



TUM THINK TANK

WORKSHOP REPORT

Envisioning the Metaverses

Spring 2023

Munich School of Politics and
Public Policy (HfP) · TUM Think
Tank



INSIGHTS AND SPARKS

Envisioning the Metaverses

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Findings from four use cases discussed at an interdisciplinary workshop hosted by the TUM Think Tank at the Munich School of Politics and Public Policy (HfP)

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Executive Summary

With participants from academia, business, industry, the public sector, and civil society, we explored the contours, shapes, and future trajectories of the Metaverse as tomorrow's digital frontier. Questions arose such as is the Metaverse an end in itself? Or do we envision the Metaverse - or Metaverses - and its applications as a means towards an end? Reflecting upon how the development of new techniques and tools, as well as how future visions for the Metaverse, could be used to serve particular needs and purposes, certain core topics could be fleshed out. Considering aspects such as trade-offs, decision-making, design, privacy, openness and security as well as functionality, our research also included four exemplary use cases in Business to Business (B2B), Business to Customer (B2C), and Government to Citizen (GOV2C) with participants from academia, business, industry, the public sector, and civil society. This report offers insights and sparks into our research and findings and poses questions for future research.

Background

As the Metaverse continues to gain in popularity as additional use cases and applications of this pioneering technology are discovered, the European Union (EU) has begun to create a vision for its development. Though at this moment, how a Metaverse will be created and shaped to support these values and principles is still unclear. To shape and mould this ambiguity into clarity, we began by exploring key questions surrounding responsibility, user rights & privacy, participation and societal well being as starting points for imaging a human-centred Metaverse. These questions were explored within an interactive Metaverse Multi-Stakeholder Workshop by examining and contrasting four specific, cross-sectional use cases; from which, we were able to identify insights and sparks from the diverse group of participants, which were then reviewed and categorised into cross-sectional themes and additional research questions.

Sharing the insights from this workshop, the first part of the paper introduces the use cases and the key insights and sparks they yielded. The second aspect of this paper groups these key insights and sparks into two priority areas (governance and regulation, inclusion and public value orientation) and highlights related challenges and desirable outcomes. Through this process, implementation issues that typically engulf frontier technologies can be further reviewed and discussed to create an open, human-centred Metaverse based on EU values and principles.

Insights and Sparks from Four Use Cases

Use cases span across contexts, including Virtual Reality (VR), Augmented Reality (AR), and Extended Reality (XR) that involved different stakeholder groups (Business-to-Business (B2B), Business-to-Customer (B2C), Government-to-Citizen (GOV2C)). To explore similarities and differences, four use cases were discussed in greater depth during the workshop. **The first use case** introduced XR Hub Bavaria (co-funded by the Bavarian Ministry for Digital Affairs), which creates virtually designed 3D spaces where users can create and enjoy experiences together – virtual spaces built by the community, for the community. These virtual spaces are built for education purposes, to share content, to exhibit art, to experience art, and to practise and implement new working methods. **The second use case** focused on a pilot Metaverse that the European Commission (EC) implemented for the 2022 Global Gateway Europe Communication Campaign. **The third use case** focused on digital twins in VR from a production and manufacturing perspective for digital modelling equipment to ensure safe workspace design and the co-design of an ergonomic workflow that can be used for training purposes. **The final use case** was conducted by Straightlabs, who utilise immersive technologies that allow users to train and practise their speaking and presentation skills before a virtual audience. Their technology encourages users to explore different scenarios and to train different experiences like speeches, lectures, or sales meetings.

The next sections offer a brief summary of each use case, followed by a summary of the key insights and sparks that emerged at the workshop, which might inspire and inform more robust future analyses. The subsequent section features some of the cross-cutting themes that surfaced across the use case discussions.

GOV2C: XR Community Spaces and Infrastructures in Bavaria with XR HUB Bavaria

Overview

Funded by the Bavarian Ministry for Digital Affairs, the XR Hub Bavaria is a facilitator of XR experiences and only supports projects and initiatives which follow democratic values. The focus of these projects is on value-driven activities rather than on commercial aspects. Since XR Hub Bavaria is co-funded by the

XR Community Spaces and Infrastructures



STAKEHOLDERS

Government to Citizen

USE CASE PARTNER

XR Hub Bavaria

Funded by the Bavarian Ministry for Digital Affairs, the XR Hub is a facilitator of virtually designed 3D spaces where users can create and enjoy experiences together. Virtual spaces built by the community, for the community for: education, content sharing, art exhibitions and experiences, and for new working methods.



