern proposes a 'physical' place for people to store and share their personal data, leveraging the tactile and symbolic qualities of a familiar object — a wallet — to help them make informed decisions about sharing potentially sensitive data types. By adding or removing specific cards, people could share different data types within the confines of a particular context or transaction. Supporting incremental and in-context approaches to consent, the Consent Wallet allows people to share individual data types on the fly in a way that supports their experience.

Context

This pattern is based on the prototype developed by **Bizverse**, which was aimed at addressing the concerns people may have when sharing potentially sensitive body-based data such as weight and body measurements while shopping for clothes in the metaverse. When people feel uncomfortable about providing accurate data they might be more likely to provide false or misleading measurements, which could limit their shopping experience.

COMPANY SNAPSHOT

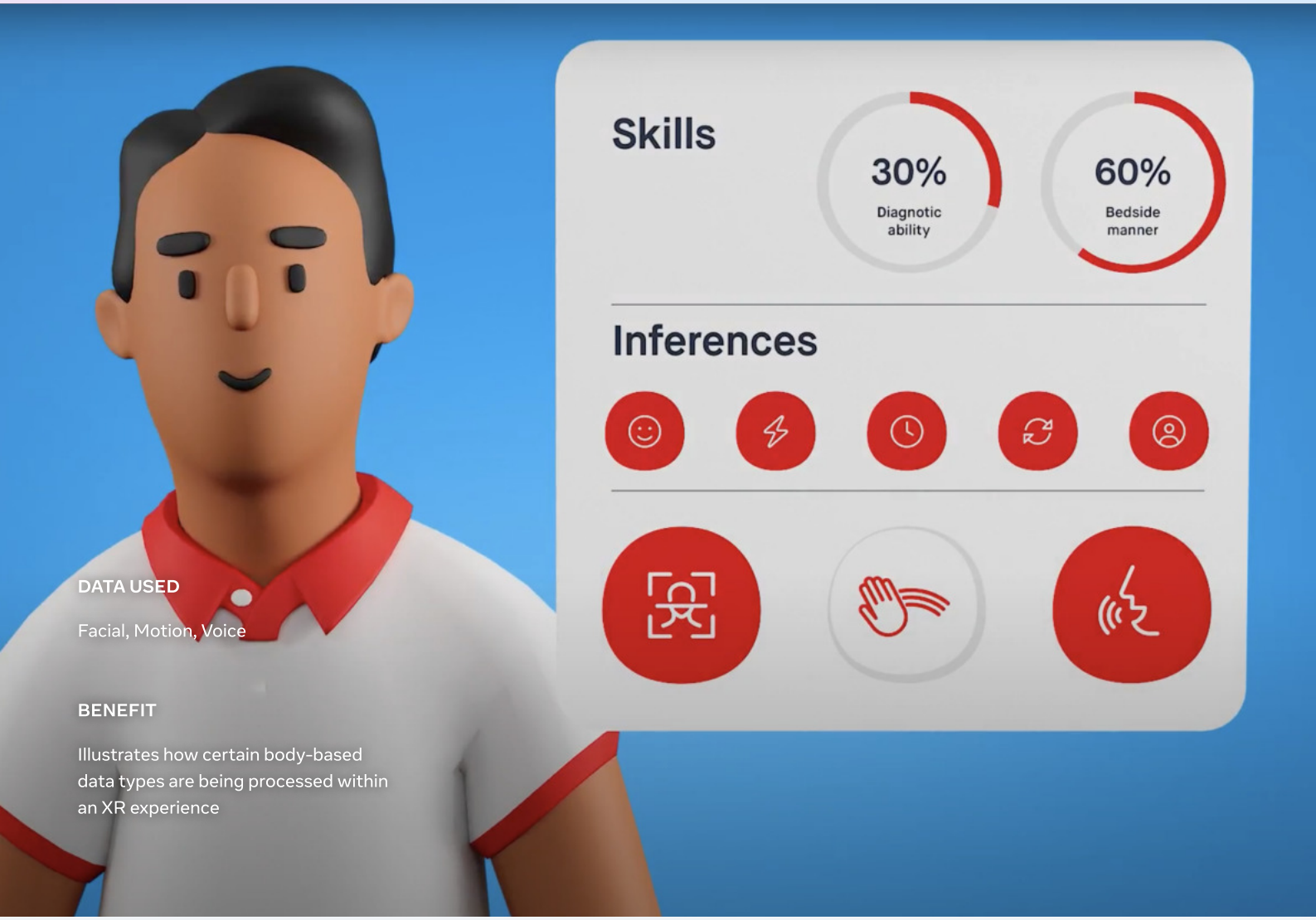
Bizverse is a platform and set of tools for companies to do business in the metaverse, enabling services such as retail and tourism.

Singapore

XR UX privacy patterns

Data head-up display

Watch the animation



DATA USED

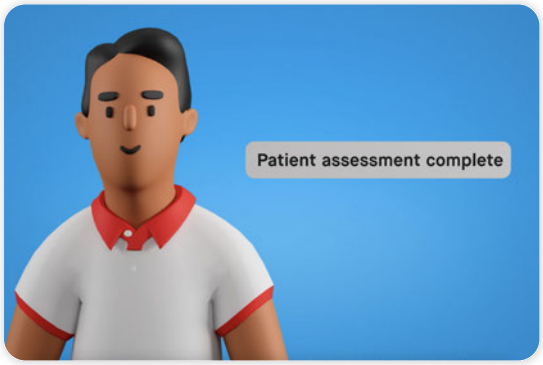
Facial, Motion, Voice

BENEFIT

Illustrates how certain body-based data types are being processed within an XR experience

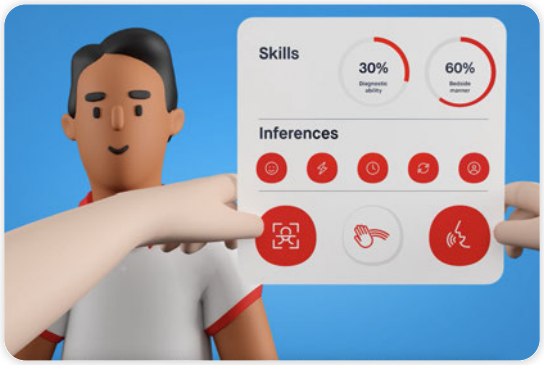
The **data head-up display** is a pull-down dashboard that can provide an overview of various metrics relating to body-based data.

Step 1



A medical student is consulting with a virtual patient.

Step 2



They pull down the Head-Up Display to view details of the data they're sharing, including how it is being used and what is being inferred from it.

Description

A pull-down dashboard, the Data Head-Up Display could show metrics for different body-based data, including types collected, how they're being used and how often (frequency). The metrics are feature-specific, providing a detailed breakdown of data processing in relation to functionality, demystifying data use to promote greater understanding and trust.

Context

Through their prototype **MediVR** explored extending their existing product functionality to incorporate facial expression analysis and gaze-tracking into VR assessments for trainee doctors. To gain and maintain the trust of their student users, **MediVR** proposed a series of solutions that demonstrate how someone's data is being used to support their experience and improve their learning.

COMPANY SNAPSHOT

MediVR is an immersive medical training simulation that enables students to learn and take assessments in the metaverse with AI-powered virtual patients.

South Korea

XR UX privacy patterns

Persona switcher

Watch the animation

DATA USED

Motion

BENEFIT

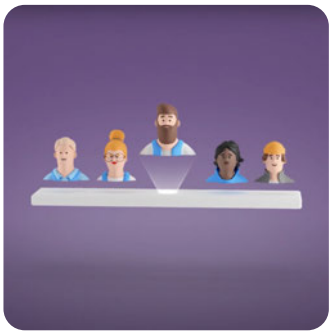
Provides the ability to use another person's body-based data to purchase gifts or obtain recommendations for them

The **persona switcher** could allow people to use the body-based data of other consenting users.

Step 1

Opening the Persona Switcher, a person can see they are currently using their own recorded body-based data.

Step 2



The feature allows them to store other consenting users' size and weight data to access when required.

Step 3

When they select another person's avatar, their body-based data is displayed.

Description

The Persona Switcher is a bar that displays the different people whose body-based data a person can access within an experience.

In this example, a person decides to use the motion data of someone else — specifically their body measurements and sizing — to buy clothes for them during a shopping experience.

Context

This pattern is based on the prototype developed by **Team Retail**, which focused on the needs of an influencer shopping for her followers using AR glasses. She has a good understanding of data privacy and wants to access the benefits of body-based data while keeping her own data secure.

SCENARIO SNAPSHOT

Team Retail's scenario centered on the experience of an influencer shopping with AR glasses.

N.B. The Trust, Transparency and Control Labs team recognizes that the idea of using other people's data may be problematic from a privacy and security point of view. However, as this concept emerged multiple times in our co-creation workshops we have included it as an emergent use case and XR UX design pattern. Privacy-enhancing technologies may provide a way forward with this use case that does not compromise privacy or security. This warrants more research and discussion prior to implementation.

INSIGHT 1

Build trust by showing value

South Korea

XR UX privacy patterns

Safety mode

Watch the animation

DATA USED

Vitals, Neural

BENEFIT

Provides recommendations in support of a person's wellbeing, helping product makers fulfill their duty of care to users

Safety mode can use a person's body-based data to safeguard their wellbeing.

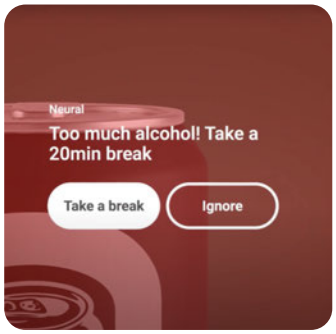
Step 1

A user wearing a pair of AR glasses switches on Safety Mode.

Step 2

An alert appears and informs them that, based on their data, they appear fatigued and inebriated.

Step 3



A notification recommends they take a break.

Description

The Safety Mode pattern is designed for situations in which people may not be aware that their wellbeing is being impacted. Using Safety Mode, a person can see what the system is reading and decide if they want to follow the recommendation to stay safe.

In this future-facing example, Safety Mode uses a person's neural data to determine when they are doing something that might affect their wellbeing, like drinking alcohol once they're already inebriated or exhausted. Upon registering a risk, the system gives them a warning and a recommendation to help them stay safe. The person can decide if they want to take the recommendation — in this case to take a break from alcohol.

Context

This pattern is based on the prototype developed by **Team Entertainment**. Their solution explored how body-based data could be used to monitor their persona's wellbeing and reduce the risk of negative experiences.

The solution was based on the needs of a high-school graduate experiencing a music festival with AR glasses. He is not very knowledgeable about data privacy and wants to enjoy the experience without distractions.

SCENARIO SNAPSHOT

Team Entertainment's scenario centered on a high-school graduate wearing AR glasses to a music festival.

2 INSIGHT
Perceived sensitivity relates to awareness

Transparency is especially useful when data is collected from passive actions and behaviors.

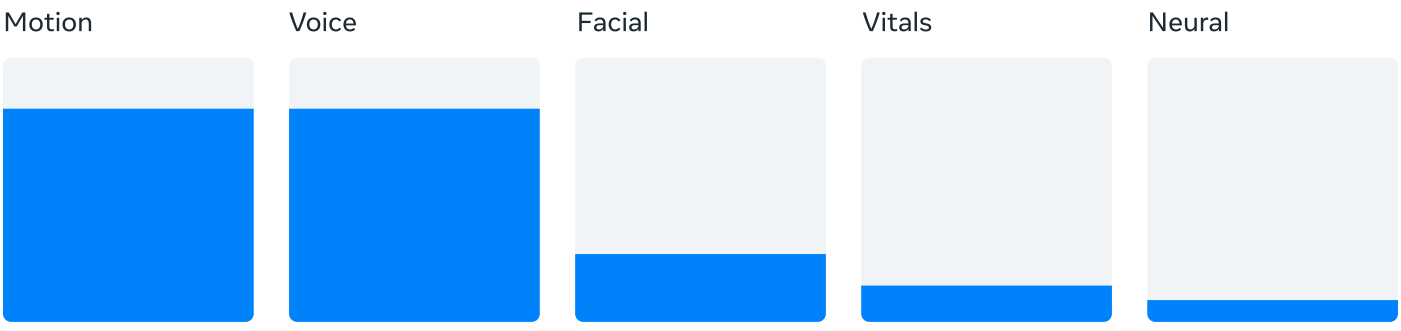
People's sensitivity around novel data types can be influenced by the way their information is collected. Facial data, for example, can be provided actively — such as intentionally smiling to note positive agreement — or passively — as when a product might 'read' a person's facial expressions to make changes or recommendations to their experience.

This means that body-based data provided passively or unconsciously may be considered more sensitive. Knowing this suggests that consent or additional controls could be most useful in these instances. This also provides an opportunity to offer proactive transparency.

This is especially the case when data is not generated from clear, intentional actions, but by subconscious processes over which people have little control, like their heart rate or pupil dilation.

Making people aware of the information they are providing, whether they are providing it actively or passively, and how it is being used within their experience, could help them make more informed decisions.

Sensitivity of active and passive body-based data types



This diagram illustrates the balance of active and passive collection of different body-based data types

Active
(Higher awareness and less sensitivity)

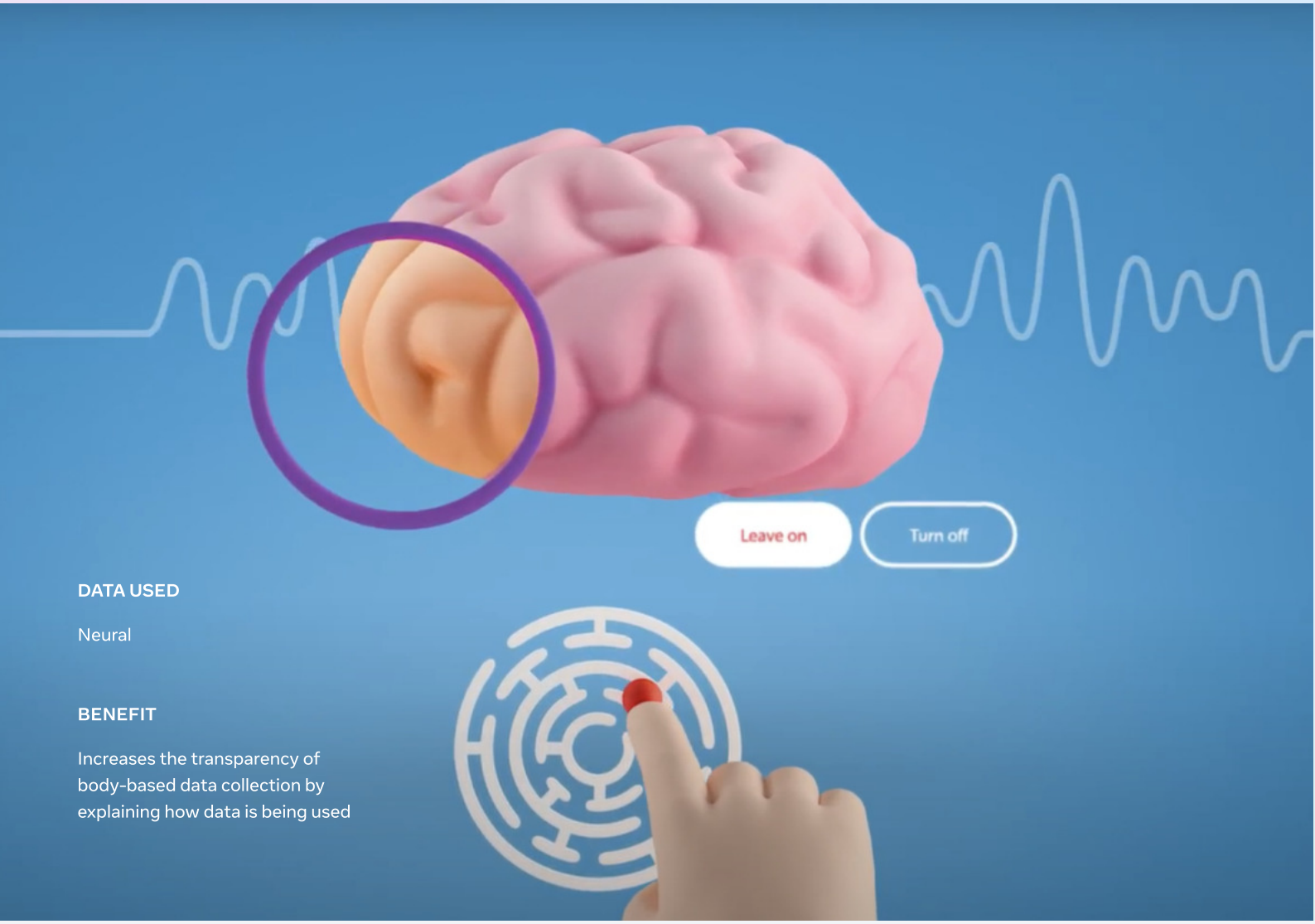
Passive
(Lower awareness and higher sensitivity)

South Korea

XR UX privacy patterns

Sandbox

Watch the animation



DATA USED

Neural

BENEFIT

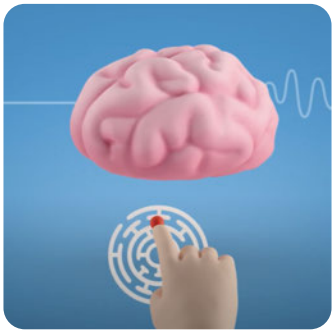
Increases the transparency of body-based data collection by explaining how data is being used

The **sandbox** could allow people to try out different body-based data types, seeing how and why they are processed before consenting to provide them.

