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EMERGING VIRTUAL WORLDS: IMPLICATIONS FOR POLICY AND REGULATION

REPORT

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ABSTRACT

This paper pursues three goals. First, it aims to identify a definition of virtual worlds that is shared among stakeholders. There are many possible ways to define virtual worlds and the metaverse that differ notably depending on the sector, the use case at hand, or the sensibility of those employing the term. The European Commission (EC)'s call for evidence on virtual worlds (April 2023)[1] has made things even more complicated. While it employs the term 'metaverse' abundantly in its promotion campaign (website, social media, and so on), it uses only 'virtual words' in the text of the call itself. The subsequent Communication by the EC (July 2023)[2] and its accompanying document[3] provide a clearer picture by offering a glossary of concepts. In this scenario, defining the boundaries of the two notions appears still necessary to both make sure that we all debate over the same subject matter and for policy makers to target policy intervention at the appropriate issues. This part concludes by providing a proposed definition of virtual worlds.

Second, on the basis of the definitions settled in the first part, this paper identifies the main characteristics of virtual worlds, and highlights a set of challenging features – both from a legal and economic standpoint – that are relevant for the debate. Third, based on the identified challenging features, the paper raises a set of questions aimed at identifying possible regulatory gaps or topics that might require the attention of policy makers.

Finally, a number of recommendations are formulated on the basis of the conclusions drawn from the discussed topics.

[1] European Commission (EC) (2023a) Call for evidence for a non-legislative initiative on virtual worlds, Ref. ARES (2023)2474961 of 5 April 2023, available at https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13757-Virtual-worlds-metaverses-a-vision-for-openness-safety-and-respect_en.

[2] EC (2023b) Communication on "An EU initiative on Web 4.0 and virtual worlds: a head start in the next technological transition", 11.7.2023, COM(2023) 442/final, available at: https://digital-strategy.ec.europa.eu/en/library/eu-initiative-virtual-worlds-head-start-next-technological-transition.

[3] EC (2023c) SWD(2023) 250 final, 11.7.2023, available at https://digital-strategy.ec.europa.eu/en/library/staff-working-document-citizens-panel-report-virtual-worlds#:~:text=This%20Staff%20Working%20Document%20(SWD,citizens'%20panel%20on%20virtual%20worlds

1. METHODOLOGY

The paper builds on a literature review and takes into account the responses to a questionnaire administered to CERRE members, as well as additional materials received from the latter. We also gathered some feedback documents that were submitted by stakeholders in the context of the EC's Call for evidence 2023.[4] Moreover, it takes into account the Communication released by the EC on July 11th 2023[5], and its accompanying document.[6]

The paper is structured as follows.

Section 2: **Definition**. We start by comparing two definitions: that of 'virtual worlds' offered by the EC in its Communication, and one that we elaborate based on our literature review. Out of this comparison, we propose a definition that clarifies the boundaries and characteristics of both 'virtual worlds' and 'metaverse'. This definition is also functional to allow challenging issues to emerge and to help identify possible regulatory gaps or policy needs.

Section 3: **Features and challenging issues**. Based on the literature review, responses to the questionnaires and materials received from CERRE members, we analyse the most challenging features of virtual worlds. To do so, we consider the most widely employed business models as of now and divide the analysis into four features: user experience, community content creation, infrastructures and technologies, and governance. Each of these features generates distinct economic, legal, and ethical challenges that are consequently analysed separately.

Section 4: **Regulatory gaps and policy issues**. For each of the issues identified in Section 3, we assess whether there are any regulatory gaps or needs for policy intervention, examining the economic rationale behind regulatory options.

[4] EC (2023a) fn. 1. In particular, we considered five papers that were attached to the feedback comments, as they provided more complete and structured responses to the call for evidence (compared to the mere comments).
[5] EC (2023b) fn 2.
[6] EC (2023c) fn 3.