IDENTIFIED AREAS OF INTEREST

- **Role of governments**
 - **Civic digital self-determination**
 - **Opportunities and fields of application for education**
 - **Specific requirements of stakeholders regarding design, development, and implementation**
 - **Inclusion of underrepresented users and future users across the globe**
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Ministry of Digitisation in Bavaria, this initiative shows an easy-to-use, outcome-driven, and action-oriented possibility for citizens in Bavaria.

Insights and Sparks

Role of governments: The technologies used to create immersive experiences are still in an early stage of development. To create value-based applications and platforms that might one day lead to an interconnected Metaverse, there is the need for innovation-friendly government regulations to support the development of innovative technologies. As such, the EU will play a key role in defining the parameters of a Metaverse from a legal, social, data, political, and economic perspective. Additionally, the extent of decentralisation in a potential Metaverse is still unclear. Metaverse communities, if large enough, can become powerful, economic actors. It is therefore vital to empower citizens to create a value-based version of a Metaverse and to support ground-level training and experimental facilities like the XR Hub Bavaria; as self-determination will be a key factor.

Civic digital self-determination: It is imperative to recognise the implications immersive technologies might have in the future for the digital identity of people and their digital self-determination. Furthermore, there might be limits of freedom in public, human-centred Metaverse structures and challenges for platform and content moderation. For content moderation and respective community building, transferable measures already exist, as established in the context of social media and online gaming platforms.

Opportunities and fields of application for education: The education system for young people needs to adapt to new immersive technologies and: (1) introduce the usage of immersive technology and (2) to include Metaverse technologies in the school curricula. This recommendation can be applied to all pioneer tech topics which have, until today, generally played a minor role in the sphere of education.

Specific requirements of stakeholders regarding design, development, and implementation: Further academic research is needed to better understand different stakeholder needs in the context of immersive technologies. It is crucial to involve young individuals in this research in order to gain a deeper understanding of how this technology will be utilised in the future. This is one reason universities should play a role in researching and generating new models and building innovative frameworks for the Metaverse. More funding is needed to incentivize research programs and help universities develop, design, and implement applications for the Metaverse and their structures.

Inclusion of underrepresented and future users across the globe: An additional key challenge will be language barriers since most of the Metaverses terminology is currently in English. Not only will there be a need to translate these terminologies to other languages, but there will be a need to include other value systems to ensure its inclusivity.

GOV2C: Metaverse Pilot in EU Communication Campaign with the EU Global Gateway Initiative

Overview

The European Commission (EC) created a Metaverse pilot as part of the 2022 Global Gateway Europe Communication Campaign. The campaign aimed to highlight the EU's role on the world stage and to expand on why investments in EU partner countries are mutually beneficial; both to recipients of EU investments and EU citizens. As the target audience of the campaign was 18–35-year-olds, the

Commission opted for a Metaverse pilot, an immersive online campaign to align with modern media consumption preferences. The campaign was social media based, but the Metaverse pilot allowed the audience to connect via an online platform and interact with campaign content, videos, art installations, campaign heroes, and influencers. This platform was also home to several events where musicians, influencers and EU investment recipients participated.

Discussion

Differences in perceived versus true stakeholder needs and expectations: This use case highlighted the importance of aligning with stakeholder needs and expectations. The focus of the workshop participants was placed on interactivity and communication within this space while the campaign was focused on people entering the space and experiencing what was offered, instead of allowing more room for interaction and creativity. It becomes clear that when addressing stakeholder responsibilities and fields of contribution, not all stakeholders will have the same needs. Thus, opportunities should be given according to unique needs and cultural contexts.

Role of governments in building and maintaining new technologies: The emergence of the Metaverse creates a crucial question: should state and public institutions take on the role of technical infrastructure providers, or should they collaborate with the private sector? At this moment, it seems unlikely that the public sector would have the means to facilitate attractive and valuable infrastructure, in contrast to the capabilities of the private sector in and outside of Europe. The providers of future applications and infrastructures will, however, be responsible for design considerations such as the inclusivity of virtual worlds and their development process, as well as the replication of “real” versus “non-real” spaces. Questions on the role of the state in the Metaverse connect to a wider discussion on power shifts. The Metaverse, with all its potential opportunities, might also be reformulating power relations.