Step 1

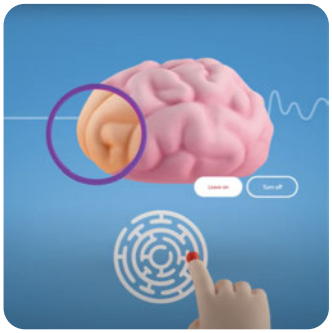
A person is provided with a simple activity to complete.

Step 2



As they complete the activity they can see how their data is being processed in real-time and what it's being used for.

Step 3



They can then decide if they would like to enable that data type or not.

Description

The Sandbox pattern features a virtual room in which people can see the influence of different body-based data types on the system. It is designed for people who want more transparency around how their data is being processed and impacting their experience.

In this future-facing pattern, the use of a person's neural data within a hypothetical scenario is demonstrated by asking them to do a short concentration puzzle, showing the data being collected and processed in the form of a graph.

Context

This pattern is based on the solution developed by **Team Education**, which explored creative ways of demonstrating how body-based data might be collected, processed and put into use. This was based on understanding the needs of a busy mother partaking in an XR professional development course.

SCENARIO SNAPSHOT

Team Education's scenario was a virtual library where their persona was undertaking a professional development course in VR.

INSIGHT 2

Perceived sensitivity relates to awareness

South Korea

XR UX privacy patterns

Live emoticon

Watch the animation

DATA USED

Facial

BENEFIT

Increases transparency by showing how facial expressions are being processed within an experience

The **live emoticon** can visualize a person's reaction or emotional state during an experience.

Step 1

A person sees something they like.

Step 2

They are notified that their interest has been detected.

Step 3

Heart emoticons visualize their interest while an icon indicates which data type was used to infer their reaction.

Description

The Live Emoticon envisages a feature which could provide a visual representation of a person's emotional response during an experience. This is designed to provide transparency around interest-based data inputs, showing people how their body-based data is being interpreted in context.

In this example, the system reads a person's facial data to infer that they like a bicycle. Registering the person's interest, the system uses Live Emoticons to represent their reaction, and icons to show the data types used to determine their response.

NB: This pattern can be used with the Fine Tuner, which allows people to adjust how their data is being interpreted to infer their likes and dislikes.

Context

Team Travel developed the prototype on which this pattern is based. Their solution explored different ways of creating transparency around how body-based data might be collected to support someone with limited mobility.

Their solution was based on the needs of a persona visiting Japan's digital twin to plan an upcoming trip with his wife.

SCENARIO SNAPSHOT

Team Travel's scenario involved a real estate agent visiting a digital twin of Japan in VR to plan an upcoming trip with his wife who uses a wheelchair.

INSIGHT 2

Perceived sensitivity relates to awareness

South Korea

XR UX privacy patterns

Body-based data cube

Watch the animation

DATA USED

Vitals

BENEFIT

Provides information on different body-based data types and their benefits

The **body-based data cube** could provide on-demand information and privacy controls for the data types a person is sharing.

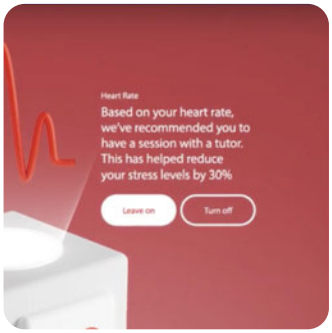
Step 1

The Body-Based Data Cube displays the different types of data that are in use.

Step 2

A person can select a data type to view by pressing on the associated icon.

Step 3



A pop-up display provides information on the selected data type and its benefits, as well as the option for someone to change their privacy preferences.

Description

The Body-Based Data Cube uses graphs, metrics, descriptions and comparisons to explain how different data types are being used within an experience. These explanations include tangible benefits a person has derived from a given data type, together with the option to modify their preferences.

Available at any time during an experience, the Body-Based Data Cube provides people with the information and ability to make informed decisions about whether they continue to share particular data types.

Context

This pattern is based on the solution developed by **Team Education**, focusing on the needs of a busy mother in the process of completing a professional development course. She is somewhat skeptical of technology and prefers not to share her data.

In their solution, the team sought to highlight the benefits of data sharing through the use of graphs, comparisons and statistics, providing increased transparency and visibility.

SCENARIO SNAPSHOT

Team Education's scenario was a virtual library where their persona was undertaking a professional development course in VR.

THEME 2

New multi-party experiences

New multi-party experiences

The immediate, embodied experiences engendered by the metaverse pose questions around the management of data when multiple parties are sharing information in real-time.

Having appropriate controls is key to people feeling empowered about their privacy. This is especially the case for social interactions and contexts where a person's experience may be defined as much by the data inputs, information and settings of those around them as it is by the data they choose to share.

Examples of these situations — which will be further enabled by future developments in XR technology — include virtual concerts and social hubs where people will be able to freely interact, as well as linear educational narratives. These experiences could involve users opting into or out of providing data in a group context, where the sharing or withholding of data can impact on the experiences of other people. Another example is where one kind of user provides consent or sets controls on behalf of another, such as a parent or guardian providing consent and settings for their child.

> ## Adaptive social experiences require in-context controls and information.

One of the key privacy questions for these experiences is how data can be managed transparently when multiple parties are interacting and sharing different levels of data across these experiences in real-time.

The prototypes developed during the Singapore and South Korea Design Jams explored the use of in-context information, responsive controls and deliberate friction to support informed consent and transparency in these situations.

Questions for platform providers, product makers and policymakers

- When should product makers provide explanations and transparency to most effectively help people make informed decisions?
- Which permissions should device makers, platform providers and product makers obtain at different stages, and from whom?
- What kind of data uses should be enabled outside individual apps and services?
- Which permissions should be persistent across different experiences?
- How can device makers, platform providers and product makers support good user experiences through interoperability, without compromising data transparency and consent?

3 INSIGHT Accommodate different levels of sharing

Privacy controls could support group dynamics while respecting individual choices.

The metaverse will allow people to have real-time social experiences with friends and strangers alike. In these dynamic contexts it's important that people have everything they need to make informed decisions about who they share their data with — whether that's a service, a platform, a company or other users.

Product makers should consider how they can respect people's individual preferences within multi-party experiences and social contexts, accommodating different levels of data-sharing and individualized control.

They also need to consider how to communicate the impacts of different privacy choices on group dynamics. What happens when only some people share the data required by a particular feature? How does an experience play out for someone who opts in compared to someone who withholds consent?

Minimizing the data required to power shared experiences and finding effective ways to communicate this to people will encourage appropriate sharing with trusted platforms and product makers.

Questions for product and policymakers

- ☐ How can product makers create playful instances of in-context transparency and consent without detracting from the immersive nature of an experience?
- ☐ How can product makers create consent mechanisms that support group interactions without compromising individual choices?
- ☐ What safeguards are required to allow for informed consent by different users in multi-party contexts?

INSIGHT 3

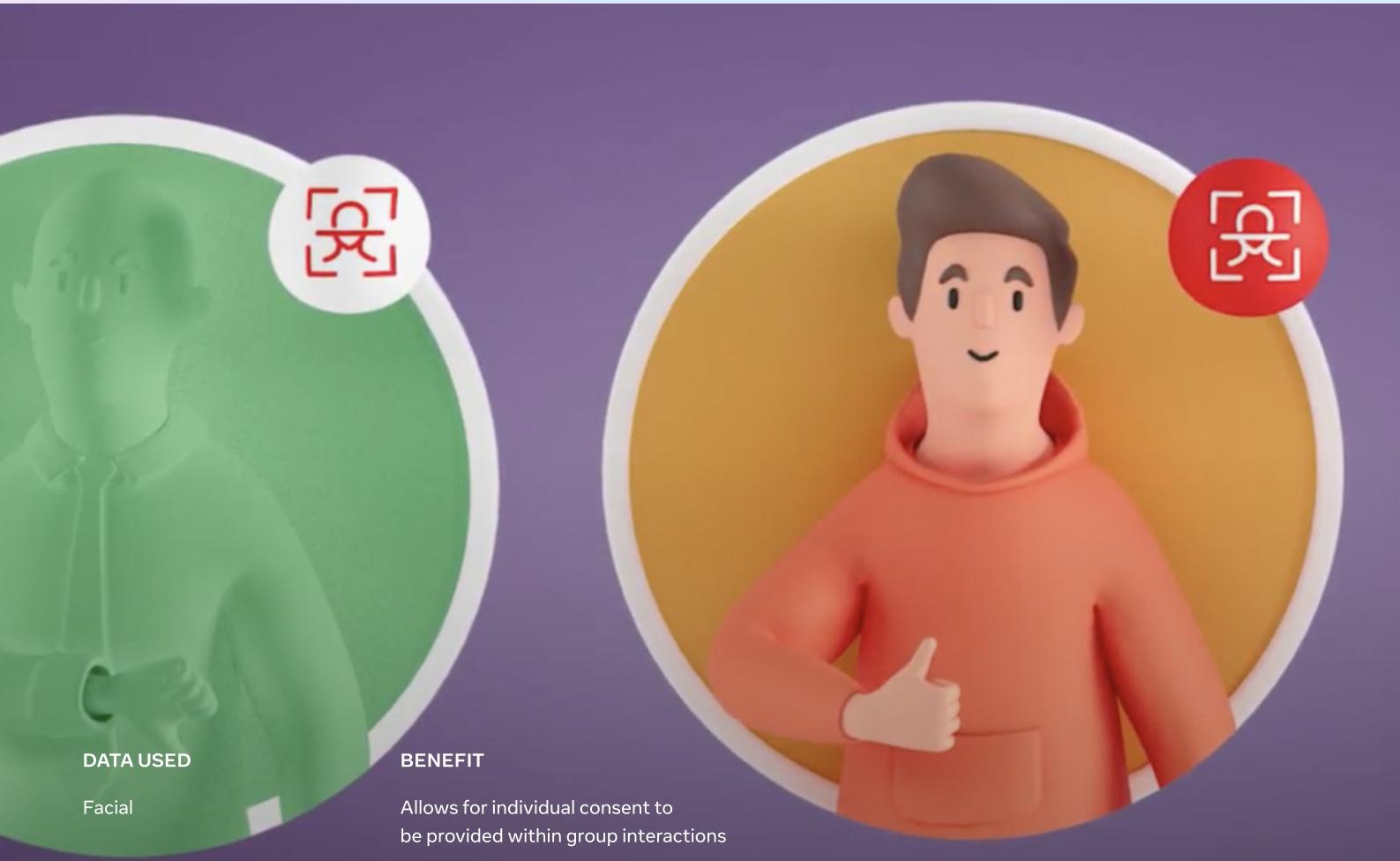
Accommodate different levels of sharing

Singapore

XR UX privacy patterns

Multi-party consent

Watch the animation



DATA USED

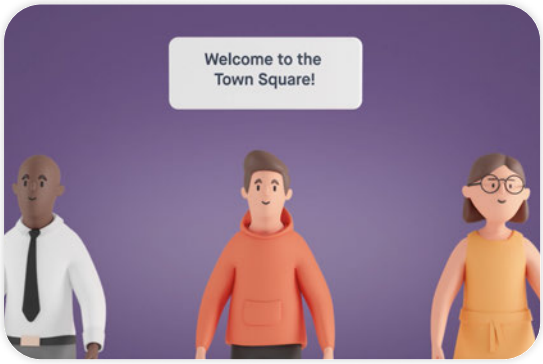
Facial

BENEFIT

Allows for individual consent to be provided within group interactions

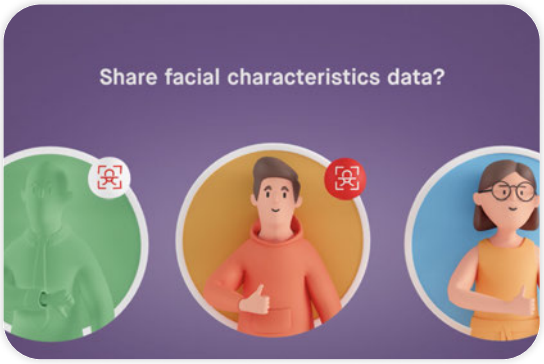
The **multi-party consent** pattern could provide an easy way for individuals to give or withhold their consent within group interactions.

Step 1



Three people arriving at a public space are asked if they would like to share their facial data.

Step 2



Two of the people indicate their consent with a thumbs up, and share their data. One person decides not to share their data, using a thumbs down to opt out.

Description

The Multi-Party Consent pattern explores how individual consent could be sought and honored within group settings in future scenarios. With a simple thumbs up/down gesture, people can opt into or out of providing their data.

In this solution, an individual withholding consent does not prevent other people from partaking in the experience, nor does the product process someone's data prior to obtaining consent. It's an easy-to-understand control that allows for different levels of data-sharing within a group setting.

Context

This pattern is based on the prototype developed by **BuzzAR**, which explored the privacy implications for XR experiences based in public settings such as shopping malls and university campuses. In these places additional precautions should be considered to ensure that potentially sensitive data is not accidentally shared or processed without consent.

COMPANY SNAPSHOT

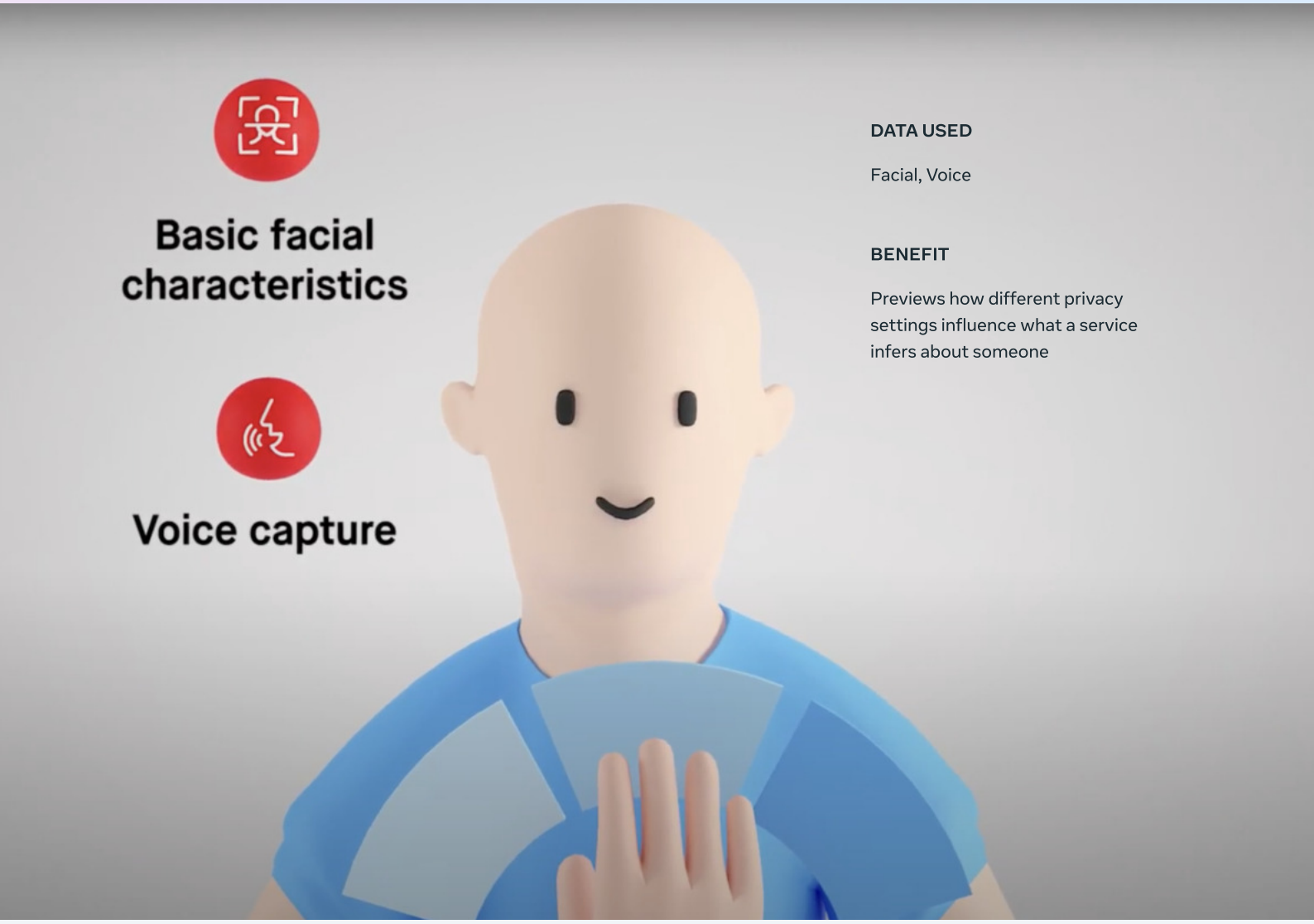
BuzzAR is a startup focused on connecting people and communities, including through the Pop-Up Metaverse, an AR installation that enables people to create avatars in their likeness.