2. DEFINITION

We start by providing two definitions. The first one is that of virtual worlds offered in official policy documents, including those by the EC (2.1); the second one we elaborated based on a literature review (2.2). We then compare the two (2.3) and provide our own definition (2.4).

2.1 Definitons of Virtual Worlds by Official Policy Papers

As outlined elsewhere,[7] the first three definitions of virtual worlds (and metaverse) to appear in official policy papers were drafted by the European Parliamentary Research Service (EPRS),[8] the U.S. Congressional Research Center (CRC),[9] and the OECD,[10] all in 2022. These documents explicitly refer to the notion of metaverse and often employ the term as a substitute for virtual worlds.

These early definitions see virtual worlds as a user experience which likely features (Fig. 1):

1. Immersivity and three-dimensionality (3D);
2. Synchronicity (that is, real-time) and persistence.

The central characteristic for all definitions is the **blending of real and virtual realities**, the degree of which varies depending on the enabling technologies by which they are powered (captured under the 'extended reality'-XR label).[11]

2023 represents a turning point, as most policymakers acknowledge that (3.) **interoperability** across networked platforms managing virtual worlds is a third characteristic: this is where the World Economic Forum[12] (WEF) and the (above-mentioned) U.S. CRS[13] convene. In the EU, virtual worlds are defined as "persistent, immersive environments, based on technologies including 3D and extended reality (XR), which make it possible to blend physical and digital worlds in real-time, for a variety of purposes such as designing, making simulations, collaborating, learning, socialising, carrying out

[7] F. Di Porto and D. Foà (2023) Defining Virtual Worlds: main features and regulatory challenges, Issue paper, July (available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4507397).

[8] "Immersive and constant virtual 3D world where people interact by means of an avatar to carry out a wide range of activities. Such activities can range from leisure and gaming to professional and commercial interactions, financial transactions or even health interventions such as surgery": T. Madiega, P. Car, M. Niestadt, L. Van de Pol (2022), Metaverse, Opportunities, risks and policy implications, EPRS (European Parliamentary Research Service), PE 733.557, at 2. It is worth noting that the document had been drafted by the European Parliamentary Research Service, which is an internal service of the Parliament conducted by civil servants, not by European Parliament policymakers.

[9] U.S. Congressional Research Service (2022), The Metaverse: Concepts and Issues for Congress, R47224, 26 August https://crsreports.congress.gov/product/pdf/R/R47224, p. 3. ("Immersive and persistent virtual world where users can communicate and interact with other users and the surrounding environment and engage in social activities, similar to interactions in the physical world". It further indicates possible applications (like entertainment, health, engineering, estate, military, commerce, education, work").

[10] See OECD (2022), Harnessing the power of AI and emerging technologies Background paper for the CDEP Ministerial meeting, DSTI/CDEP(2022)14/FINAL, 15 November, available at https://one.oecd.org/document/DSTI/CDEP(2022)14/FINAL/en/pdf, p. 7. (AI-enabled "immersive environments based on augmented reality (AR), virtual reality (VR), mixed reality (MR) and other extended reality (XR) technologies that enhance the realism of virtual experiences, blurring the lines between the physical and digital worlds").

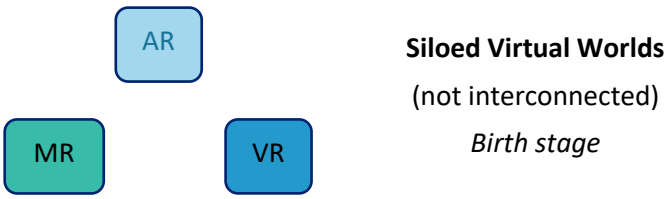
[11] On the notion of extended reality see also EC (2022), Extended reality: opportunities, success stories and challenges (health, education), September, available at the following link https://digital-strategy.ec.europa.eu/en/library/extended-reality-opportunities-success-stories-and-challenges-health-and-education.