B2B: Digital Twins in Manufacturing SMEs with a Consulting Firm

Overview

Focusing on production and manufacturing digital twins in VR, a Consulting Firm supported a client in the creation of a Digital Twin platform. The client was interested in not only modelling their equipment to

Digital Twins in Manufacturing SMEs



STAKEHOLDERS
Business to Business

USE CASE PARTNER
A Consulting Firm

For a manufacturing firm, a digital twin platform was leveraged to both model workspace design and to co-design ergonomic workflows. While identifying design flaws in virtual space allowed for enhanced collaboration and saving costs, the co-design of workflows was used for training purposes in the simulated environment.



IDENTIFIED AREAS OF INTEREST

- **Enhancing communication and project planning with new technologies**
 - **Building ergonomic and human-centred workflows**
 - **Data and cyber security & IP protection**
 - **End user acceptance of new technologies**
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ensure that the design of the workspace could safely contain a large piece of machinery, but to also co-design an ergonomic workflow that would be later used for training purposes.

Enhancing communication and project planning with new technologies: The client's first goal was to ensure that the machinery and all required supporting units would function within the allocated space. Design flaws can be identified with a digital twin before trying to install physical equipment and the interplay and communication between various parts of machinery can be simulated and tested. They can bring together key decision makers to collaborate earlier in the planning phase of a project, which could help ensure that multiple designs work synergistically within a space. This example highlights that digital twins could become a crucial tool for the production and manufacturing sector as a communication and collaboration tool.

Insights and Sparks

Building ergonomic and human-centred workflows: Digital twins can also be leveraged to design a human-centric workflow. In this use case, this could include health experts using the digital twin to co-design an ergonomic workflow with input from the end users, both to gain their expertise and encourage proper workflow adoption afterwards. Users would then be digitally trained in a workflow, which allows for individualised learning experiences. By training in a simulated environment, users can receive digital "hands-on-experience" on potentially hazardous machines, which helps mitigate risks before actually training on the real machine. The presenters of this use case mentioned that the client had six weeks initially planned for "in-real-life" training, but only needed three weeks due to the knowledge and skills the users had already obtained through the "digital" training. This became an adaptable educational tool for the trainees as they could learn at their own speed through supported and guided steps. The effectiveness of these kinds of training remains to be seen, with some arguing that they can provide a sense of False Safety, where the user has trained so significantly in the "digital world" that they falsely believe they know how to implement the workflow in the "real world."

Data and cyber security and IP protection: Concerns about data and cybersecurity are evident, as there might be apprehension about the possibility of competitor or unfriendly actors gaining access to the training processes or the product models. For companies like ASML (who are one of the main computer chip producers in Europe), if a hostile actor were able to better understand their production process, or even their training process, they would be able to gain invaluable information. From a different perspective, digital twins could enhance and enable international cooperation as it could be used to build partnerships between international players and facilitate training and information sharing. These concerns depend on the form of the digital twin or "digital shadow". While a digital twin replicates the real environment as closely as possible, "digital shadows" transform data for the digital space and might simplify and stylize certain aspects. This use case was more of a "digital shadow" than a true digital twin; as the data they received from the client had to be transformed for the digital space. Through this transformation, more specific technical aspects of the initial model were lost. Thus, this was not an exact digital twin, and it would not be as detrimental from a security perspective if the model were to be obtained from a competitor.

End user acceptance of new technologies: While the possible benefits of digital twins for the manufacturing sector were evident from this use case, most individual users are still unaware of how digital twins could be useful in their everyday lives. Additionally, there is still a high inequality to access across the globe; as some areas might not have access to the necessary data or technology.

B2C: VR Speech Trainer Enabled by AI with Straightlabs

Overview

The immersive technology start-up Straightlabs created a solution named “VR Speech Trainer,” a virtual reality program that allows users to train and practise their speaking and presentation skills in front of a virtual audience. When using their speech trainer, users receive direct feedback from the screen about speed, tone, hands, and body orientation, and immediate feedback from the (virtual) audience.

VR Speech Trainer Enabled by AI



STAKEHOLDERS
Business to Customers

USE CASE PARTNER
STRAIGHTLABS

The “VR Speech Trainer” is a virtual reality program, leveraging Artificial Intelligence, that allows users to train and practise speaking and presentation skills in front of a virtual audience. When using the speech trainer, users receive direct feedback from the screen from the virtual audience.