Singapore

XR UX privacy patterns

Preview slider

Watch the animation



DATA USED

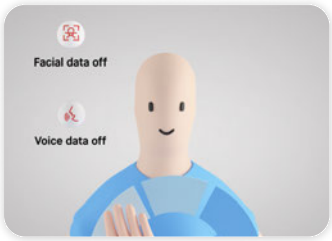
Facial, Voice

BENEFIT

Previews how different privacy settings influence what a service infers about someone

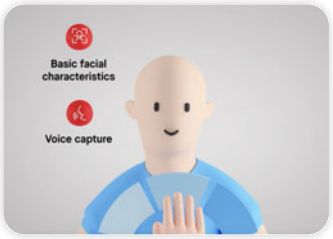
The **preview slider** could allow people to see the impact of different data types on their avatar's appearance before they start an experience.

Step 1



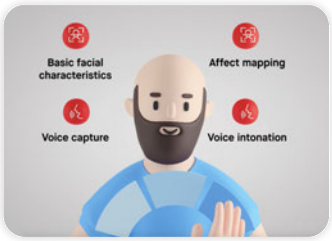
Before speaking with a virtual customer service agent, a person can select the data types and the level of data they want to share.

Step 2



What the agent is able to infer about the customer is determined by the data they share, as reflected in the fidelity of their avatar.

Step 3



Once they decide on the data they wish to share, they can exit the preview mode and speak to the customer service agent.

Description

The Preview Slider pattern aims to give people transparency and control over their data, providing a preview of what the system and other users will see based on the body-based data they share. This could allow people to make an informed decision about the impact of sharing or not sharing particular data types.

Similar to a Zoom or Microsoft Teams cal preview window, the pattern shows someone how they outwardly appear to others — moving from low fidelity (no data sharing) to high fidelity (more extensive data sharing). This fidelity reflects the information that is available to other users within an experience, as represented by the appearance of their avatar. It also reflects what the system can infer about them, such as interest and emotional state (derived from facial data and voice analysis). In doing so, the Preview Slider helps to demystify the use of body-based data, highlighting its value in a visual and interactive way.

Context

Singapore Airlines developed the prototype on which this pattern is based. Their digital concierge solution explored the potential for creating positive customer experiences by assessing and responding to people's facial expressions with tentative future technologies.

People might not always be aware of the role their emotional state plays in personal interactions, especially when it comes to unfamiliar XR technologies and data collection of their physical characteristics such as voice and facial expressions. Before people are willing to use customer support services in XR, they should be confident of the value that data-sharing can bring to their experience.

COMPANY SNAPSHOT

One of the world leading's airlines, **Singapore Airlines** is exploring ways to enhance customer experience leveraging emerging XR technology.

4 INSIGHT
Support creators and guides with simple tools

Metaverse creators will play a key role in shaping people's privacy and consent experiences.

The development of transparency consent and control frameworks, akin to admin and moderator toolkits, may be an effective way to help people consider the different data privacy dependencies and consents required within metaverse experiences.

But it's not just product makers and platform providers who need to provide transparency and control for different types of users.

The metaverse will open up opportunities for people to design metaverse spaces with particular rules. It will also enable intermediaries, such as educators and community administrators, to guide users through experiences in certain ways.

To be truly effective, guidance around protecting people's privacy could be extended to these creators and guides. Wherever possible, this guidance should be made simple and actionable in the form of templates and tools.

Helping these groups establish different levels of transparency, consent and control could greatly support them to create consent flows and control hierarchies that account for the complex user relationships that will be enabled in the metaverse.

Questions for product and policymakers

- ☐ How can platform providers and product makers support creators to design and implement privacy flows within existing products and platforms?
- ☐ What are the considerations for creating a consent and control framework?
- ☐ How might policymakers work with product makers and platform providers to create consent and control frameworks that support relevant policy recommendations?
- ☐ What might different consent and control flow design patterns look like?

INSIGHT 4

Support creators and guides with simple tools

Singapore

XR UX privacy patterns

Consent flags

Watch the animation

DATA USED

Facial (eye-tracking)
Motion (hand-tracking)

BENEFIT

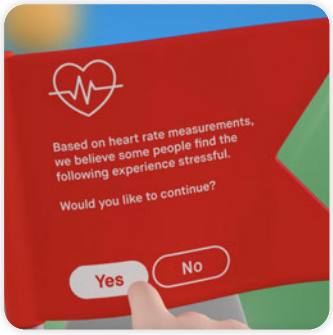
Enables supervising users to screen experiences on behalf of more vulnerable users without limiting their personal autonomy

Consent flags could allow a supervising user to place notifications and hold points throughout an experience.

Step 1

A young student walks through a virtual landscape and encounters a red flag. Everything beyond the flag is obscured behind a blur filter.

Step 2



The student picks up the flag, reviews the content notification and consents to continue with the experience.

Step 3

The blur filter disappears and the rest of the scene comes into focus.

Description

The Consent Flags design pattern would allow a supervising user to place consent flags throughout an experience. When a flag is placed, everything beyond that point will be obscured for secondary users until they review the consent flag — essentially a notification about potentially sensitive content or data processing. This pattern establishes a hierarchy of consent, in which supervising users can implement checks and safety precautions for more vulnerable users.

Context

MeshMinds' prototype, which forms the basis of this pattern, investigated hierarchies of consent, in particular those found within institutional settings such as schools. In these contexts, multiple parties — such as teachers, parents and students — are required to provide consent. **MeshMinds'** solution addressed different forms of consent that may be required for students to partake in XR experiences in a school setting, including experience vetting and parental permissions.

SCENARIO SNAPSHOT

MeshMinds is a creative agency designing immersive experiences that combine technology and art, such as Climate Breakers, a narrative-based VR experience.

INSIGHT 4

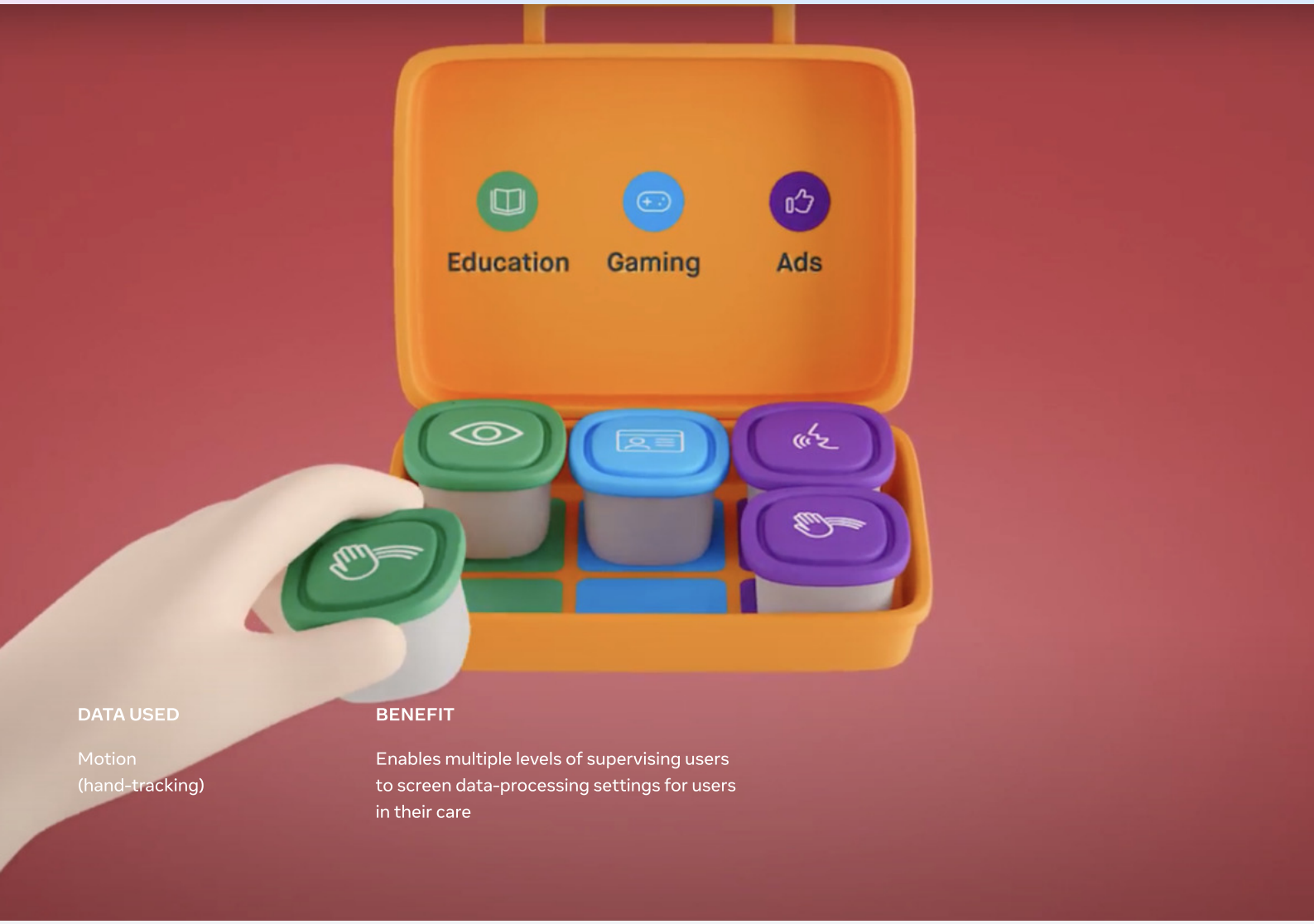
Support creators and guides with simple tools

Singapore

XR UX privacy patterns

Consent lunchbox

Watch the animation



DATA USED

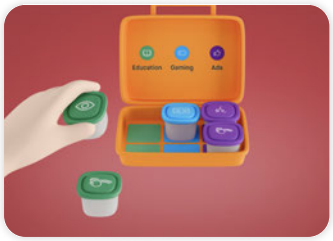
Motion (hand-tracking)

BENEFIT

Enables multiple levels of supervising users to screen data-processing settings for users in their care

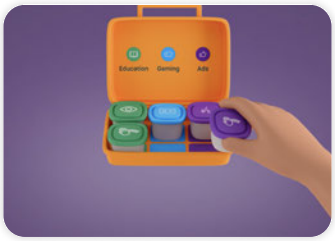
The **consent lunchbox** would allow parents and teachers to modify and approve the data types students are able to share in different XR contexts and experiences.

Step 1



Reviewing a student's Consent Lunchbox, a teacher adds two data types to Education experiences.

Step 2



The student's parents then review the configured Lunchbox and remove any data types they do not want collected within particular contexts. They remove a data type from Ads.

Step 3

The final, approved configuration determines which data types the student is able to share in different experiences.

Description

Like a bento box, the Consent Lunchbox sorts data types into different categories of XR experience, such as education, gaming, retail and ads. Supervising users such as teachers and parents can add or remove data types from these categories, determining the information secondary users such as students and children are able to share within these contexts.

This enables responsible parties to provide oversight for more vulnerable users, helping to ensure their wellbeing and safeguard them against exploitation. The Consent Lunchbox is akin to a multi-party permissions setting, where teachers can set or alter the privacy settings. This configuration is then passed on to the parents, who can approve or modify the nominated data types before their children engage with the experience.

Context

This pattern is based on the prototype developed by **MeshMinds**, which explored hierarchies of consent, in particular those found within institutional settings such as schools. Their solution addressed different forms of consent that could be required for students toexperience their narrative-based educational experience, Climate Breakers, including teacher supervision and parental permissions.

COMPANY SNAPSHOT

MeshMinds is a creative agency designing immersive experiences that combine technology and art, such as Climate Breakers, a narrative-based VR experience.

THEME 3

Gestural and spatial controls

Gestural and spatial controls

The movements, actions and interactions enabled by AR and VR technology are materially different to those facilitated by flat, screen-based interfaces.

Spatially, the metaverse is distinct from previous digital experiences. People can move seamlessly between products and places that have indistinct boundaries. They engage with people and objects around them through a range of physical gestures and embodied actions that feel more life-like and intuitive than text-and-icon-based notifications and menus.

This new spatial dimension opens up opportunities to use physical gestures as control mechanisms, digital objects as interfaces, and location-based settings to establish control defaults.

> Privacy is more than data — it's how a person relates to a particular place and the other people in it

The participants in these projects identified a range of opportunities for data privacy mechanisms to embrace these new ways of being and interacting. They explored challenges associated with persistent permissions and interoperability, including ways product makers can signal changes of location or shifts in social etiquette, allowing people to proactively control the information they share in different situations.

Questions for platform providers, product makers and policymakers

- How can platform providers and product makers support seamless movement between places, balancing persistent world-level permissions against context-specific consent and control?
- How might these parties provide transparency and control specific to different places and situations in a way that supports good user experiences?
- How might platform providers and product makers work together to develop standard data privacy interfaces and interaction patterns across different experiences?
- How might geo-fenced or location-based settings be incorporated and managed at the platform and product levels?

5 INSIGHT
Balance intuitive controls with deliberate friction

Encouraging people to slow down can help them make more informed privacy decisions.

Controls in the metaverse are moving beyond screen-based paradigms to take the form of:

- **Object-based interfaces (form)** — 3D objects in place of screen-based elements such as windows, notifications, pop-ups and drop-downs. These can include talismans and shortcuts to activate privacy presets, e.g. putting on a mask to go incognito.
- **Gesture-based interactions (mode)** — Movements and gestures in place of mouse clicks and screen taps, e.g. thumbs up/down, selection by eye movement or gaze, voice activation and spoken direction.

In becoming more gestural and intuitive, these emerging controls are presenting product makers with valuable opportunities to create seamless, uninterrupted experiences.

Product makers need to carefully consider how they structure XR experiences, ensuring that object-based interfaces and gestural interactions don't distract from the important privacy choices people need to make. This could involve introducing deliberate friction at key moments, encouraging people to take the time to consider their data-sharing options, helping to instill trust and supporting people's long-term data education.

Questions for product and policymakers

- ☐ How might product makers leverage dimensionality in their privacy controls?
- ☐ How might platform providers and product makers work together to develop standard XR interaction patterns for privacy and transparency?
- ☐ What kind of objects and interactions are best suited to transparency, consent and control moments?

INSIGHT 5

Balance intuitive controls with deliberate friction

Singapore

XR UX privacy patterns

Privacy accessories

Watch the animation

DATA USED

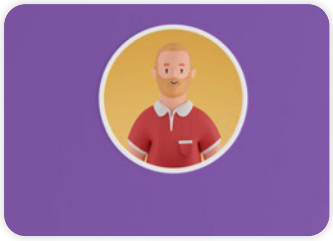
Facial, Motion, Voice

BENEFIT

Allows people to quickly update their privacy preferences as they move between contexts

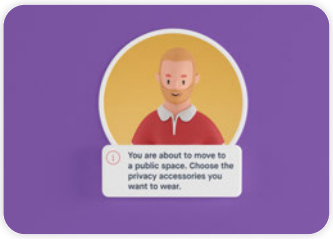
Privacy accessories could make data controls readily accessible for people via object-based interfaces.

Step 1



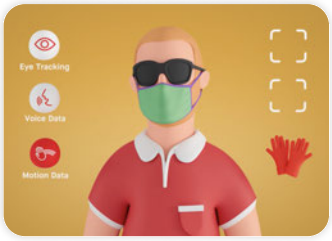
A person is in a private space.

Step 2



As they leave the space, a display indicates the data they are sharing and the privacy accessories available for each data type.

Step 3



They decide to put on a mask to disable voice data and a pair of sunglasses to disable facial data.

Description

The Privacy Accessories design pattern aims to make data controls readily accessible for people via an object-based interface. The objects function as persistent controls that allow people to intuitively toggle data-sharing on or off for different types of body-based data — sunglasses for eye-tracking, a face mask for facial data and gloves for hand-tracking.

Context

This pattern is based on the prototype developed by **My Meta Farm**, which focused on addressing people's concerns and mistrust over personal data capture. These concerns included issues such as the selling of data to third-party advertisers, the inference of emotions for advertising purposes and how their data might be used in the future. For an immersive product such as **My Meta Farm**, body-based data plays an important role in facilitating nuanced and embodied interactions that provide a strong sense of social presence — gaining people's trust and confidence are paramount to engagement and the creation of a compelling multi-user experience.

COMPANY SNAPSHOT

My Meta Farm is a metaverse world that provides a space for people to socialize, create and play games together.

INSIGHT 5

Balance intuitive controls with deliberate friction

South Korea

XR UX privacy patterns

Fine tuner

Watch the animation

DATA USED

Facial

BENEFIT

Provides the ability to give feedback on interpretations of body-based data

The **fine tuner** could allow people to adjust how their body-based data is being interpreted in context.

Step 1

The user sees an item they like.

Step 2

A notification displays the data type and the inference made.

Step 3

The user can change the inference if they feel it is incorrect.

Description

The Fine Tuner is designed for someone who wants to teach a system how to accurately read their data, ensuring interpretations are more precise in the future.

In this example, the system shows a visual representation of a person's emotional response during an experience. Inferring that the person likes the bicycle, the system shows a heart emoticon. The person disagrees with this interpretation, choosing another option that represents their feeling better — in this case a doubting face.

Context

This pattern is based on the solution developed by **Team Travel**, which explored different ways of providing transparency around the passive collection of body-based data. This included providing people with the ability to see inferences as they are made and confirm their accuracy.

Team Travel's solution was based on the needs of a persona visiting Japan's digital twin to plan an upcoming trip with his wife who relies on a wheelchair for mobility.