[12] World Economic Forum WEF (2023), Interoperability in the Metaverse, January, available at https://www3.weforum.org/docs/WEF_Interoperability_in_the_Metaverse.pdf. The report is part of the "Defining and building the metaverse initiative" launched by the WEF in May 2022. (The metaverse is an "immersive, interoperable and synchronous digital world" where interoperability is meant to enable "data to circulate via interoperable infrastructure, of participants to move themselves, their assets and creations across platforms and experiences", at 3.

[13] U.S. CRS, above fn 9, at. 4.

transactions or providing entertainment".[14] In the EC's view, interconnection and interoperability are key features, although they are associated to more mature stages of development of virtual worlds, rather than being a key characteristic of present ones. More specifically, at birth (present), virtual worlds are siloed and each allows for a given type of user experience, enjoying different degrees of immersivity, synchronicity, and persistence (Fig. 1).

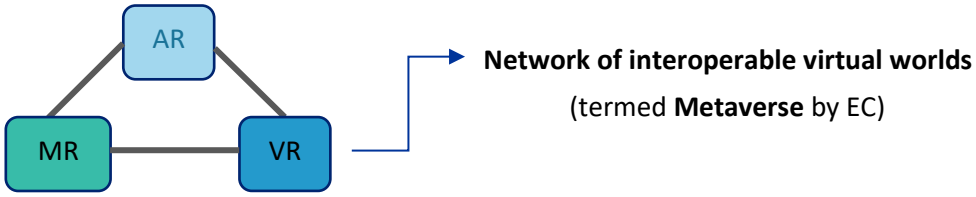
Fig. 1: Virtual worlds at Birth (current) stage



The enabling technologies are selected based on the type of service or experience users may wish to have. State-of-the-art enabling technologies include augmented reality (AR),[15] virtual reality (VR),[16] and mixed reality (MR), but not necessarily emerging ones (such as neural technologies).

In this scenario, the EC (Communication 2023) emphasises the need to foster interoperability (at least of certain key elements) to create a network of interconnected virtual worlds.[17] The EC names such a network 'the metaverse'[18] (Fig. 2).

Fig. 2: Virtual worlds (metaverse) at Infancy stage – EC's Communication and literature review



Interoperability between different platforms and networks and standardisation, in the EC's view, should be fostered to enable 'the seamless use of identities, avatars, data, virtual assets, experiences or environments and the associated rights across platforms and networks'[19]. In this sense, virtual

[14] EC (2023b), fn 2 p. 1. Instead, the EC's SWD's Glossary provides the following definition of 'virtual worlds': "Persistent, 3D, real-time, immersive environments, blurring the line between real and virtual, for socialising, working, learning, making transactions, playing and creating" (p. 87).

[15] In AR, devices like smart glasses overlay information on your view of the real world: L. Walsh (2023) What is the Metaverse? And will it help us or harm us? University of Cambridge Blogpost, 27 July (available at: https://www.cam.ac.uk/stories/metaverse).

[16] In VR environments, 'your digital image, or avatar, can connect, explore and experience virtual spaces with others who are not physically present': Walsh, fn 15. As a caveat, we need to clarify that virtual worlds and virtual reality are two different concepts: the first one refers to the whole user experience, while the second is one of the enabling technologies for the user experience.

[17] EC (2023b): "Web 4.0 (..) is powered by open and highly distributed technologies and standards that enable interoperability between platforms and networks and freedom of choice for users" (at 4). "The Commission, in cooperation with Member States and stakeholders, will engage with key organisations active in the development of standards for open and interoperable virtual worlds and Web 4.0." (at 11)

