



An Informal Summary of the First Workshop of the Series "Foresighting the Technologies and Co-Factors that May Shape the Future of Virtual Worlds and the Web 4.0"

January 16th, 2025 – 3 to 5 PM (CET)

Introduction

The first workshop session in the "Improved Foresight" series underlined the ambition to co-design the future of virtual worlds and Web 4.0 ecosystems, focusing on fostering a human-centric and open European digital strategy. The meeting, part of the Horizon Europe OpenVerse initiative, brought together a diverse group of stakeholders, including industry professionals, policymakers, academics, and representatives from the European Commission.

The session commenced with an introduction by Gianluca Misuraca, co-chair of the workshop, who emphasised the overarching goals of exploring technological developments and designing future scenarios for virtual worlds aligned with European values. As a vital part of the OpenVerse project, the outcomes from this session aim to feed into a strategic roadmap and policy recommendations.

The methodology, outlined by Pierre Rossel, focused on collaborative foresight rather than prediction, recognising the complexity and uncertainty of the technological landscape. The structured sequence included interactive exercises on a Miro board, fostering a collective exploration of the factors shaping virtual ecosystems by 2030 and 2040.

Key Themes Discussed

1. Technological Innovations in Virtual Worlds

The workshop's first exercise (Q1 and Q2) focused on exploring the technological drivers shaping the evolution of virtual worlds, explicitly identifying differences between applications in **entertainment** and **professional domains**. Participants engaged in an interactive brainstorming session, using the structured Miro board to highlight and rationalise key technologies for both contexts.

Q1: Technologies for Entertainment and Gaming Applications

This segment addressed the technologies expected to shape virtual worlds predominantly from an **entertainment perspective**, including gaming, virtual marketing, virtual real estate, and virtual events. Participants highlighted the following as the main crucial technologies driving innovation in this domain:

- **Artificial Intelligence (AI):** The role of AI in enhancing immersive experiences was heavily emphasised. The key drivers are AI's capacity for personalisation, non-player character (NPC) behaviour, and adaptive gaming and entertainment environments.
- **Blockchain:** Blockchain technologies, including NFTs and smart contracts, were discussed as transformative for creating secure, decentralised systems for digital asset ownership in entertainment-focused virtual worlds.



- **Connectivity Technologies:** The emergence of 5G and the potential of 6G were identified as critical to enabling seamless, high-quality virtual experiences, particularly for multiplayer games and live virtual events.
- **Virtual and Augmented Reality (VR/AR):** Participants noted VR/AR's dominance in creating engaging gaming experiences, with opportunities for crossover into other forms of entertainment, such as live concerts and theatre in virtual spaces.

The discussion also highlighted Europe's stronghold in creative industries, particularly in digital art, storytelling, and fashion, as a competitive advantage. However, it was acknowledged that Europe lags behind in developing large-scale gaming platforms capable of rivalling those from North America and Asia.

Q2: Technologies for Professional and Industrial Applications

In contrast, this section examined technologies crucial for virtual worlds tailored to **professional and industrial uses**, including training, collaboration, industrial simulation, and professional services. Key technologies identified included:

- **Simulation Software and Digital Twins:** These were noted for their transformative impact on industrial design and training, particularly in sectors such as architecture, manufacturing, and healthcare.
- **Robotics and IoT:** Integrating IoT and robotics with virtual environments was highlighted as a game-changer for professional applications, enabling more dynamic and interactive simulations.
- **Security and Data Integrity:** Robust cybersecurity measures were deemed essential for protecting sensitive information in professional virtual settings, particularly in sectors like defence, healthcare, and finance.
- **Collaborative VR Platforms:** Platforms allowing teams to work together in shared virtual spaces were seen as pivotal for the future of remote work and professional collaboration.