SCENARIO SNAPSHOT

Team Travel's scenario involved a real estate agent visiting a digital twin of Japan in VR to plan an upcoming trip with his wife who uses a wheelchair.

NB: This pattern extends the Live Emoticon pattern, which shows a visual representation of a person's reaction during an experience.

INSIGHT 5

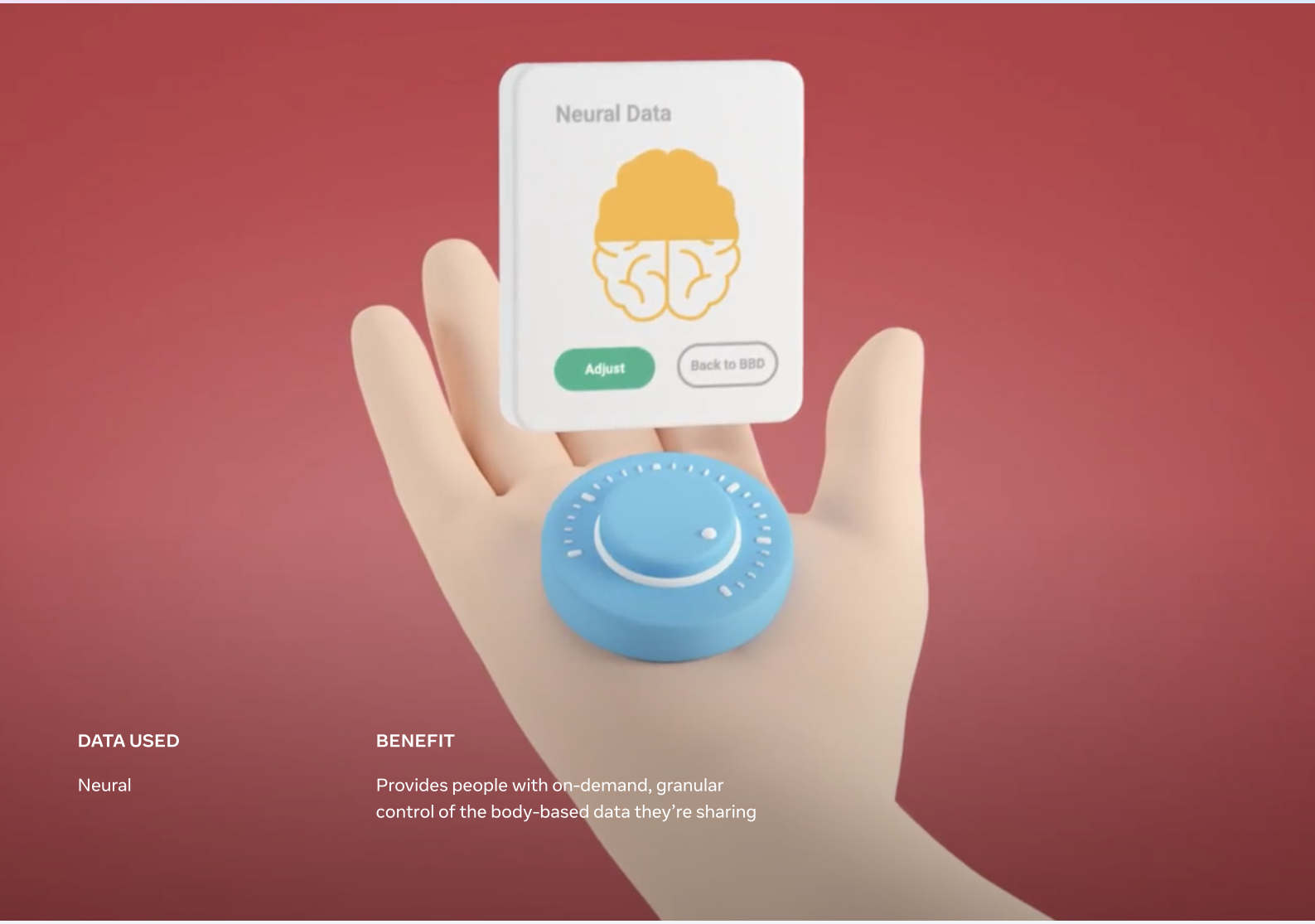
Balance intuitive controls with deliberate friction

South Korea

XR UX privacy patterns

Controls-at-hand

Watch the animation



DATA USED

Neural

BENEFIT

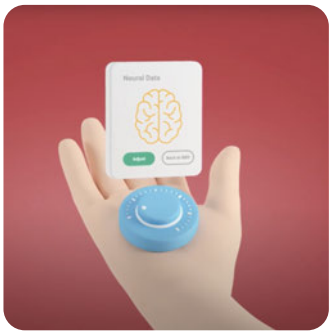
Provides people with on-demand, granular control of the body-based data they're sharing

The **controls-at-hand** pattern features a dial that enables people to adjust the amount of data they're sharing for particular data types.

Step 1

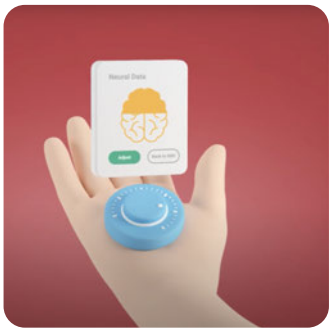
A person stares at their open palm for three seconds to make the data dial appear.

Step 2



Once it appears, they can use the dial to select the data type they want to adjust.

Step 3



They can then modify the amount of that data type they wish to share.

Description

The Controls-At-Hand pattern features a dial that people can access at any point in an experience. It is designed for someone who wants to control the data they share without interrupting an experience.

In this future-facing example, the system has been reading the person's neural data to gauge their interest levels and provide recommendations. The person doesn't want to reveal their full level of engagement, so they access the Controls-At-Hand dial to turn down the level of neural data they are sharing.

Context

The prototype created by **Team Entertainment**, on which this pattern is based, explored how to make body-based data easy to understand and control without causing too much friction to the overall experience.

The solution was based on the needs of a high-school graduate experiencing a music festival with AR glasses. He is not very knowledgeable about data privacy and wants to enjoy the experience without distractions.

SCENARIO SNAPSHOT

Team Entertainment's scenario centered on a high-school graduate wearing AR glasses to a music festival.

6 INSIGHT Leverage existing place-based norms

Privacy considerations are context-specific and can shift as people move from one location to another.

While the metaverse allows people to move seamlessly between different spaces and places, their privacy preferences don't always remain constant. They will necessarily be more comfortable sharing their data in some contexts than in others, depending on the types of experiences offered by different places and the way these experiences use their data.

Schools, hospitals and banks, for example, each have specific privacy expectations in terms of what people share and how they behave within them. As product makers recreate these places in XR, they should encourage mental models that link specific behaviors and expectations with these contexts as a way for people to take control of their privacy.

This could involve making the codes and conventions of different situations more explicit, clearly signaling shifts in social context and providing responsive controls that allow people to update their settings on-the-go.

This might also take the form of geo-fenced consents and controls, with data settings corresponding to different locations — providing people with privacy functionality even beyond what can be experienced in real life.

Questions for product and policymakers

- ☐ How might platform providers provide consistent privacy controls across a world, allowing people to adjust their privacy settings according to different places?
- ☐ How might product makers support these controls by signaling the social codes of different situations, including shifts in context, in a way that allows people to adjust their privacy settings quickly and intuitively?

INSIGHT 6

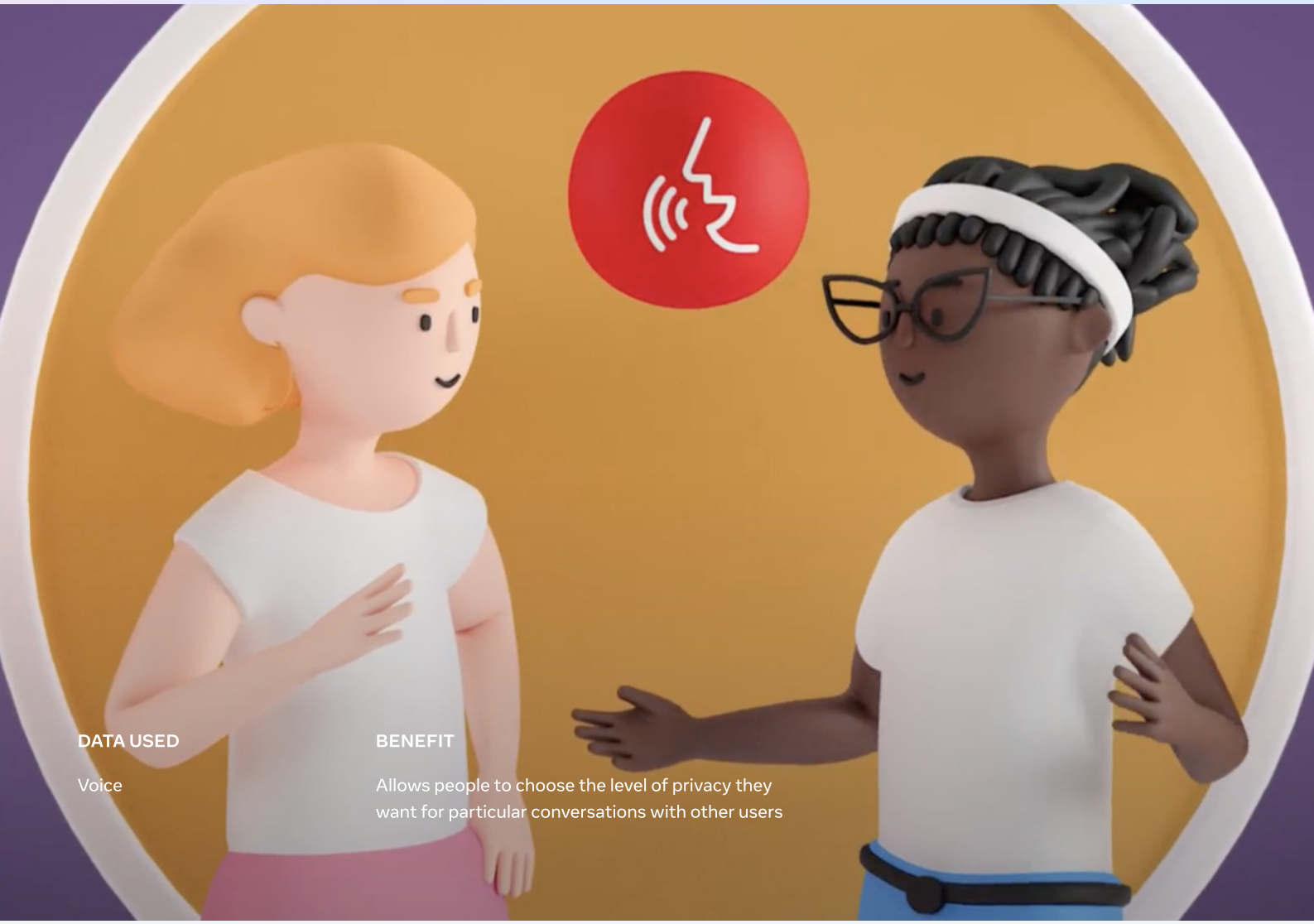
Leverage existing place-based norms

Singapore

XR UX privacy patterns

Sound bubble

Watch the animation



DATA USED

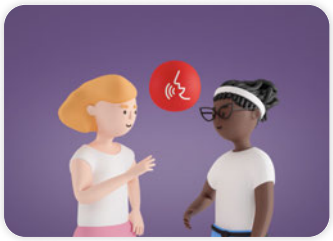
Voice

BENEFIT

Allows people to choose the level of privacy they want for particular conversations with other users

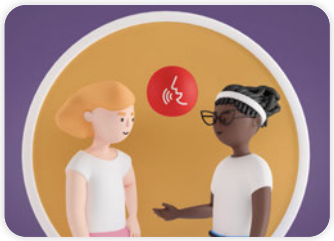
The **sound bubble** is an adjustable, color-coded boundary that can set the privacy level of a conversation within a public space.

Step 1



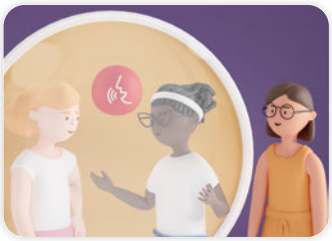
A person invites another user to an open conversation by creating a green sound bubble. The other person touches the bubble to accept.

Step 2



The green bubble surrounds both of them and they start having an open conversation that anyone can hear.

Step 3



As other people enter the space, they decide to change their conversation mode to private (a red bubble) so that the contents of their conversation cannot be overheard.

Description

The Sound Bubble pattern aims to provide people with the ability to set the privacy level of conversations they initiate or participate in. When starting a conversation, they choose the privacy level they want — open, closed or invisible — before extending an invitation to other users. At any point in the conversation, participants can update the privacy setting of the interaction, offering ongoing control over their privacy and creating peace of mind while talking to others in immersive spaces.

Context

Based on the privacy solution developed by **Smobler**, this pattern emerged from the need to address potential student concerns around the privacy of their conversations within a metaverse university social hub. These concerns included assumptions around data collection and the 'hidden-camera effect', a tendency for some people to suspect everything they say and do in XR is subject to capture and processing.

COMPANY SNAPSHOT

Smobler is a creative agency that develops metaverse worlds and experiences for businesses to engage their clients, including Aventis Metaverse, the world's first graduate school in the metaverse.

INSIGHT 6

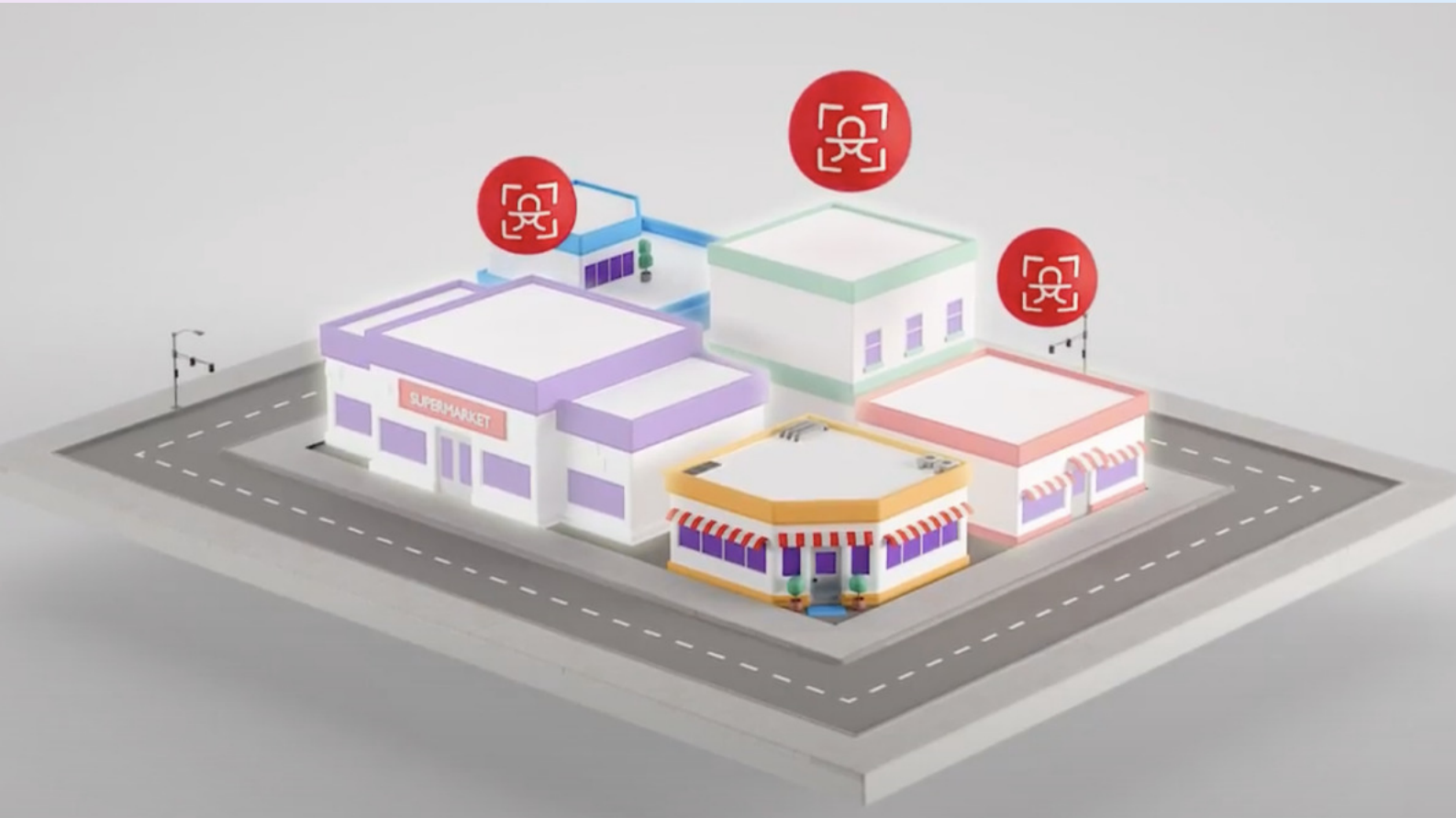
Leverage existing place-based norms

South Korea

XR UX privacy patterns

Permission map

Watch the animation



DATA USED

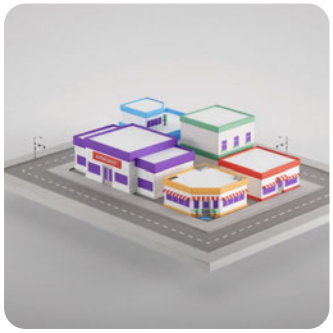
Facial, Voice, Vitals

BENEFIT

Allows people to define the body-based data types they share in different places and contexts

The **permission map** would allow people to see and modify the data types that can be accessed in specific locations.