IDENTIFIED AREAS OF INTEREST

- **Privacy and security of user data**
 - **Role of trustworthy technology and the user data paradox**
 - **Immersive technologies and their hidden costs**
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Insights and Sparks

Privacy and security of user data: One key challenge for end-users of immersive technologies is user privacy. Technology developers want (and need) data to train their Artificial Intelligence (AI) systems to provide feedback to users. This use case highlighted two reasons why developers are not receiving more user data: (1) users were unwilling to provide the data and (2) worker unions refused to allow the use of employee data. To overcome conflicting requirements, iterative design processes can be created. In this instance, Straightlabs addressed these concerns by adjusting their technology design to worker union's requests by removing eye-tracking tools within the headset. This demonstrates the potential for collaboration to ensure user privacy.

Role of trustworthy technology and the user data paradox: A data paradox might be identified in the context of data-rich applications as stakeholders would like to have access to tools that are better attuned to their requirements but prefer to not provide the required sensitive and personal user data. This hesitancy to provide developers with additional data might be caused by a lack of trust between the two communities. Building this end user trust will be necessary, and a key input to this trust will be including stakeholders in the design process.

Immersive technologies and their hidden costs: Immersive technologies have immense potential for skill training and education. However, this technology also presents possible hidden costs, such as: not including and integrating cultural nuances and addressing intercultural communication, as well as

concerns surrounding the safety and wellbeing of users when using immersive technologies. Safety measures should be enacted to protect the well-being of users, especially of young people and vulnerable populations.

Cross-Sectional Themes

As the Metaverse continues to grow and gain in popularity and use, it is essential that the mistakes of previous waves of socio-technical change are not repeated, and that the creation of this technology results in an open, human-centred Metaverse based on EU values and principles. Two main themes and priority areas for further research emerged during the workshop conversations: governance and regulation, and inclusion and public value orientation.

USE CASES			
	GOV2C	XR Community Spaces and Infrastructures	XR HUB Bavaria
	B2B	Digital Twins in Manufacturing SMEs	Consulting Firm
	GOV2C	Metaverse Pilot in EU Communication Campaign	EU Global Gateway Initiative
	B2C	VR Speech Trainer Enabled by AI	Straightlabs

Governance and Regulation

This workshop identified four focus areas for the priority area: governance and regulation. This prominently involves privacy, and data security and IP protection, data governance, and the role of governments in Metaverse infrastructure: How do we know with whom personal information and ideas are being shared? And how can these be better protected? What will data governance look like within the Metaverse? What is the role of governments when building Metaverse infrastructure? How will the wellbeing and safety of users be maintained? Additional research around these questions can help in developing an open and human-centred Metaverse.

Privacy

USE CASES



As users become more concerned with their privacy, pioneering technology developers will need to incorporate their participation to gain their trust. By listening to their concerns, and including them within the design process, user's privacy concerns can, to an extent, be mitigated. Though, this could create additional privacy concerns, as user's data could be used to simulate additional training data, causing users to provide more information about themselves than they originally were willing to disclose.

Data Security and IP protection

USE CASES



The security of information, ideas and intellectual property presents challenges – both on an individual and on an organisational level. Concerns of inappropriate access and use of end-user data can be raised, as well as concerns about industry espionage and the potential of unfriendly actors gaining access to data and models. In a digital twin context, with the data representing real-world workspaces, technology and equipment, organisations aim to ensure no third-parties gain access to these

informations. If hostile third party actors were able to gain access to their intellectual property, companies and businesses could lose their competitive edge.

(Data) governance

USE CASES



Just as important as securing user data and ideas, is understanding who is held accountable to do so. A concern across the use cases was regulation and its challenges. The need for innovation-friendly regulations to support the development of innovative technologies, while also protecting their users, is vital. As the Metaverse might reformulate power relations; who should be entrusted with ensuring accountability? Should there be self-regulation, or should regulations and standards be set on a national, if not global level? Additionally, should previous regulations for pioneer technologies (e.g.: guidelines for content moderation from social media and online gaming) be used as frameworks and building blocks for the needs of the Metaverse?