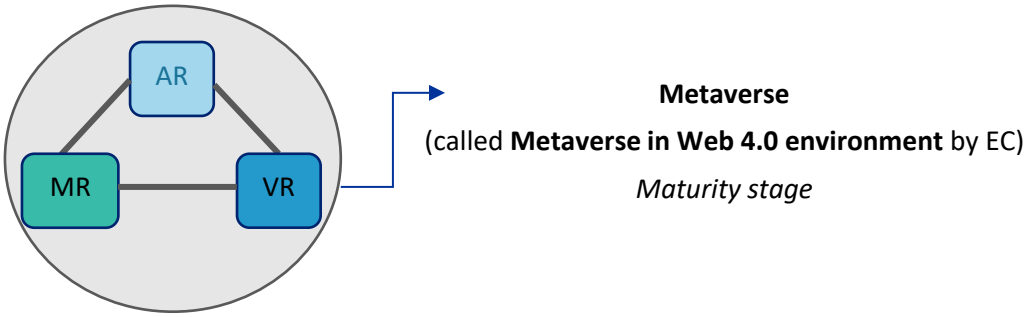
[18] EC (2023c), at 86 provides a Glossary where the metaverse is defined as "Interoperable network of virtual worlds".

[19] EC (2023b) at 11.

worlds are no longer seen as synonymous with metaverse, the latter being a development of the former.

A third, further, stage is envisaged by the EC where, thanks to the realisation of the next-step Internet (that is, the Web 4.0),[20] the infant metaverse will encompass the ensemble of real and virtual worlds, within one environment that coincides with the next gen web (Fig. 3).[21]

Fig. 3 – Metaverse in Web 4.0 (EC Communication and literature)



Hence, based on the analysed official policy papers, one can distinguish **three phases of development of virtual worlds** culminating in the Web 4.0-type of Metaverse[22] (*Table 1*):

[20] EC (2023b) at 1: "virtual worlds are an important part of the transition to Web 4.0". "Web 4.0 is the expected fourth generation of the World Wide Web. Using advanced artificial and ambient intelligence, the internet of things, trusted blockchain transactions, virtual worlds and XR capabilities, digital and real objects and environments are fully integrated and communicate with each other, enabling truly intuitive, immersive experiences, seamlessly blending the physical and digital worlds" (Ibid.). In contrast, "Web 3.0 is the third generation of the World Wide Web. Its main features are openness, decentralisation, and users' full empowerment enabling them to control and realise the economic value of their data, manage their online identities and participate in governing the web. Semantic web capabilities allow linking data across webpages, applications and files. Decentralised technologies and digital twins enable peer-to-peer transactions, transparency, data democracy and innovation along entire value chains": (Ibid).

[21] M. Trunfio, S. Rossi (2022), *Advances in Metaverse Investigation: Streams of Research and Future Agenda. Virtual Worlds*, 1, p. 103 available at: https://doi.org/10.3390/virtualworlds1020007.

[22] JRC (2023) fn 24.

Table 1: Phases of development of Virtual Worlds

	BIRTH	INFANCY	MATURITY
TIMESPAN	NOWADAYS	MID RUN	LONG RUN
DEGREE OF INTERCONNECTION AND INTEROPERABILITY	Siloed virtual worlds	Interconnection/ interoperability of virtual worlds	Interconnected/ interoperable virtual worlds within one environment that coincides with the web
EMPLOYED TERMINOLOGY ***(by the EC)***	Virtual worlds	Metaverse	Metaverse in Web 4.0

2.2 Definitions in Scholarship

As described elsewhere,[23] scholarship, and specialised literature in particular,[24] speak mainly of metaverse rather than virtual worlds. The latter are theorised as building blocks for the metaverse which, in turn, is composed of interconnected virtual worlds.[25] The type of virtual worlds that scholarship has in mind, therefore, equates to the Infancy stage seen above.

Compared to official policy documents, the scholarship emphasises the feature of mass content creation:[26] while the blockchain already allowed users to create NFTs on a decentralised manner, with easily manageable generative AI tools, content creation is popularised to mass scale. Among

[23] Di Porto & Foà, fn 7, para. 2.1.2. There were no substantial changes since the publication of our Issue paper, hence, we refer to it.