A recurring theme in this discussion was the need to focus on **human-centric design** to ensure accessibility, inclusivity, and ease of use in professional virtual environments. Furthermore, participants pointed out the fragmented adoption of virtual technologies in European enterprises, which lags behind the rapid uptake observed in consumer-focused applications. This gap was attributed to:

- **Regulatory Complexity:** Divergent regulatory frameworks across EU member states complicate the adoption of virtual platforms in professional settings and the difficulty of coping with them.
- **Cultural Resistance:** Many traditional European enterprises remain hesitant to embrace virtual solutions due to organisational inertia and concerns over ROI.
- **Cost of developing new means and tools** in a highly competitive arena, dominated by North American players, and yet complying fully with European values and open and human-centric requirements

Synthesis and Key Takeaways

The discussions in Q1 and Q2 underscored a dual imperative for Europe:

1. **Leverage Creative Strengths:** Europe's rich tradition in cultural and creative industries positions it well to excel in entertainment-focused virtual worlds. However, concerted efforts are needed to support platform development and promote interoperability to compete globally.

2. **Accelerate Professional Adoption:** Bridging the adoption gap in professional and industrial contexts requires targeted initiatives to address regulatory barriers, support SME investment, and incentivise experimentation with virtual technologies.

2. Role of SMEs and Startups

The second exercise (Q3) centred on identifying strategies and opportunities for European SMEs and startups to thrive in the burgeoning virtual world ecosystem. Participants explored areas where these smaller entities could contribute most effectively, especially in the face of competition from larger, globally dominant players.

Key Areas of Opportunity for SMEs and Startups

Participants identified several roles that SMEs and startups can play within the virtual world ecosystem, emphasising their adaptability and creativity:

1. **Content Creation and Innovation:**
SMEs were recognised as pivotal in developing high-quality digital content, building on Europe's historical strength in the creative and cultural industries. From immersive storytelling to digital fashion and gamified experiences, SMEs can carve out niche markets that leverage Europe's artistic heritage.
2. **Customisation and Localisation:**
SMEs have the agility to customise and localise virtual solutions for specific industries, cultural contexts, or geographies. For example, smaller firms can tailor VR training simulations for regional enterprises or design virtual environments that reflect local aesthetics and values.
3. **Specialised Technologies:**
Startups specialising in foundational technologies—such as AR/VR, blockchain, and IoT—were highlighted as essential contributors to developing unique tools or applications that more prominent players may overlook. These innovations often serve as building blocks for more extensive systems.
4. **Supportive Ecosystems:**
Participants noted the potential for startups to act as enablers within the ecosystem. For instance, they can provide middleware, APIs, or tools that enhance virtual platform interoperability or help integrate emerging technologies like neural chips.

Barriers to SME Success

While the opportunities for SMEs are abundant, participants identified significant barriers:

- **Funding Limitations:**
SMEs often lack access to the substantial funding required to develop competitive platforms or invest in advanced R&D, public funding, private investment markets, and venture capital. The dominance of well-funded players from North America and Asia exacerbates this disadvantage.
- **Regulatory Complexity:**
Divergent regulations across EU member states present a challenge for SMEs attempting to scale operations or access cross-border markets.
- **Workforce and Skills Gaps:**
Participants noted disparities in technical resources and workforce training across Europe, particularly between Western and Eastern regions. Bridging this gap was seen as essential for fostering innovation.

Ethical and Economic Implications

The discussion also extended to global labour dynamics. Participants highlighted the risks of outsourcing digital labour, such as potential exploitation or inequities in value distribution. A strong call was made to ensure that ethical standards govern global collaborations and that Europe invests in local talent development.

Recommended Actions

Participants advocated for:

- **Cross-European Collaborations:**
Strengthening partnerships across regions to share technical expertise, resources, and best practices.
- **Incentivising Innovation:**
Implementing funding programmes and tax incentives to encourage SMEs to explore disruptive technologies and niche markets, including in the industrial and service sectors.
- **Regulatory Simplification:**
Harmonising regulations to create a more conducive environment for SMEs to scale across borders.

3. Strengths and Weaknesses in the European Ecosystem

The third exercise (Q4–Q5) focused on analysing Europe's current strengths and weaknesses within the virtual world ecosystem to build on successes and address gaps to foster a competitive and inclusive digital future.