Step 1



The Permission Map shows the different places where a person's body-based data can be collected.

Step 2

Specific data types are indicated by icons.

Step 3

People use the Permission Map to define which data types can be collected in which places.

Description

The Permission Map pattern proposes a digital geofencing approach to data-sharing, allowing people to establish consent presets for specific areas and contexts within metaverse experiences. People could use the pattern to see the body-based data types they are sharing in different locations, modifying their privacy settings based on type of place or for specific zones. For example, someone may wish to limit data access to specific retailers or trusted parties.

Context

Team Retail developed the prototype that forms the basis of this pattern. Their solution explored place and data collection — particularly the controls people might need when moving through spaces owned by different vendors or companies. To develop the pattern, the team focused on the needs of an influencer shopping with AR glasses.

COMPANY SNAPSHOT

Team Retail's scenario centered on the experience of an influencer shopping with AR glasses.

INSIGHT 6

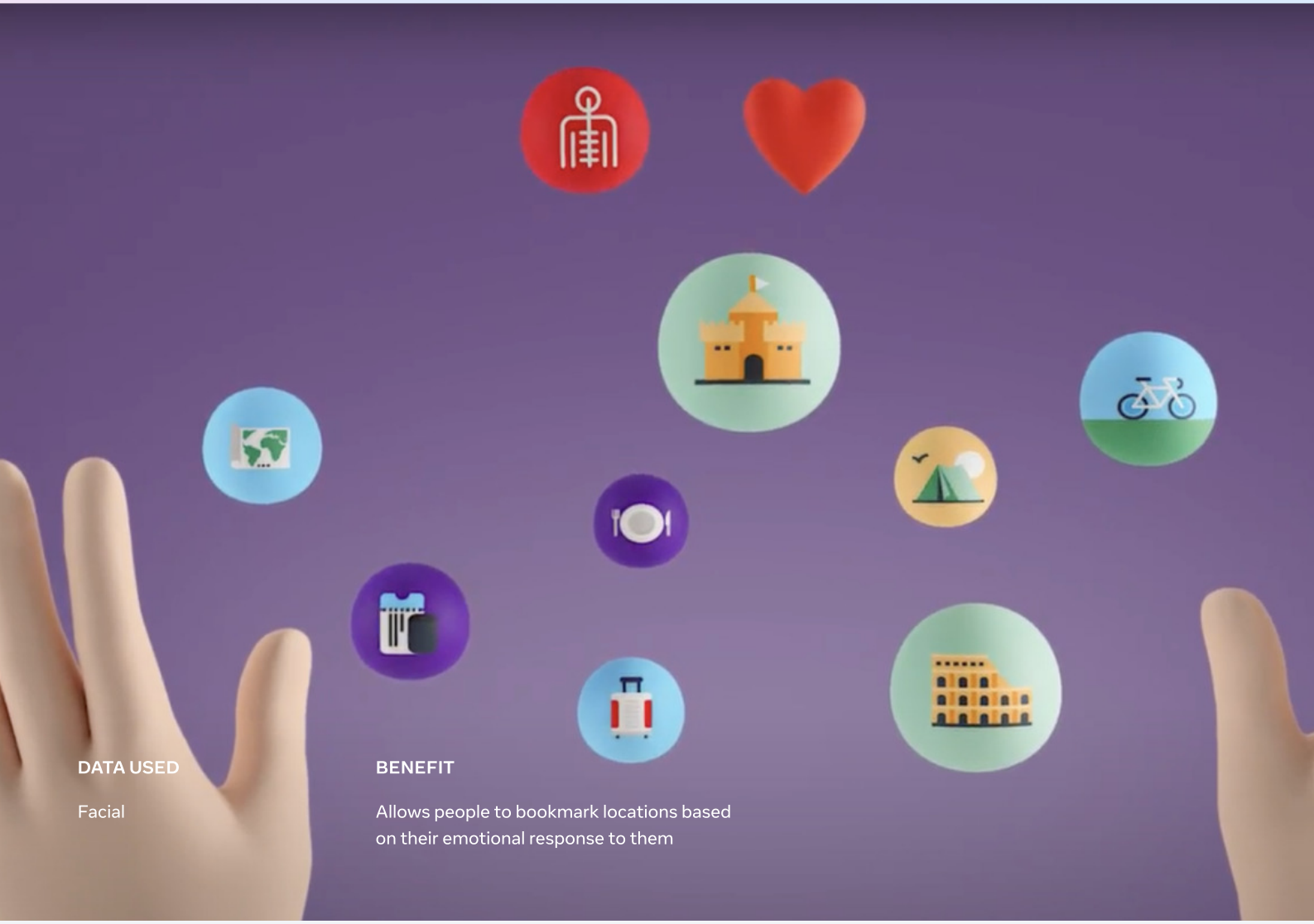
Leverage existing place-based norms

South Korea

XR UX privacy patterns

Landmarks

Watch the animation



DATA USED

Facial

BENEFIT

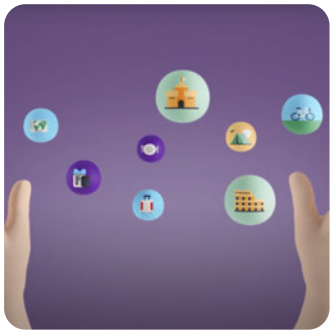
Allows people to bookmark locations based on their emotional response to them

The **landmarks** pattern features a map-based representation of places where a person has had particular emotional reactions.

Step 1

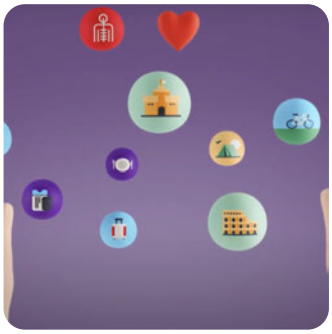
A person accesses the Landmarks feature by placing their hands in front of them, palms facing each other.

Step 2



They complete the gesture by sliding their hands open.

Step 3



This reveals all the places where positive reactions have been recorded.

Description

The Landmarks pattern is designed for people who want to have on-demand access to a record of places they have liked within an experience.

In this example, the system has been reading the person's facial data to recognize their positive reactions to places during an XR travel experience. The system saves these places as landmarks that the person can show or hide by performing a pre-defined hand gesture. This would give the person transparency about what data is being recorded about different locations.

Context

The prototype developed by **Team Travel**, which underpins this pattern, explored how simple gestures could be used to enable a person to easily access different features.

Their solution was based on the needs of a person with low technology and privacy savviness, leveraging body-based data to provide relevant recommendations and gesture-based controls to navigate their experience.

SCENARIO SNAPSHOT

Team Travel's scenario involved a real estate agent visiting a digital twin of Japan in VR to plan an upcoming trip with his wife who uses a wheelchair.

4 Next steps

Opportunities for further exploration

As XR technologies and capabilities advance, questions around how people share and control data in the metaverse are becoming increasingly important.

This report contributes to early efforts to explore these questions with people and work towards answers.

The insights presented in this report highlight key considerations for the sector around data privacy in XR experiences and the metaverse, while the design patterns provide initial guidance on the creation of transparency and consent moments in XR products and services.

There is still much to be understood, however, in terms of how people will interact with each other and digital objects in 3D experiences at scale. How will people most effectively learn and absorb information in these somatically and semantically rich environments? How will they interact with privacy controls and consent mechanisms in real-time social interactions?

The metaverse will only realize its full potential by becoming an open, interoperable, privacy-preserving space in which everyone can play, learn and work. Industry must lead the way in building cross-sectoral partnerships that engage with different groups and users, ensuring the needs and aspirations of all people are taken into account in the development of the metaverse.

Key opportunities for further research and focused inquiry

- Roundtable discussions and policy engagements to discuss these findings and their applicability in different regions and cultural contexts, incorporating feedback to inform future research engagements
- Developing the XR UX design patterns in this report to deploy and test them in real products[1]
- Further research on the relationship between data collection and people's awareness of these processes, including how this influences their perceptions of sensitivity and control in digital environments
- Developing and iterating best practices for the design of notifications and controls in the metaverse via consultation with product users and global experts
- Exploring the role of data education and ways people can become more informed about the use of data in the metaverse through channels outside of the immediate immersive experience

[1] Some of the companies that participated in the Singapore Accelerator this season have been developing their prototype designs as solutions within their existing products. We look forward to seeing the results of these endeavors and how their learnings may apply to other products and services.

5 Appendices

APPENDIX A

Tools and frameworks

This appendix documents the tools and frameworks developed to support the participants in the Singapore and South Korea programs.

These resources are included here as a reference for the research methodologies we deployed in each project and the co-design findings detailed in this report. Also presented here are our reflections and observations on their use in these projects.

We welcome the use of these tools and frameworks for research projects and by product makers designing data privacy interactions in XR products and services.

Used in both programs

Singapore-specific

South Korea-specific

FRAMEWORK

Body-based data types

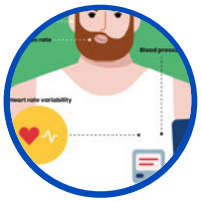
To explore data transparency, consent and control in XR and the metaverse, we developed the following taxonomy of body-based data types.

Facial

Facial data generally refers to the measurement and location of facial features, including the eyes

Motion

Motion data is created by capturing (or predicting) the movement of the body and hands



Vitals

Vital signs reflect essential body functions, including heartbeat, breathing rate, temperature and blood pressure

Neural

Neural data (also referred to as neuro data) has no agreed upon definition, but generally refers to data captured by measuring electrical signals between neurons in the nervous system, or proxies of this activity

Voice

Voice data captures a range of data unique to the voice such as tone and intonation, as well as the actual words spoken

Further detail on these data types is included in the **Body-Based Data Cards**.

FRAMEWORK

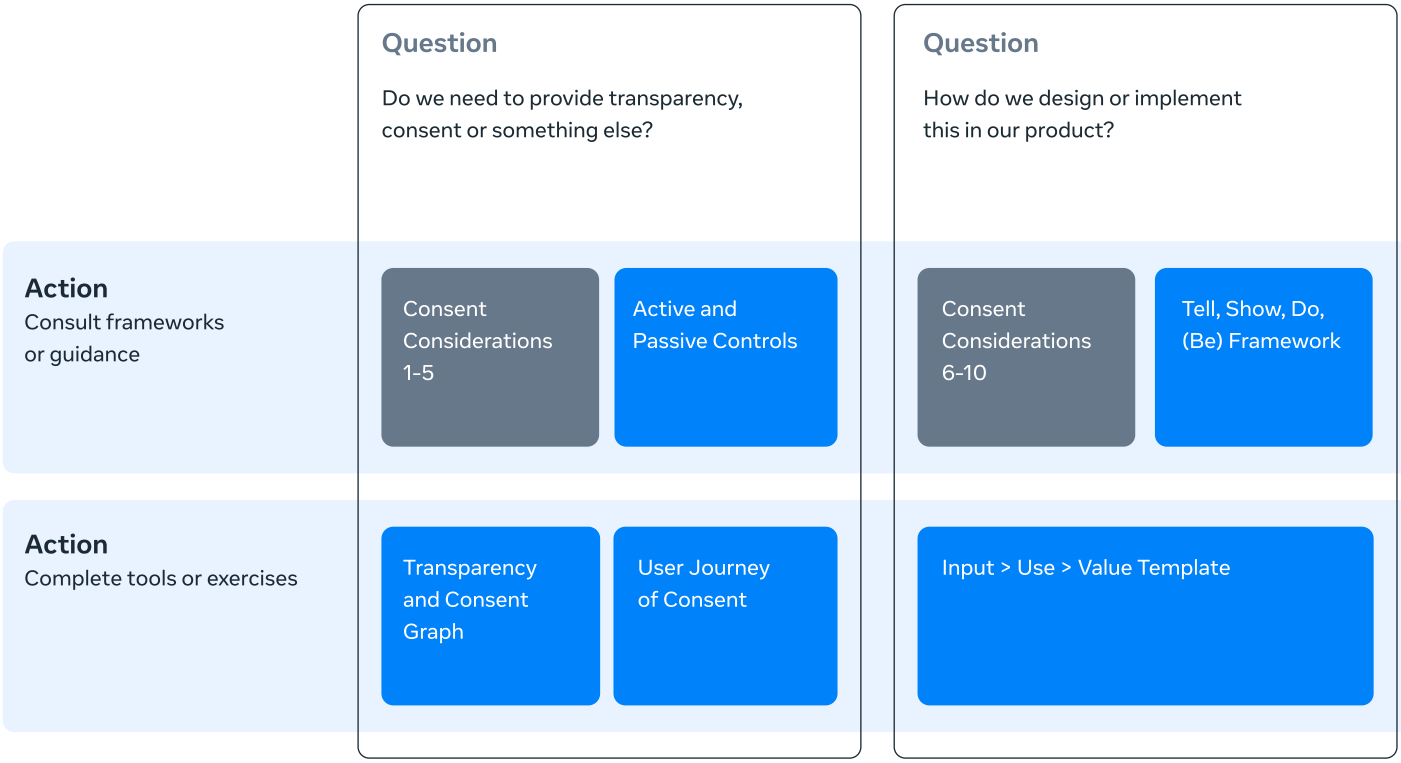
Consent framework flow

This flowchart shows how to apply the tools featured in this report in the product development process

FRAMEWORK

Consent framework table

This table shows the particular product development questions the tools in this report address



TOOL

XR prototyping kit

When it comes to prototyping, XR requires a different approach to two-dimensional, screen-based interfaces. Within a Design Jam, people require specific tools and methodologies to create embodied and immersive XR prototypes.

XR prototyping kit

To represent different interface elements and XR interactions, the XR prototyping kit includes a range of objects and materials, from cardboard and clear perspex to goggles, polystyrene shapes and a three-meter weather balloon. The purpose of this kit is to enable participants to move beyond a screen-based approach and think in three dimensions.

XR prototyping zone

An XR prototyping zone is a partitioned space for participants to prototype and bodystorm within, depicting the immediate surroundings of a person in an XR environment. Defining this space encourages participants to step away from 2D device-based experiences and into 3D spatially-based ones.

Capturing XR prototypes

Using items from the XR prototyping kit, participants should stage and capture their solutions in a video. This allows shows the interface from the perspective of the user while depicting 3D UI elements in time and space.

Things to include in an XR prototyping kit:

- **Transparent sheets** (A3 and A4 sizes) to depict UI elements in space
- **Colored sheets** to build flat or curved surfaces and objects
- **Safety glasses** or goggles to depict AR and VR headsets and devices
- **Styrofoam shapes** as object building blocks
- **Balloons** for spherical surfaces and objects
- **Dowels** for handles and levers
- **Blank A3/A4 paper**
- **Stationery** such as scissors, tape, glue, markers and pens

FRAMEWORK

Singapore

Input > use > value template

The Input > Use > Value Template supports product makers to clarify and rationalize the data they process.

While the core features of many emerging metaverse technologies rely on new data types, product makers still need to rationalize the data they collect from people.

This model provides a simple way to articulate data inputs and their uses, clearly identifying the value these uses create for people using a product — as distinct from the value derived by the product maker. With a focus on data minimization, the model encourages product makers to be targeted about the data they collect and process.