[24] For a broad overview of the debate, see: M. Ball (2022), The Metaverse: And How it Will Revolutionize Everything, WW Norton; M. Baier-Lentz (2022), Three technologies that will shape the future of the metaverse – and the human experience World Economic Forum, available at the following link https://www.weforum.org/agenda/2022/02/future-of-the-metaverse-vr-ar-and-brain-computer; Y.K. Dwivedi et al. (2022) *Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy*, International Journal of Information Management, 66 (available at https://doi.org/10.1016/j.ijinfomgt.2022.102542); S.M. Park, Y.G. Kim (2022) A Metaverse: Taxonomy, components, applications, and open challenges. Ieee Access, 10, pp. 4209-4251; I. Hupont Torres, et al. (2023) Next Generation Virtual Worlds: Societal, Technological, Economic and Policy Challenges for the EU, available at doi:10.2760/51579 (also referred to below as "JRC (2023)").

[25] L. Floridi (2022), Metaverse. A matter of eXperience, available at: https://ssrn.com/abstract=4121411 (noting that "just as there is the Web and there are websites, there is the Metaverse and the 'metaverse sites'").

[26] M. Ball (2020) The Metaverse: What it is, Where to Find it, and Who Will Build it, 13 January, available at: https://www.matthewball.vc/all/themetaverse; J.M. Garon (2022), Legal Implications of a Ubiquitous Metaverse and a Web3 Future, available at: https://ssrn.com/abstract=4002551; M. Lewczyk (2021), Snapchat Commits to the Metaverse With Launch of 3D Bitmojis, Virtual Humans, 28 July, available at: https://www.virtualhumans.org/article/snapchat-commits-to-the-metaverse-with-launch-of-3d-bitmojis.

institutions, only the WEF stresses the importance of mass content creation in the economics of virtual worlds (for instance,by enabling users to shape their own virtual and immersive experiences, mass content creation increases their engagement while enhancing the attractiveness of virtual worlds).[27]

Even more far-reaching definitions exist in the literature. These envisage fully-realised environments which would coincide with, or englobe, the Web (4.0),[28] and their occurrence will likely be achieved in the medium to long term (experts speak of a 20-year timespan).[29] Also here, we observe that the scholarship's widest definition coincides with EC's idea of 'metaverse in web 4.0' outlined above.

To sum up, scholarship's definitions of virtual worlds incorporate three elements: plurality of interconnected virtual worlds, user experience (also found in policy definitions), and mass content creation. These defintitons suggest two configurations of virtual worlds, largely corresponding to the Infancy and Maturity phases outlined above, taking the Birth stage as a starting point.

2.3 Comparison of Definitions

The EC's definition (Communication 2023) is fairly aligned with the scholarship's, as it contains explicit reference to content creation ("designing, making simulations"), which marks a full recognition of the relevance of this component, as we proposed.[30]

Moreover, in becoming aware of possible evolutions of virtual worlds, the EC reformulated its definition (as compared to the 2023 Call for Evidence), making it more forward-looking and future-proof (not limiting its scope to a recognition of the current scenario).

At the same time, however, the most recent EC documents are unclear as regards the terminology used to distinguish state-of-the-art (Birth stage) and prospective (Infant) virtual worlds. The latter are termed 'metaverse' (although only in the EC's SWD, not the Communication), making it appear that interoperability and seamless communication among networked virtual worlds would become key elements in a not yet clear stage. In other words, despite acknowledging the relevance of interoperability and standardisation throughout the Communication (and SWD), it is uncertain when they will be established, by whom, and through which means.

Finally, like in the scholarship, core characteristics of the last (Maturity) phase are still uncertain, as much depends on how the Web 4.0 will work.[31]

[27] World Economic Forum (WEF), Demystifying the consumer metaverse, January 2023, p. 43. See also Cominted Labs, How AI Will Revolutionize Metaverse Content Creation, available at https://comintedlabs.io/how-ai-will-revolutionize-metaverse-content-creation/.