Strengths

Participants identified key areas where Europe demonstrates significant potential:

1. **Creative Industries:**
Europe's long-standing reputation for excellence in cultural and creative industries was seen as a cornerstone of its strength. Participants noted that sectors such as gaming, digital fashion, and digital art continue to flourish, contributing to high-quality content production.
2. **Regulatory Leadership:**
Europe's robust regulatory frameworks, particularly in data security and privacy (e.g., GDPR), were recognised as global benchmarks. These frameworks promote inclusivity and ensure ethical governance in virtual ecosystems.
3. **Commitment to Human-Centric Design:**
A recurring theme was Europe's focus on creating technologies aligned with societal values. Virtual worlds that prioritise accessibility, inclusivity, and ethical use are seen as essential for differentiating Europe in the global market while continuing to stimulate user creative involvement for individuals, professionals, and communities.

Weaknesses

Despite its strengths, several areas of concern were raised:

1. **Fragmented Regulations:**
Participants repeatedly emphasised the challenge of regulatory fragmentation across EU

member states. This patchwork creates inefficiencies, raises costs, and hinders the ability of SMEs to operate seamlessly across borders.

2. **Lagging Investment in Foundational Technologies:**

Europe was identified as falling behind in critical technological domains, already salient like artificial intelligence, but also, for the coming years, in quantum computing, advanced robotics, and perhaps neural networks. Participants stressed that this gap could hinder Europe's ability to compete with more technologically advanced regions and, regarding virtual worlds, how this will impact innovation for smaller European players.

3. **Lack of Standardisation:**

The absence of interoperable standards across virtual platforms was seen as a major impediment to fostering a cohesive ecosystem. Without clear standards, the risk of siloed developments and limited cross-platform compatibility increases.

4. **Geographical Disparities:**

Uneven access to resources, funding, and technical expertise across Europe—particularly between Western and Eastern member states—was identified as a structural weakness that must be addressed to ensure equitable development.

Recommendations

Participants made several strategic recommendations:

- **Harmonised "28th Regime":**

The idea of a unified regulatory framework for SMEs often referred to as the "28th regime," was proposed to streamline operations across member states and reduce barriers to scaling.

- **Investment in Foundational Technologies:**

Participants called for targeted funding to support quantum computing, neural networks, and other cutting-edge research areas, emphasising long-term strategic investments.

- **Standardisation Initiatives:**

A push for developing EU-wide standards for virtual worlds and related technologies was seen as essential to ensuring interoperability and fostering innovation, even though in a competitive economy, there is also competition for distinct standards aiming at the same goal.

- **Addressing Regional Disparities:**

Increasing investment in education, training, and infrastructure in underrepresented regions was recommended to bridge the gap between technologically advanced and lagging areas.

Synthesis and Strategic Outlook

These discussions underscored Europe's dual challenge of building on its existing strengths while addressing systemic weaknesses. By investing in creativity, fostering regulatory coherence, and championing technological innovation, Europe has the potential to establish itself as a leader in the virtual world ecosystem. However, achieving this vision will require targeted policies, significant funding, and a commitment to inclusivity and collaboration across the continent.

Long-term Disruptors

In the final exercise, participants examined three critical disruptors—quantum computing, neural technologies, and environmental factors—assessing their potential impacts on the future of virtual worlds. The structured exercise encouraged attendees to evaluate the disruptors on a scale of influence, ranging from strongly positive to strongly negative.

Quantum Computing



Quantum computing emerged as a game-changing technological prospect, albeit with caveats. While it promises unprecedented computational power capable of revolutionising simulations and AI-driven virtual world design, participants noted that its practical application remains in nascent stages. Concerns about the potential for geopolitical monopolies in quantum advancements and their implications for Europe's technological sovereignty were discussed.

The lack of accessible frameworks for SMEs to engage with quantum technologies was also raised, highlighting the importance of bridging the gap between research and commercialisation.

Neural Technologies

Neural technologies elicited a mixed response, including neural chips and brain-computer interfaces. Some participants saw these technologies as transformative, enabling seamless interactions within virtual worlds and providing unprecedented accessibility for individuals with disabilities. Others flagged concerns around privacy, ethical implications, and the societal readiness to accept such deeply integrated technologies.

