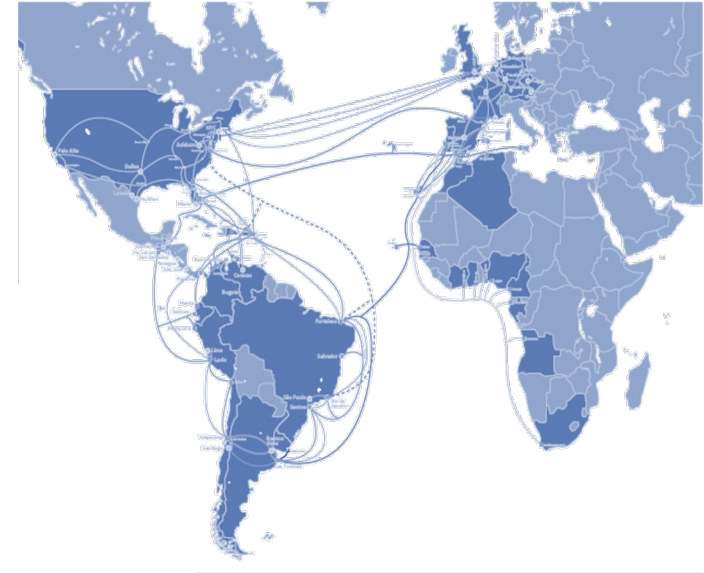


Towards the Metaverse: Market Potential & Research Challenges

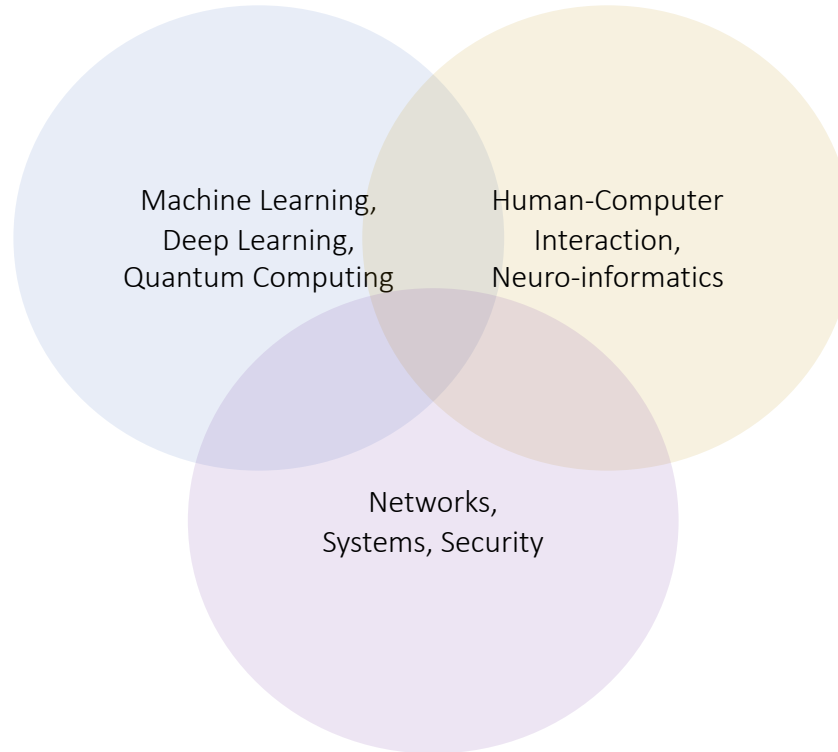
Ioannis Arapakis, Principal Research Scientist
Telefónica Research (Discovery)

About us

- Telefonica operates in 12 countries, with presence in 33:
 - Main operations in EU (Germany, Spain), UK and Brazil
- Telefónica I+D is the research company of the Telefonica group:
 - The biggest private R&D centre in Spain
 - Strong connection with academia: JRUs, 5TONIC, MadQCI
 - Extensive presence in EU-funded projects (FET, Pathfinder, RIA, IA)



Telefónica Research



Telefónica: A Metaverse-ready Telecom

- Metaverse: “an opportunity to connect people's lives even better.”
- Telefónica & Metaverse:
 - Technical challenges: Edge computing, low-latency technologies, Network-as-a-Service (NaaS), APIfication
 - Co-creation: XR-Experience Center; Metaverse Innovation Hub (with Meta), Partnerships, Investments in start-ups
 - Interoperable & Open: Metaverse Standards Forum
 - ...