	Input	Use	Value to user	Value to product maker	Alternative inputs
EXPLANATION	What is the data input?	How is the data used?	What value does it give to the person sharing that data?	What value does it provide to the product maker?	Are there any alternative inputs that could be used instead?
EXAMPLE	*Eye-tracking is the input.*	*Eye-tracking is used to infer items of interest to the user.*	*Recommendations are tailored to the user's interests.*	*Increased user engagement with product.*	*Like button to assess interest.*

Use this framework in conjunction with the Consent Considerations

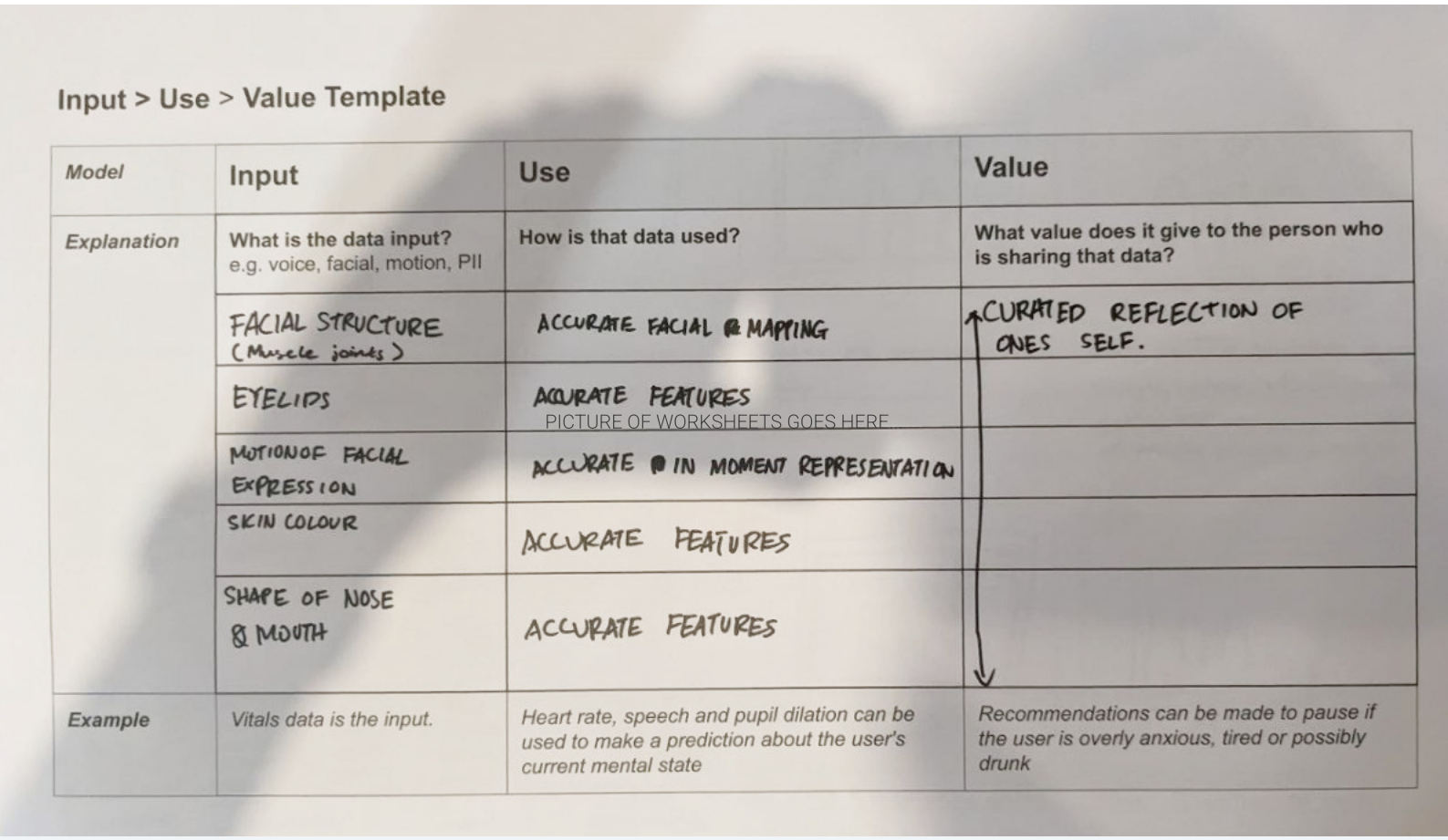
The Input > Use > Value Template can be useful when applying the Consent Considerations, in particular **Consent Consideration 3: Respect expectations**, assisting product makers in determining the consent moments required to address user expectations.

Singapore

The Input > Use > Value Template was used in the Singapore Design Jams to help participants consider and map the benefits of data processing.

Prior to the introduction of this framework, there was a tendency among the participating companies to opt for collecting all available data types in their proposed use cases. By considering the benefits to both the user and the business, participants were able to balance their hopes of future monetization against the risks of driving people away through excessive data collection.

Particularly with emerging and novel technology, people will err on the side of caution, moving away from products they perceive as having unjustified data collection practices. We found this template was particularly useful in assisting companies to clearly articulate the value of data processing and rationalize their collection practices. This led to discussions around privacy-centered alternatives using less sensitive inputs.



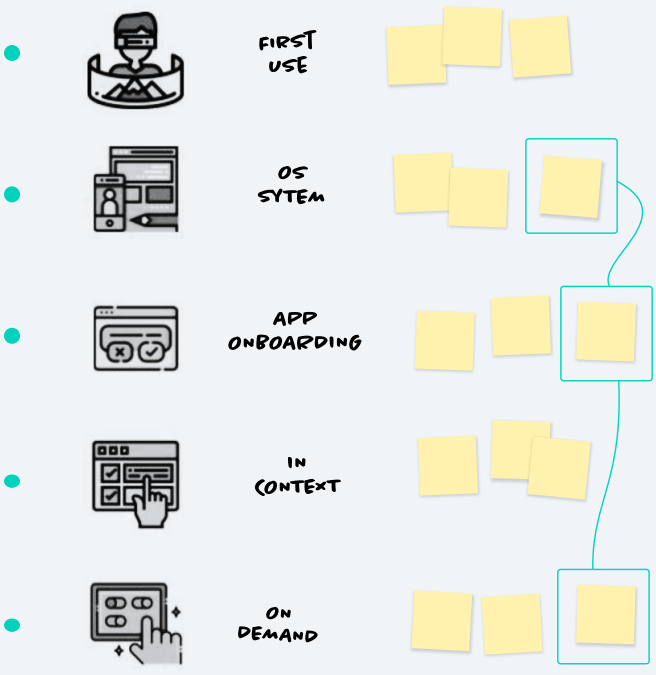
FRAMEWORK

Singapore

User journey of consent

The User Journey of Consent framework assists product makers and policymakers to map data-use notices across a user experience.

This model helps to determine the transparency, consent and control moments that might be useful to people at different stages of their experience. In mapping and visualizing the user journey, workshop participants are able to refine the flow of interactions and determine which consent mechanism, such as an onboarding tutorial or providing data-sharing controls, might be best suited to the product or service at a particular stage. This process can also help identify redundancies and unnecessary friction, fine-tuning and streamlining the user experience.



The User Journey of Consent is a simple way for workshop participants to consider the broader consent ecosystem in determining when to request permissions for different data types.

*See also **Analyze Transparency in Context** in the TTC Labs Toolkit*

Use this framework in conjunction with the Consent Considerations

In providing a framework with which to map consent moments throughout the user experience, the User Journey of Consent is a useful activity to complete when assessing the Consent Considerations, particularly **Consent Consideration 4: Be selective to support a journey**, where it can assist product makers to be selective regarding consent moments and avoid over-taxing the user.

Singapore

The User Journey of Consent framework helped Design Jam participants to re-think their approaches to consent, splitting out upfront permission requests to device first use, OS/system and in-context moments.

Building on previous Trust, Transparency and Control Labs work, the User Journey of Consent model introduced in the Design Jams extends the user journey from upfront, in-context and on-demand touchpoints to also include device first use and system level. This extension encouraged participants to consider the broader consent ecosystem, thinking through questions of interoperability, persistent permissions and context-specific consents. In doing so, it posed important questions about the potential roles and responsibilities of hardware makers, product makers and platform providers in the metaverse.

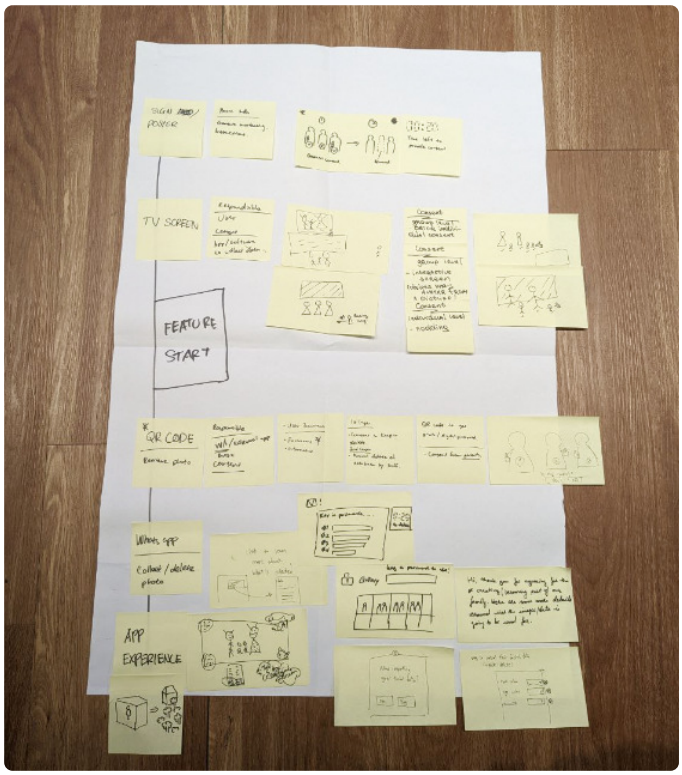
Prior to prototyping, participants were asked to visualize and plot consent responsibilities across different touchpoints, identifying data types, considering their value and locating them within the user journey.

In working through their use cases, participating companies were able to revise their approaches to data collection, transparency and consent. They split out upfront, clustered consent models and replaced them with an incremental, in-context approach.

This framework provides opportunities for product and policymakers to address questions of control, transparency and consent, including:

- Equipping **product makers** with an expanded user journey to identify potentially sensitive data types and develop appropriate consent mechanisms and controls

- Assisting **policymakers** to understand the responsibilities of other parties, in addition to product makers, such as hardware makers or platform providers, in promoting people-centric approaches to data transparency, consent and control.



FRAMEWORK

Singapore

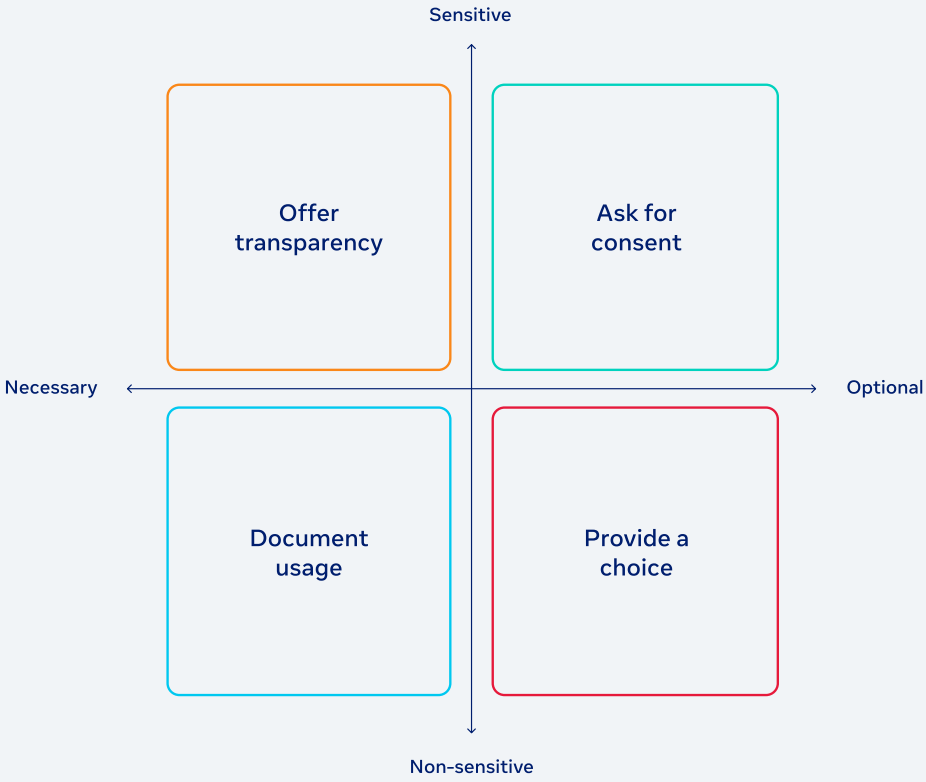
Transparency and consent graph

The Transparency and Consent Graph is a tool to consider the kinds of consent mechanisms that might best support people in their product journey: transparency, consent moments, controls and documentation.

This framework helps product makers assess data types and use cases for different transparency and consent scenarios.

Based on a particular use case or product feature, the tool allows product makers and policymakers to map data on scales of sensitivity and necessity, providing an indication of possible consent mechanisms for further exploration.

This brings issues of data sensitivity to the fore, encouraging consideration of the necessity of different data types and highlighting tensions and trade-offs in the process.



The Transparency and Consent Graph is a simple tool to assess potential consent mechanisms based on data sensitivity and necessity.

Consent Considerations

The Transparency and Consent Graph is a useful tool to identify opportunities for data minimization, particularly when applying **Consent Consideration 1: Reduce risk and minimize collection**, which focuses on mitigating privacy risk before seeking consent.

Throughout the Singapore Design Jams, the Transparency and Consent Graph was particularly useful for considering specific cases of data collection and use.

The framework was less useful for considering generalized data usage or data types in isolation (i.e. only for eye-tracking). This was especially so in a user journey where the same data types might be processed in different ways. This could result in a single data type being mapped to multiple quadrants of the graph, making it difficult to identify a corresponding consent mechanism.

The graph also proved effective when mapping definitive data types. It was harder to implement for decisions around inferential data, as one inference may consist of numerous data points, each with varying sensitivity.

TOOL

Singapore

Consent considerations

The Consent Considerations are an experimental framework, currently in development, which aims to support designers as they make decisions on data use.

These considerations have been developed from the outputs of previous Trust, Transparency and Control Labs Design Jams, synthesizing academic research, user experience research and global legal and regulatory frameworks. They summarize the questions and reflections of stakeholders, as captured in previous workshops.

One of our goals in Singapore was to test whether this type of framework could be useful for helping product makers think through when and how they might offer transparency, consent and control in their products. This process involved consultation with Singapore's Personal Data Protection Commission (PDPC) to consider how the framework can support Singapore's existing data protection guidelines.

These considerations will continue to be discussed and tested at further workshops.*

There are five Decision and five Design Considerations, with guidance for each provided on the following pages.

> **These considerations are not validated or endorsed by legal experts in any jurisdiction, and are not intended to be a source of legal guidance. They are simply a set of design statements aimed at prompting discussion and thought.*

Decision
To guide ***when*** you seek consent

1. Reduce risk and minimize collection

2. Build individual and community value

3. Respect expectations

4. Be selective to support a journey

5. Let people change their minds

Design
To guide ***how*** you seek consent

6. Ensure accessibility

7. Make consent requests with clarity

8. Be fair

9. Be consistent

10. Group thoughtfully

1. Reduce risk and minimize collection

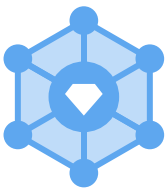
You should seek to eliminate or mitigate privacy risk, if possible, such as through data minimization, before turning to consent. Be responsible in your data practices and avoid burdening people with the obligation of privacy self-management. Consider your structural advantages and responsibilities.

Time limitation, privacy-enhancing technologies and use specificity all help to reduce privacy risk.

Identifying sensitive data types

The **Transparency and Consent Graph** allows individuals and teams to develop a shared understanding of data sensitivity and its necessity within a particular use case. The tool provides a framework for product makers to consider and rationalize data processing, and identify appropriate data minimization and consent strategies.

2. Build individual and community value



When people give data permission, it should be a value exchange. You should ask for data use when you think value is being created, and you should offer that value to the user.

Value can also be created at a group or community level. Community value includes safety, integrity, security (and more). In cases where significant community value is being created you may not need individual consents, particularly if they would damage that community value.*

**Depending on the legal jurisdiction, there may be other legal bases for processing data besides consent, such as Contractual Necessity. In Singapore, companies can consider leveraging deemed consent and exceptions to their consent obligations such as the Business Improvement Exception or Legitimate Interest Exception for consent management (where applicable). For more information, please refer to the PDPC's Advisory Guidelines on Key Concepts in the Personal Data Protection Act.*

3. Respect expectations

A consent moment might be needed where data processing is important but would be unexpected for an average user.

Identifying consent moments

The **Input > Use > Value Template** helps product makers to clarify and rationalize the data processing necessary for a product use case and determine the potential consent mechanisms required.

The impact of the identified consent moments on the user journey can be explored further and validated using the **User Journey of Consent** exercise.

4. Be selective to support a journey

Be discerning so as not to over-tax the user. Consider whether transparency, education, consent or controls are the best modality, and whether the right moment for each is upfront, in-context or on-demand.

Build long-term, positive relationships — don't just mitigate downside risk.

Mapping the user journey

To help determine the best approach to deliver consent moments at the right time, the **User Journey of Consent** framework can be utilized to map consent modalities over the user experience.
It is important for product makers to consider consent across the entire user journey to create a positive product experience and avoid overtaxing the user.

5. Let people change their minds

If you ask for consent, where practical and appropriate people should be able to change their minds to both rescind the consent and delete the data that's been collected.

People should have end-to-end control of their data relationship.

6. Ensure accessibility

Reflecting different levels of literacy, ensure that language and content design are accessible to the widest range of users. Limit complexity and express important information in the simplest way that would be comprehensible to non-experts.

Design with your users' contexts in mind, reflecting limits on time and screen space.

7. Make consent requests with clarity

Ask for consent explicitly and prominently, driven around a polar question. State the relevant uses of data.

Communicate the potential upsides and downsides of giving consent. Surface the most important information first and prominently, ensuring that people who have little time have the best opportunity to engage.

8. Be fair

Consent moments should describe benefits and outcomes fairly and present balanced options.

A consent mechanism should not use unnecessary confirmations or other types of friction which favor consenting over declining or dismissing. Consent moments should not assume the user intends to trigger a consent.

9.
Be consistent

Throughout a person's data relationship with a product, consistency and standards will support better experiences.

Use a consistent tone, language and visuals across consent moments and user experiences, explaining how choices can be managed or revisited later.

10.
Group thoughtfully

Collect consents in a way that makes sense to people, using their natural mental models. Group only when user control will be increased, not to obfuscate or cause 'consent fatigue'.

TOOL IN PRACTICE

Singapore

Validating the consent considerations

Participants in the Singapore Design Jams were asked to nominate the Consent Considerations that most informed or supported their prototypes.