[28] See M. Damar (2021) Metaverse shape of your life for future: A bibliometric snapshot, in Journal of Metaverse, 1 (1), pp. 1-8 (describing the metaverse as "the layer between you and reality", to emphasise its immersivity, and defining it as a "3D virtual shared world where all activities can be carried out with the help of augmented and virtual reality services").

[29] See the opinions by several experts reported by the PEW Research Center (2022) The metaverse in 2040, June 30 (available at: https://www.pewresearch.org/internet/2022/06/30/the-metaverse-in-2040/).

[30] Di Porto & Foà, fn 7. In the Call for evidence 2023 the EC did not acknowledge mass content creation as an essential element of virtual worlds.

[31] Possible scenario are identified, for instance, by Ericsson, which speaks of 'Internet of senses': 10 Hot Consumer Trends 2030, December 2019 (available at: https://www.ericsson.com/4ac661/assets/local/reports-papers/consumerlab/reports/2019/10hctreport2030.pdf).

2.4 Our Definition of Virtual Worlds

In light of the above review, we propose the following definition of virtual worlds:

> *"An immersive, synchronous, persistent and **unified** 3D user experience that enables mass content creation".*

We deem this definition comprehensive and not-too-far-reaching at once. At the same time, it better clarifies the subject matter we are discussing and may be widely agreed upon.

While capturing the main characteristics of virtual worlds identified by earlier definitions, it does include features that have already landed on the market, like Mass Content Creation. This definition captures the second phase of virtual worlds, that is, their Infancy (intermediate stage), but not the last Maturity one (metaverse in Web 4.0) (see *Table 1* above), where further features will emerge that are not foreseeable yet.

By referring to 'Unity' of the user experience, our definition adds clarity about the relevance of interoperability and standardisation. To grant users the ability to operate cross-platform and perform a wider experience, interoperability and standardisation should be available among platforms, but limited to certain features. The latter (as discussed below 4.4 and 5.4), could be, for instance, identity verification, virtual assets, currency, as this would enhance trustworthiness among users and enlarge the demand.

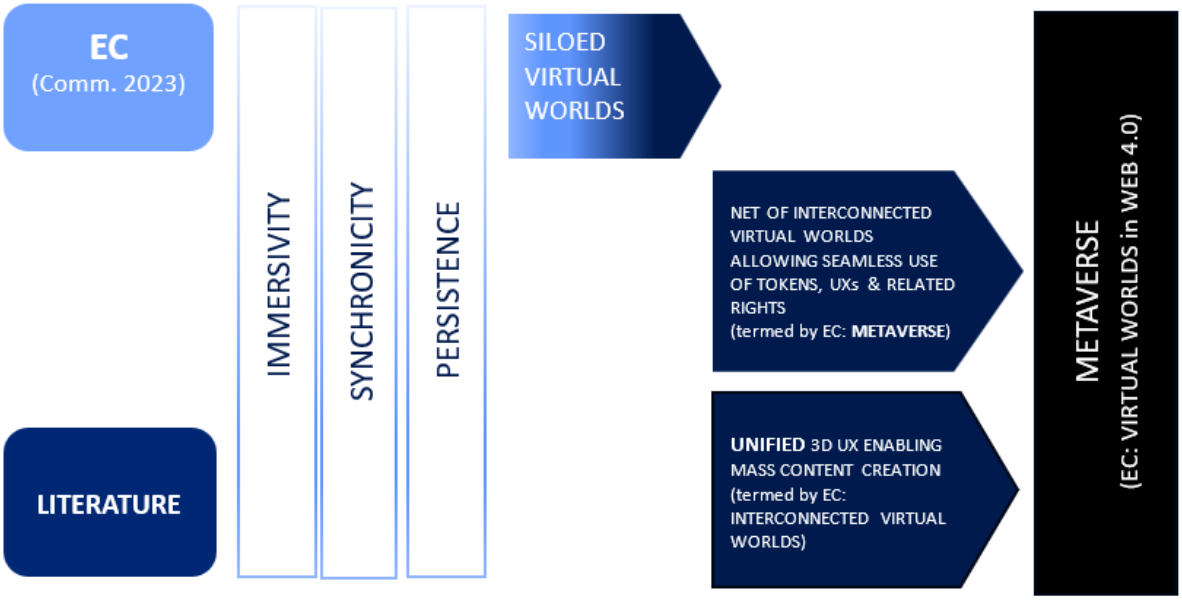
On the contrary, at this stage, it would be premature to recommend interoperability and standardisation among the technologies or inputs used to create virtual worlds (such as AR or VR) and/or the underlying technological infrastructure to deliver the experience (for instance, hardware, network, etc.), as the EC seemed eager to in its Call for evidence (but not the Communication).[32]