Role of the government in Metaverse infrastructure

USE CASES



Governments face several challenges in creating state-funded infrastructure for the Metaverse. Should governments become providers of infrastructure within virtual worlds which are technically provided by the private sector? Responses to this question are mixed. The XR Hub Bavaria is co-funded by the Ministry of Digitisation in Bavaria and has become an exemplary, outcome-driven and action-oriented virtual world for the citizens of Bavaria (and the world) to visit and explore. Though there could be concerns that some communities could become so large, that they become powerful actors within the Metaverse and shape it in a way that is not reflective of its stakeholders. Contrary to this, it might not be possible for states to “keep-up” with the technological advancement necessary to develop such virtual worlds at scale. Additionally, if governments are designing the Metaverse, will they be designing a “top-down” centralised realisation of virtual worlds, and will stakeholder needs and requirements be included, or will there be differences in expectations like those seen between stakeholders and the European Commission?

Inclusion and Public Value Orientation

Five focus areas were identified regarding inclusion and public value orientation. This includes topics that were heavily discussed across several of the use cases, like which effects can be observed on trust and the user’s wellbeing? How can the Metaverse be used to further enhance educational opportunities? How will the Metaverse fulfil the needs and requirements of users? How can it be developed in such a way to facilitate diversity and inclusion? Additionally, how can the global unequal access to technology be addressed, mitigated, and resolved? By incorporating these topics into the development of the Metaverse, we can create a digital space that respects the health, well-being, and rights of its users.

Trust

USE CASES



There currently seems to be a lack of trust between users and technology providers. A deficiency in transparency from the side of the provider often leads users to wonder how and by whom their data can and is being exploited. Some of these concerns surround unlawful access to data, especially if a hostile company or actor were to gain access. One way to build trust amongst its users can be to include them within the security or design process, which could help to slowly build trust over time.

Wellbeing and safety of users

USE CASES



Pioneering technologies can be used to increase the wellbeing and safety of others. By digitising a workspace and including the opinions of health experts, an ergonomic workflow that supports employee wellbeing and mental health can be created. The workspace model that was discussed was also used to virtually train employees, serving as a precautionary measure to reduce the risk of accidents when operating real machinery. However, it is essential to address concerns regarding False Safety, as it may inadvertently instill an unwarranted level of confidence in workers, potentially resulting in safety hazards.

Educational opportunities

USE CASES



The Metaverse and its building block technologies, like VR, can provide significant advantages from an educational and training perspective. They could provide an opportunity to become an enriching educational tool in schools and in continuous education. Though currently, there needs to be a better incorporation of pioneer technologies into the education system, as well as an improved system for working directly with schools and teachers. Though, this should only occur after sufficient protocols have been created and implemented to ensure the safety of young users.

Stakeholder Inclusion and Participation

USE CASES



Not all stakeholders have the same needs; and this discussion made it clear that additional research and the implementation of a “needs analysis” will be required for Metaverse builders to create content that is relevant for all users. Vulnerable and often underrepresented groups need to be included as stakeholders, and a focus on the diversity of cultures should be kept in mind when designing the Metaverse. Further research could be conducted to determine how different cultural communities would differ in the ways they would design and interact with virtual worlds. Encouraging the engagement and participation of the youth would also help to build a future-forward thinking Metaverse.

Access to technology

USE CASES



There is a high, global access inequality for pioneer technologies and the materials and data required to support them. Without ensuring that all communities have the materials they need to be successful when implementing new, pioneer technologies, there will always be technological gaps between communities that “have access” and those that do not “have access.” Without intervention, this could create a centralised, non-inclusive and non-human-centred Metaverse that perpetuates a lack of representation from those who are typically and historically already underrepresented.

Outlook

Within these four use cases, potential contours, shapes, and future trajectories of the Metaverse as tomorrow's digital frontier were explored. Different questions on implications, opportunities, and challenges related to immersive technologies and the related experiences for individuals as well as organisations were explored, and insights were developed that sparked cross-sectional themes and created additional research questions. Nine focus areas were identified that require further research and consideration in the future, to ensure the development of an open and human-centred Metaverse that is built on EU values and principles. For this, not only academics, but different stakeholders from industry, governments, and civil society should come together to jointly ideate and co-create on this technology-frontier. Additional workshops focused on these areas could provide additional information, ideas, and insights to enable a deeper understanding of the opportunities and challenges presented by immersive technologies and the Metaverse.