What is the
Metaverse?



A Technical Definition

*"A massively scaled and interoperable network of real-time rendered 3D virtual worlds that can be experienced synchronously and persistently by an effectively unlimited number of users with an **individual sense of presence**, and with continuity of data, such as **identity, history, entitlements, objects, communications, and payments**."*¹

¹Ball, M. (2022). *The metaverse: and how it will revolutionize everything*. Liveright Publishing.



A Network of Social Value

- The Metaverse as “a network of **connected experiences** which provide **fulfilment**, develop **social relationships** or otherwise provide **value** to a community of users.”¹
- → How to provide value to the users?

¹Narula, H. (2022). *Virtual Society: The Metaverse and the New Frontiers of Human Experience*. Random House.

The Value of Presence

- Feelings of **presence** in social XR platforms:
 - Increase feelings of **relatedness** between users¹
 - Increase **enjoyment** of the interaction¹
 - Increase perception of **social support**²
 - Increase **feelings of community** in online, remote education³

¹Barreda-Ángeles, M., & Hartmann, T. (2022). Psychological benefits of using social virtual reality platforms during the covid-19 pandemic: The role of social and spatial presence. *Computers in Human Behavior*, 127, 107047.

²van Brakel, V., Barreda-Ángeles, M., & Hartmann, T. (2023). Feelings of presence and perceived social support in social virtual reality platforms. *Computers in Human Behavior*, 139, 107523.

³Barreda-Ángeles, Horneber, & Hartmann, *under review*. Easily applicable social virtual reality and social presence in online higher education during the covid-19 pandemic: A qualitative study

A Community of Users

- Limited adoption: chicken-and-egg problem
- Users' **motivation** and **ability** (also, triggers?)
 - What **motivates** users to use metaverse driven applications
 - Have the users the **ability** to use them?

Motivation

- Some **barriers**:
 - Lack of content, lack of added value
 - Poor **realism** of the social interaction (poor avatars)
- Some potential solutions we aim to explore:
 - Give a new (immersive) twist to content that is already valuable
 - e.g., sports in the metaverse?
 - Realism: wi-fi based gesture recognition, improving social interaction via avatars

Ability

- Some **barriers**:
 - **Content creation** is hard for many end users
 - **One-size-fits-all solutions** that neglect users' diversity
- Some potential solutions we aim to explore:
 - AI-supported creation & personalization of XR content and interaction

Social & Psychological Risks

- Some current concerns:
 - Harassment & bullying feels more vivid
 - Addiction?¹
 - Different perception of the reality?²
 - ...

¹Barreda-Ángeles, M., & Hartmann, T. (2022). Hooked on the metaverse? Exploring the prevalence of addiction to virtual reality applications. *Frontiers in Virtual Reality*.

²Barreda-Ángeles, M., & Hartmann, T. (2023). Experiences of Depersonalization/Derealization Among Users of Virtual Reality Applications: A Cross-Sectional Survey. *Cyberpsychology, Behavior, and Social Networking*, 26(1), 22-27.

Some final thoughts

- Place the human at the center of the network and application management
 - The perception of the user is to be assessed in real-time
 - Optimizations in application and network must be performed if the perception degrades
- Many challenges in performing usability evaluations on XR systems, considering that they cannot rely on design guidelines for traditional User Interfaces (UIs) like traditional Quality of Experience (QoE) assessments
- Evaluation also heavily dependent on the characteristics of the end-users
- To provide a full understanding XR user perception, we need to combine the assessment of QoE, well-being (cybersickness), environmental presence, and application usability

Thank you for your attention



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