The discussion underscored the need for robust ethical standards and regulatory frameworks to ensure these technologies enhance inclusivity without exacerbating surveillance risks or deepening digital divides.

Environmental Factors

The environmental impact of virtual ecosystems was a polarising topic. While many participants acknowledged the significant carbon footprint of blockchain, AI training, and high-resolution streaming, others highlighted the potential of virtual worlds to reduce physical consumption and waste. Examples include the growing adoption of digital fashion and virtual goods, which can offset the environmental toll of producing physical items.

A thought-provoking debate emerged around the paradoxical nature of environmental factors. On the one hand, virtualisation could mitigate the environmental impact of traditional industries; on the other, it risks exacerbating energy consumption if renewable energy solutions are not integrated into infrastructure planning.

Reflections on the Q6 Discussion

The dialogue following Q6 was rich and multi-faceted, touching on broader themes beyond the immediate disruptors. Key reflections included:

1. Digital Sovereignty and Equity

- The conversation returned to the importance of building European capacity in emerging technologies. Participants reiterated the urgency of reducing reliance on non-European technological giants, particularly in areas like quantum computing and neural chips.
- Concerns about disparities between technologically advanced regions and those lagging behind within the EU were highlighted. Attendees recommended targeted investments in education and infrastructure to ensure that advancements in disruptor technologies are distributed equitably.

2. Balancing Innovation and Regulation

- A consensus emerged around the necessity of pre-emptive regulation to manage the ethical and societal implications of some specific developments, in particular AI and neural technologies, but in an ambidextrous perspective, that should also leave room and supportive means, on an equal basis, to innovation incentives. Participants suggested leveraging Europe's leadership in GDPR as a foundation for similar foresight-driven frameworks governing future disruptors.
- Several attendees advocated a proactive approach to integrating environmental impact assessments into technological R&D, ensuring alignment with the EU's Green Deal objectives.

3. Sustainability and Technological Interplay

- The group discussed the complex interplay between technological innovation and sustainability. While disruptive technologies could accelerate the energy efficiency of virtual worlds (for BC-functionalities and generative AI support, at least), the risk of unintended consequences, such as resource overuse or rebound effects, was noted.
- The question of how well-intentioned collaborative virtual worlds can help mitigate the environmental impact is still subject to debates and more efficient measurements.
- A promising avenue highlighted was the promotion of circular digital economies, where virtual assets, infrastructures, and systems are designed for reusability and energy optimisation.

4. A Pragmatic Roadmap

- The workshop concluded with a call to action for pragmatic yet ambitious policy recommendations. Participants suggested leveraging foresight exercises like this one to prioritise funding for pilot projects that test the real-world implications of these disruptors.
- The idea of a European Digital Transition Observatory was floated, where the progress and challenges of integrating disruptors into virtual worlds could be systematically tracked and evaluated.

Future Directions

Several forward-looking recommendations emerged:

- **Data and Interoperability:** Developing frameworks for data sharing and interoperability, emphasising trust and ethical governance. Participants discussed the integration of blockchain for secure and efficient supply chains.
- **Policy Alignment:** The need for pan-European regulatory coherence was a recurring theme, with suggestions for a unified regulatory framework to enable SMEs to scale efficiently.
- **Capacity Building:** Emphasising skill development in emerging technologies, particularly in regions with underutilised talent pools like Eastern Europe.
- **Sustainability Focus:** Including environmental impact assessments in developing virtual world technologies and prioritising green innovations.

Conclusion



The workshop effectively served as a platform for multidimensional dialogue, balancing technological foresight with socio-economic considerations. It marked the beginning of a structured process to shape Europe's strategy for virtual worlds, with future sessions set to delve deeper into governance, geopolitical dynamics, and roadmap implementation.

This session's active participation and diverse expertise exemplified the collective intelligence approach central to foresight exercises. With inputs synthesised into actionable insights, the session laid a robust foundation for crafting Europe's sustainable and inclusive digital future.