5. Let people change their minds

7. Make consent requests with clarity

2. Build individual and community value

4. Be selective to support a journey

10. Group thoughtfully

The two most commonly selected Considerations were **Let people change their minds** and **Make consent requests with clarity.** The prevalence of these two considerations reflects the importance of user controls when designing for new body-based data types, ensuring people have the tools they need to provide — or revoke — consent at any time.

After some challenges interpreting and applying the Consent Considerations in the first Design Jam, all participant groups were able to identify considerations that were reflected in or which were used to inform the design of their solutions in the second Design Jam.

The next most commonly selected considerations were **Build individual and community value**, **Be selective to support a journey** and **Group thoughtfully**, which together point to the participants' collective regard for the user experience in informed consent. This includes questions around the value exchange inherent in someone providing their data, and the contemplation of consent as an iterative journey rather than a set of isolated moments.

Ultimately each group selected different considerations to inform or support their prototype solutions, with no two groups nominating the same considerations.

TOOL IN PRACTICE

Singapore

Using the consent considerations as a selective tool

The Singapore Design Jams validated the effectiveness of the Consent Considerations as a selective tool.

The companies and external experts participating in the Singapore project were all able to take a selective approach to the Consent Considerations, quickly identifying the considerations that supported or informed their prototypes.

This kind of approach potentially allows the Consent Considerations to have the most impact, without product makers getting stuck on considerations they don't fully understand how to apply.

This approach also avoids making the application of the considerations an onerous or box-checking exercise. By contemplating the considerations in a non-prescriptive manner, product makers can draw on different considerations in different situations, selecting those most appropriate to their use case, the data types they're collecting and the information their users need to make an informed decision in that moment.

However, this approach limits the use of the considerations in a systematic or comprehensive fashion, including as a tool for auditing transparency and consent touchpoints.

FRAMEWORK

Singapore

Active and passive controls

Making a distinction between active and passive controls allows us to consider the implications of passive inputs on transparency and consent.

Data types such as vitals and eye movements create the potential for adaptive experiences that can respond to passive or unconscious inputs. Whereas active controls require someone to make a conscious decision in a given moment, passive controls are more indirect. They might include changes to an experience in response to someone's behavior or what a product can infer from someone's data. Rather than seeking consent to make these actions every time, a product might rely on a persistent consent provided in advance to enable passive controls.

Example	Give thumbs up to confirm purchase 	Provide soothing music when someone is experiencing anxiety 
Model	Active controls	Passive controls
Explanation	Active controls require an action to accept, decline or clarify something being done	Passive controls happen through inferences or thresholds, with action taken without the active confirmation of the person sharing that data

This framework assists product makers and policymakers to better understand the novel and embodied dimensions of metaverse experiences.

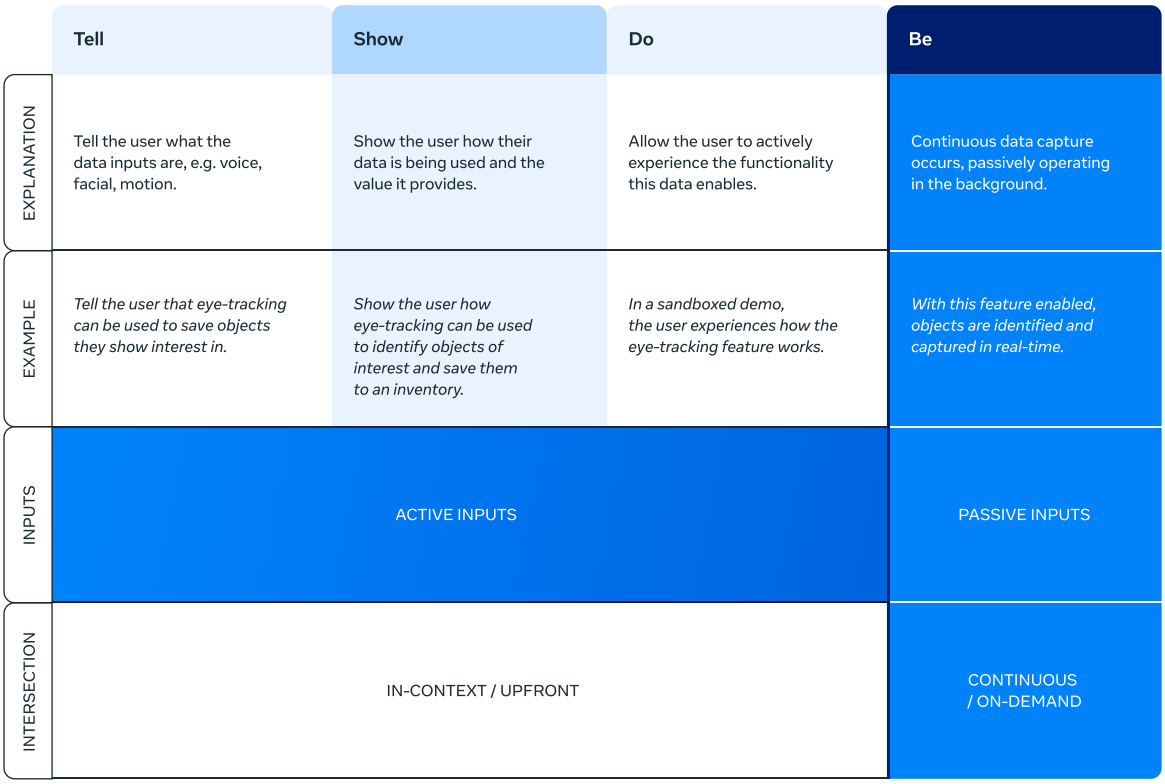
FRAMEWORK

Singapore

Tell, show, do, (be)

The Tell, Show, Do, (Be) framework illustrates different approaches product makers can adopt to inform people about body-based data privacy.

These approaches align with changes a product makes in response to someone's conscious, active inputs (active controls) and passive inputs (passive controls), as described in the **Active and Passive Controls framework**, helping people understand data use in context.



FRAMEWORK

Singapore

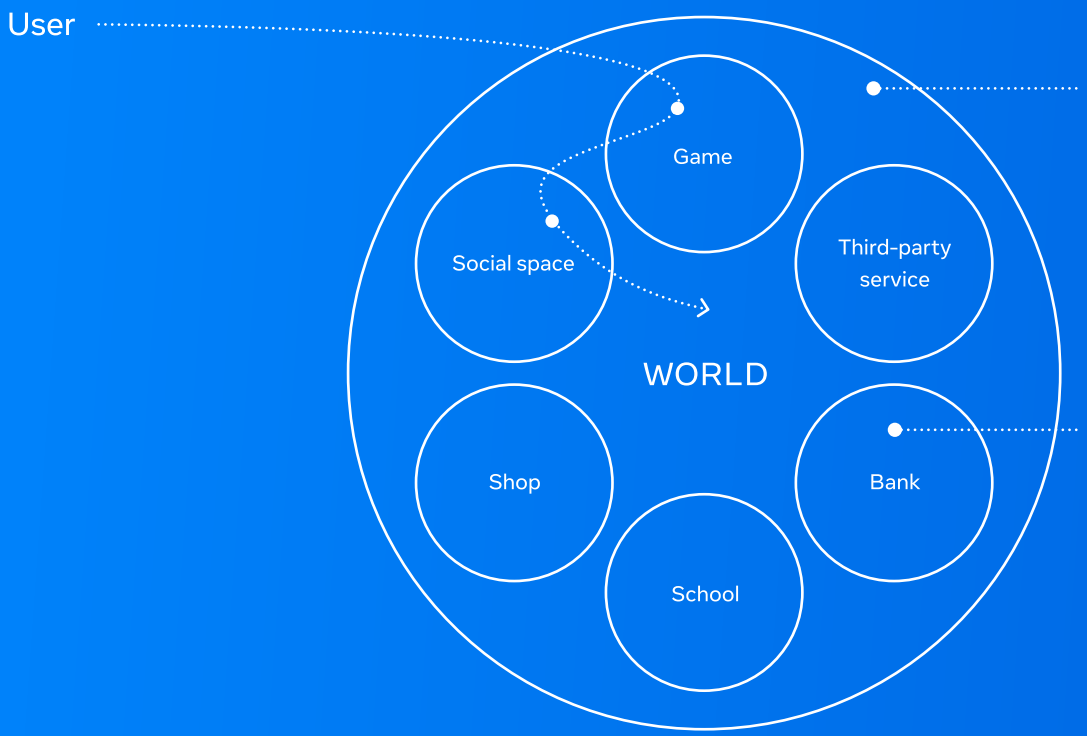
Consent contexts: Worlds and places

People don't necessarily want to share the same data in all contexts — they may want to adjust their settings as they move between contexts, interactions and experiences.

This Consent Contexts diagram is a way to visualize the two main contextual layers in the metaverse: the world (platform) and the place (product). While people may move seamlessly between these layers, their consent may not transfer with them.

To support people with appropriate privacy controls for specific places, product makers can provide prompts that make data-use clear for their individual contexts.

At the world level, platform providers may need to rely more heavily on upfront consents to avoid constant prompts and notifications. This approach supports good user experiences, but can inadvertently reinforce the hidden camera effect: the concern that people are being watched and surveilled. Operating on an absence of confirmation to the contrary — people assume they're being watched unless they're told otherwise — the hidden camera effect can have a negative impact on people's comfort levels and the data they're willing to share.



World: The platform, such as Horizons or Decentraland

Place: Individual places or contexts within the world. These can be third-party products located within a platform or distinct spaces and experiences within a product.

This framework assists product makers and policymakers to better understand the novel and embodied dimensions of metaverse experiences.

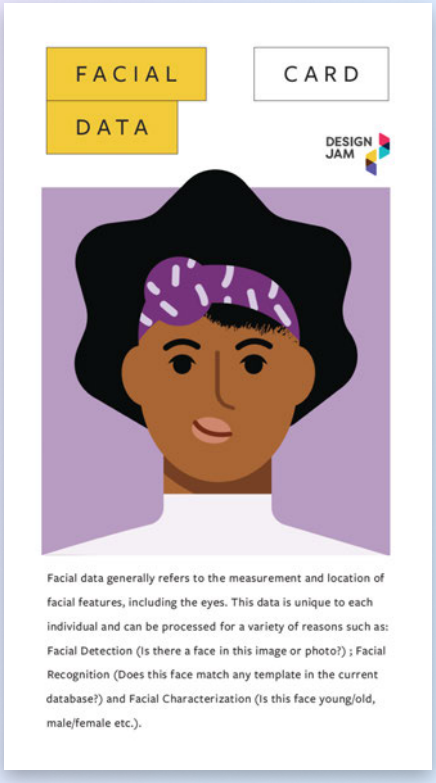
TOOL

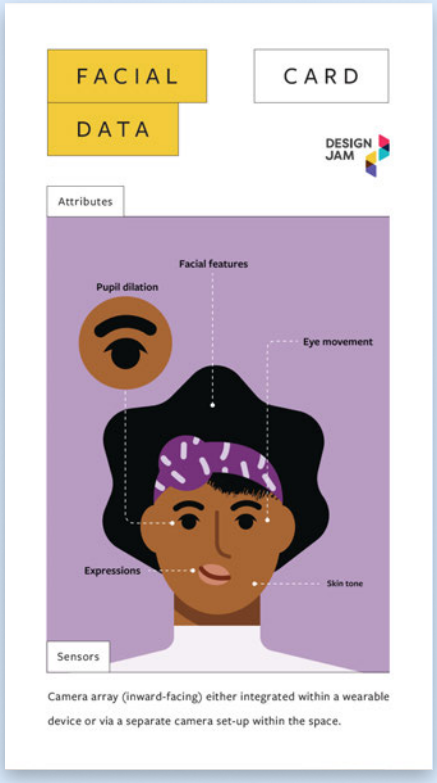
South Korea

Body-based data cards

The Body-Based Data Cards provide an overview of the five main body-generated data types used by XR technologies: facial, motion, vitals, neural and voice.

Body-based data is an evolving set of inputs that are still in their infancy and require a vastly different approach than more conventional types of data. To help people understand the breadth and capability of body-based data, these Body-Based Data Cards present an easy-to-grasp taxonomy that breaks data into five overarching groups. These cards can be introduced at the beginning of Design Jams or co-design workshops to help build a foundational understanding of the novel data types central to embodied XR experiences.





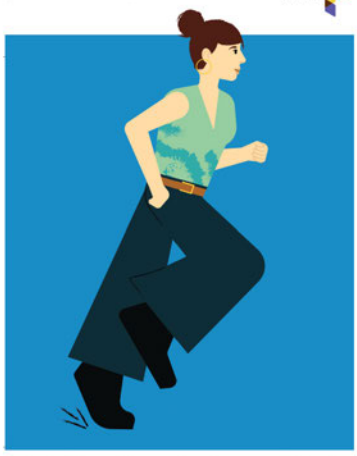
TOOL

Body-Based Data Cards

South Korea

MOTION DATA CARD

DESIGN JAM



Motion data is created by capturing the movement of the body and hands using both camera arrays within wearable devices and sensors placed within these devices. This data can be used to reconstruct the particular gait of an individual or to record hand gestures and movement.

MOTION DATA CARD

DESIGN JAM

Attributes

Sensors

Cameras (inward-facing, integrated or separate to wearable device), Hand Sensors, Accelerometer Gyroscope

VITALS DATA CARD

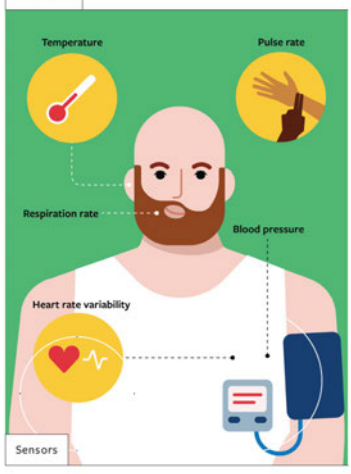
DESIGN JAM

Vital signs reflect essential body functions, including your heartbeat, breathing rate, temperature, and blood pressure. These can be measured by devices worn on the body to deliver accurate measurements from sensors placed against the skin via form factors such as necklaces, watches and headbands.

VITALS DATA CARD

DESIGN JAM

Attributes



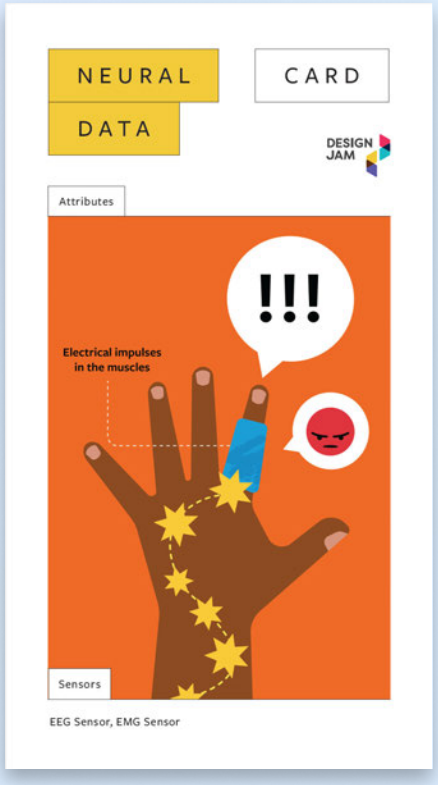
Sensors

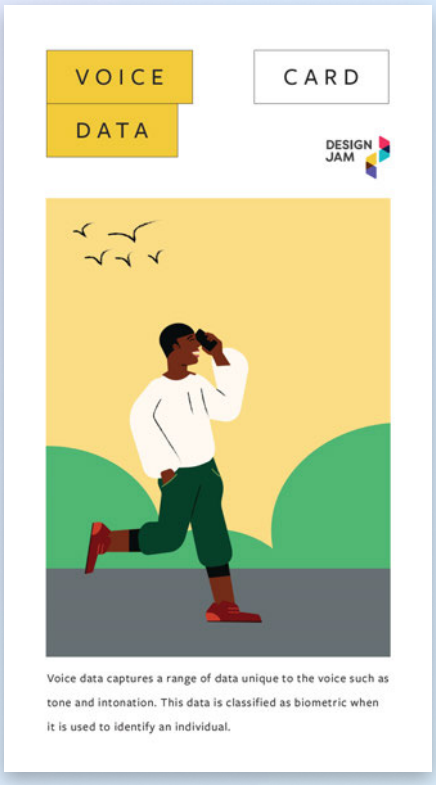
Blood pressure sensor, Thermometer

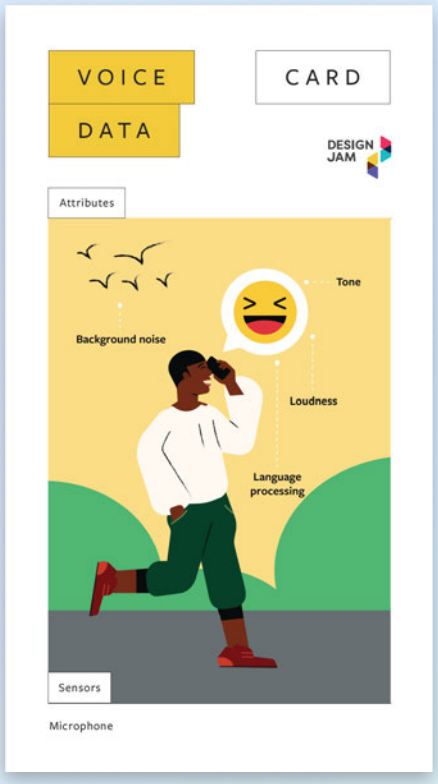
TOOL

Body-Based Data Cards

South Korea







TOOL

South Korea

XR scenarios

Viewed and experienced in VR, these scenarios help people establish a foundational understanding of the differing contexts and needs within XR experiences.

Developed for the Body-Based Data in XR project, these scenarios have a broad application across different metaverse contexts. They were specifically created to be used in conjunction with the **XR personas** detailed elsewhere in this Appendix.

Education

This scenario takes place in a virtual library. It is paired with the persona of a busy mother using VR to take a professional development course. She is somewhat skeptical of technology and prefers not to share her data.

Live Entertainment

This scenario details the experience of a high school graduate attending a music festival while wearing AR glasses. He does not know much about data privacy and wants an enjoyable, distraction-free experience.

Shopping

This scenario details the experience of an influencer while shopping with AR glasses. She has a good understanding of data privacy and is interested in benefiting from body-based data while keeping that data secure.

Travel

This scenario details the experience of a real estate agent who visits a digital twin of Japan in VR to plan an upcoming trip with his wife, a wheelchair user. He has low technology and privacy savviness.

TOOL

South Korea

XR personas

The personas on the following pages provide product makers with the opportunity to better understand the needs of different people and their feelings and concerns around body-based data and privacy.

This set was developed for use within a South Korean context, providing a culturally nuanced insight into the motivations and backgrounds of different users. They were specifically created to be used in conjunction with the **XR scenarios** detailed elsewhere in this Appendix.

Choi Gyeong-hee (42)

Mother and financial services administrator

DESIGN JAM

"I'd like to progress in my career while being able to work from home."

Scenario: Learning and education

Gyeong-hee is a single mother who lives in Oncheon-dong, Dongnae-gu, Busan with her 12 year-old son, 10 year old daughter, and her mother. She works in admin at a financial adviser's firm and wants to learn new skills that can help her become a financial adviser in the future. Her mother used to care for the children while Gyeong-hee was at work, but this is no longer feasible as she is getting old. When Gyeong-hee is done with her study, she wants to establish her own consulting studio and work online.

XR experience	Belief on privacy
XR devices VR headset. **Experience** She has proactively learned about XR devices to make sure her children are safe when navigating the virtual world. She now enjoys using her VR headset for work, online shopping and learning new skills.	"I'm very worried about others seeing data from me and my family, that's why I've turned on all the privacy settings in our devices."

Privacy savviness		
low	med	**high**
Tech savviness		
low	**med**	high

DESIGN JAM

Scenario: Learning and education

Gyeong-hee is interested in taking a professional development course on financial planning via a study room in VR. Before the course begins, she takes a quiz that is able to assess her knowledge. Based on the quiz, the materials in the space are updated to match the results of her assessment.

As Gyeong-hee completes certain materials, new materials show up for her to go through. At times she finds some materials difficult, and the system adjusts by providing new or different material to support her learning.

At one point, the system recommends that Gyeong-hee meet with an instructor regarding some material that she is finding difficult. She meets the instructor in VR to get guidance and recommendations on other materials.

Later, the system recommends a study group for Gyeong-hee to join in VR. This group was created by the system based on what it has observed from each person's learning experiences so they can study best together. Over the coming weeks, Gyeong-hee meets regularly with her study group in VR, and her progress in the materials start to improve over time.

Once ready, Gyeong-hee takes the exam for the most recent module in VR. She ends up passing and is able to move on to the next module.

Body-Based Data Utilized

FACIAL	MOTION	NEURAL	VITALS
Facial data generally refers to the measurement and location of facial features, including the eyes. This data is unique to each individual and can be processed for a variety of reasons such as: Facial Detection (is there a face in this image or photo?) ; Facial Recognition (does this face match any template in the current database?) and Facial Characterization (is this face young/old, male/female etc.).	Motion data is created by capturing the movement of the body and hands using both camera arrays within wearable devices and sensors placed within these devices. This data can be used to reconstruct the particular gait of an individual or to record hand gestures and movement.	Neural data (also refered to as "neuro data") is captured through measuring electrical signals between neurons in the nervous system, or proxies of this activity. Information is acquired and processed via devices such as Brain-Computer Interfaces (BCIs) which could be inserted either inside or on the head (invasive or non-invasive) or Nervous-System Sensors such as Electromyography (EMG) devices which could be worn as wristbands.	Vital signs reflect essential body functions, including your heartbeat, breathing rate, temperature, and blood pressure. These can be measured by devices worn on the body to deliver accurate measurements from sensors placed against the skin via form factors such as necklaces, watches and headbands.

TOOL

XR personas

South Korea

Jang Jia (24)

Psychology student and influencer

DESIGN JAM

"I wonder if I can have a job that's different from my parents' corporate jobs. I want to start my own business but I'm not sure what it'll take."

Scenario: Retail

Jia is in her final year of social psychology at Sookmyung Women's University and works as an intern in behavioral economics at a fashion boutique. Recently, she started using XR to create beauty and fashion posts and she's also consented to represent brand products in different ways. This has helped her gain many new followers in just a few weeks. She's looking to increase her visibility and maybe start her own business as a fashion influencer.

XR experience	Belief on privacy
XR devices Newish versions of AR and VR devices. **Experience** She's experienced in using XR devices to study, socialize and create fashion and beauty content.	"I'm concerned that if I get a lot of new followers, my private information might not stay safe."

Privacy savviness		
low	med	high

Tech savviness		
low	med	high

DESIGN JAM

Scenario: Retail

Jia is doing real-world shopping with her AR glasses. At the shopping centre, she lets the AR system know that she is looking for a new pair of shoes. She also notes that she is open to recommendations of anything similar or complementary to that.

On the way to the sneaker shop, Jia sees a clothing shop highlighted to her. She stops there to look at different clothing. The AR glasses show different information on the clothes she interested in. Jia steps in front of a smart mirror to see what different recommended clothing might look like without having to try them on. She ends up making a couple of purchases to be collected later.

Jia then heads to a sporting goods store. The AR glasses notice that she is interested in roller skates, and highlights a pair that is in her size. She tries them on and the AR glasses indicate how good of a fit they are. She purchases a pair that she likes, again to be collected later.

Now done shopping, the AR glasses lead Jia to a collection area of the shopping centre, which is filled with different sized lockers. The AR glasses highlight and unlock the locker containing her purchases. The AR glasses show an overview of her purchases, which she collects and then leaves the mall.

Body-Based Data Utilized

FACIAL	MOTION
Facial data generally refers to the measurement and location of facial features, including the eyes. This data is unique to each individual and can be processed for a variety of reasons such as: Facial Detection (is there a face in this image or photo?); Facial Recognition (does this face match any template in the current database?) and Facial Characterization (is this face young/old, male/female etc.).	Motion data is created by capturing the movement of the body and hands using both camera arrays within wearable devices and sensors placed within these devices. This data can be used to reconstruct the particular gait of an individual or to record hand gestures and movement.

Yoon Jin-Hyung (56)

Real estate agent and avid traveller

DESIGN JAM

"I hope my wife and I can continue visiting new places and enjoying new experiences. I can't wait to be in a new place again."

Scenario: Travel

Jin-Hyung owns a real estate agency in Beakun-dong, Nam-gu, Gwangju where he lives with his wife. They love traveling, but haven't been able to do it as often in recent years because of an accident that had left his wife with a life-changing spinal injury. She now relies on a wheelchair for mobility.

XR experience	Belief on privacy
XR devices Uses a borrowed VR headset. **Experience** Doesn't have a lot of experience but heard that he could have a better travel experience if he uses cities' digital twins.	"This is my first time using XR technologies. I'm wondering if they can take our data and use it without us knowing."

Privacy savviness		
low	med	high

Tech savviness		
low	med	high

DESIGN JAM

Scenario: Travel

Jin-Hyung is planning a holiday to Japan and wants to visit a digital twin of the city he is interested in to explore, book accommodation and plan his time. He visits this Japanese city via virtual reality.

As Jin-Hyung explores, the system notices him straining to read text on a poster, and makes adjustments to help his visibility. The system also registers, based on his facial expressions, things he is interested in, like a rental car. Based on this, and detecting Jin-Hyung's age, the system recommends a nearby car rental with a special for people aged 55 and over.

While walking down a certain street, Jin-Hyung asks the system for any available apartments he and his wife could stay at in the area. The system highlights one, Jin-Hyung takes a tour of the place and decides to book it.

Later, Jin-Hyung finds a temple and explores it. The system, noting his strained movement, provides an accessibility assessment of the temple.

Once Jin-Hyung has finished exploring, he is presented with a summary of his places of interest as an itinerary for the trip.

Body-Based Data Utilized

FACIAL	MOTION	VITALS	VOICE
Facial data generally refers to the measurement and location of facial features, including the eyes. This data is unique to each individual and can be processed for a variety of reasons such as: Facial Detection (is there a face in this image or photo?); Facial Recognition (does this face match any template in the current database?) and Facial Characterization (is this face young/old, male/female etc.).	Motion data is created by capturing the movement of the body and hands using both camera arrays within wearable devices and sensors placed within these devices. This data can be used to reconstruct the particular gait of an individual or to record hand gestures and movement.	Vital signs reflect essential body functions, including your heartbeat, breathing rate, temperature, and blood pressure. These can be measured by devices worn on the body to deliver accurate measurements from sensors placed against the skin via form factors such as necklaces, watches zand headbands.	Voice data captures a range of data unique to the voice such as tone and intonation. This data is classified as biometric when it is used to identify an individual.

TOOL

XR personas

South Korea

Kim Jihoon (18)

High school graduate, aspiring AR content creator

DESIGN JAM

"My friends and I enjoy trying new experiences together. We all have AR glasses now and want to use them to enjoy the places we visit in a different way."

Scenario: Entertainment

Jihoon lives in Sangam-dong, Mapo-gu, Seoul with his parents and his little sister. He just finished high-school and is going to start a course in interior design. His parents just gave him the latest AR glasses. He's been seeing how other people connect their social media to XR experiences at the places and events where they go and is excited about starting to create his own AR content when he hangs out with his friends.

XR experience	Belief on privacy
XR devices Latest AR glasses, family VR headset. **Experience** He's new to having his own devices without parental supervision.	"Privacy is something only old people worry about."

Privacy savviness		
low	med	high

Tech savviness		
low	med	high

DESIGN JAM

Scenario: Entertainment

Jihoon and his friends attend a real-life music festival while wearing their AR glasses. As a VIP attendee, the AR glasses will give him access to a range of special areas and show him special content throughout the festival. Jihoon learned about the AR-enhanced music festival through social media and after getting tickets with his friends, created a group in which they could share messages, photos, videos, and their location during the event.

Based on Jihoon's current mood, the AR glasses suggest a music act he might like, and provides directions to it. As Jihoon watches the show, the AR glasses note that the music act has some special bonus content to accompany the performance. He selects to see the bonus content during the show and shares it on his social media.

After some time, the AR glasses notice that Jihoon appears to be a bit fatigued and hungry. It suggests that he take a short break to relax and get something to eat. Jihoon is provided directions to a rest area. There, he buys some food and takes a break.

Based on the music that Jihoon has been enjoying, the AR glasses provide further recommendations, letting him know where and when they are playing.

Whilst watching another band, the AR glasses notify Jihoon that some of his friends are nearby, and asks if it is OK to share their location so he can be found.

Body-Based Data Utilized

FACIAL	MOTION	NEURAL	VITALS
Facial data generally refers to the measurement and location of facial features, including the eyes. This data is unique to each individual and can be processed for a variety of reasons such as: Facial Detection (Is there a face in this image or photo?) ; Facial Recognition (Does this face match any template in the current database?) and Facial Characterization (Is this face young/old, male/female etc.).	Motion data is created by capturing the movement of the body and hands using both camera arrays within wearable devices and sensors placed within these devices. This data can be used to reconstruct the particular gait of an individual or to record hand gestures and movement.	Neural data (also refered to as "neuro data") is captured through measuring electrical signals between neurons in the nervous system, or proxies of this activity. Information is acquired and processed via devices such as Brain-Computer Interfaces (BCIs) which could be inserted either inside or on the head (invasive or non-invasive) or Nervous-System Sensors such as Electromyography (EMG) devices which could be worn as wristbands.	Vital signs reflect essential body functions, including your heartbeat, breathing rate, temperature, and blood pressure. These can be measured by devices worn on the body to deliver accurate measurements from sensors placed against the skin via form factors such as necklaces, watches and headbands.

APPENDIX B

Organizations, partners and participants

About Trust, Transparency and Control Labs

Initiated and supported by Meta, Trust, Transparency and Control Labs drives collaboration between policymakers, privacy experts and technologists through design thinking.

Meta

We build trust, and we advocate for transparency and control, for Meta platforms and for digital services around the world. Our aim is to focus on what people across the globe need, want and require from technology. We need to keep working together to develop a scalable approach to building trust, transparency and control into data-driven products and services. Our vision is to create meaningful relationships between people and data that are sustainable and equitable for all.

To date, Trust, Transparency and Control Labs has brought together more than 300 industry and design companies as well as 200 policy, academic and civil society organizations globally to tackle shared challenges.

These challenges include notification and consent, explaining data concepts to different audiences, algorithmic transparency, AI explainability, privacy and digital literacy, augmented and virtual reality, and designing for young people.

Trust, Transparency and Control Labs creates materials that anyone can use, adapt and replicate. We publish design solutions and reports that synthesize learnings and insights from co-creation workshops called Design Jams, enabling the wider community to collaborate on shared challenges. We develop interactive exercises and visual explainers to support understanding and exploration. And we share our open-source **Toolkit** to support designers and practitioners.

Together with our network of design partners, including expert agencies operating in key regions around the world, we actively foster collaboration and innovation in order to speculate on potential solutions and future-facing approaches to driving digital trust, transparency and control.

Project partners

The Infocomm Media Development Authority (IMDA) and Personal Data Protection Commission (PDPC) develop and regulate the infocomm and media sectors in Singapore.

Taking a holistic approach to regulating these converging sectors, the IMDA and PDPC have created a dynamic and exciting sector filled with opportunities for growth through an emphasis on talent, research, innovation and enterprise.

The Artificial Intelligence Institute (AIIS) is South Korea's largest innovation center dedicated to AI research.

Established in 2019, AIIS leads and supports AI-related research at Seoul National University (SNU), facilitating collaboration across diverse academic disciplines and industry.

Craig Walker designs and researches for the world's leading organizations.

Based in Australia and Singapore, Craig Walker partnered with Trust, Transparency and Control Labs to plan, design and facilitate the fourth season of the APAC Data and Privacy Accelerator in Singapore and the Body-Based Data Privacy in XR project in South Korea.

Additional delivery partners

Wow.D Lab is a Seoul-based agency focused on enabling companies with mindsets and skills related to design thinking.

One of our local collaborators for the Body-Based Data Privacy in XR project, Wow.D provided essential set-up and delivery support on the ground.

Translating and facilitating the Design Jam agenda, activities and supporting assets in Korean, the Wow.D team was invaluable in enabling the participation of SNU academics and students and ensuring we learnt as much as possible through this engagement.

Scenery of Today is a graphic design studio and publisher.

Based in Seoul, Scenery of Today helped develop and translate the materials for the Body-Based Data Privacy in XR Design Jam.

This included commissioning illustrator and cartoonist Hanna Something to create the graphics for the South Korean Body-Based Data Cards.

Agency is a strategic human-centered design practice that guides companies through their innovation journey.

Agency provided expert facilitation support for the second Design Jam for Data Transparency and Control in the Metaverse in Singapore.

Participating companies

Singapore

Data transparency and control in the metaverse

Seven APAC-based companies were involved in this project. Following the theme of data transparency and control in the metaverse, each of these companies is engaged in the development of XR products and services, with the ambition and aspiration to further leverage these in the metaverse in the years to come.

These companies were joined by external privacy experts from academia, government and industry.

Bizverse (Vietnam)

Bizverse is a platform and set of tools for companies to do business in the metaverse, enabling services such as retail and tourism.

BuzzAR (Singapore)

BuzzAR is a startup focused on connecting people, including through the Pop-Up Metaverse, an AR installation that enables people to create avatars in their likeness.

MediVR (Singapore)

MediVR is an immersive medical training simulation that enables students to learn and take assessments in the metaverse with AI-powered virtual patients.

My Meta Farm (Vietnam)

My Meta Farm is a metaverse world that provides a space for people to socialize, create and play games together.

MeshMinds (Singapore)

MeshMinds is a creative agency designing immersive experiences that combine technology and art, such as Climate Breakers, a narrative-based VR experience.

Smobler (Singapore)

Smobler is a creative agency that develops metaverse worlds and experiences for businesses to engage their clients, including Aventis Metaverse, the world's first graduate school in the metaverse.

Singapore Airlines (Singapore)

One of the world's leading airlines, Singapore Airlines is exploring ways to enhance customer experience by leveraging emerging XR technology.

Project participants

South Korea

Body-based data privacy in XR

Participants in the Body-Based Data Privacy in XR Design Jam consisted of students and academics from Seoul National University and external privacy experts.

Design facilitators from Wow.D Lab and Craig Walker worked with the Trust, Transparency and Control Labs team to plan and deliver the workshop activities and exercises throughout the day-long event.