Our definition does not use the word metaverse (as the EC does), which can be misleading for operators and users, but employs the concept of 'unified' user experience, which characterises the essence of networked virtual worlds. Metaverse, instead, indicates the final stage of development, where there is a full convergence of real and virtual realities in a Web 4.0 environment.

The content of the various definitions and the progressive breadth they have (with the mature stage definition being the broadest and most all-encompassing) is graphically represented in Fig. 4.

[32] The Call for evidence (EC 2023a) referred to the 'seamless communication among smart devices', thus implying that visors, smart glasses, C-BIs, mobiles of the future, IoT sensors, and so on should be able to connect, interact and exchange data without interruptions. See Di Porto&Foà, fn 7, para. 2.2 for comments.

Fig. 4: Unpacking and comparing definitions of virtual worlds



In the following, we will use the definition of virtual worlds that we have drawn (above, 2.4).

3. CHARACTERISTICS OF VIRTUAL WORLDS

In the following, we provide a list of characteristics of virtual worlds which are extracted from the review above. Virtual worlds are characterised by: (1) immersivity; (2) synchronicity (or real time); (3) persistence; (4) unity; (5) three-dimensionality; and (6) mass content creation. While features 1, 2, 3 and 5 are fairly undisputed concepts, Unity (4) and mass content creation (6) are not.

While we generally refer to the CERRE Issue Paper for a thorough discussion of these characteristics, nonetheless we deem useful to highlight here the essential elements[33] that are relevant for the analysis of policy issues (below, Section 4).

Immersivity: it refers to the type of experience that the virtual worlds enable composed of: in-web presence, that indicates the idea that virtual worlds may enable experiences not 'in front of the web' but 'within the web'; and sensoriality. Different immersion levels of user experiences may be enabled by different technologies.

Synchronicity: the ability of virtual environments to allow users to communicate and interact in real time, or in ways that make them feel as if they were actually in a common environment. Different devices and technologies allow for diversified degrees of synchronicity.

Persistence: It indicates that virtual worlds continue to evolve even when users are not connected to them, and the consequences of such evolution are perceived by/affect the user when connected again.

Unity: quality of a plurality of virtual worlds that are interconnected and interoperable among them, a condition that does not exist in the present phase (Birth in Fig. 1, above), but will materialise at a more mature stage of development (Infancy), most reasonably due to the EC's position on this point. Once virtual worlds are unified (that is, interconnected and interoperable), users will be allowed to move their identities, data, currencies, and items seamlessly from one to another.

Mass Content Creation: Users are enabled to create content (for instance, through generative AI, or NFTs minting programmes) or apps to add new features to virtual worlds, modifying the environment in which they enjoy the services.

Three-Dimensionality: the user experience occurs within computer-simulated electronic 3D virtual environments (in the case of VR) or through the interaction with computer-simulated electronic 3D virtual elements (in AR and MR). This characteristic is strictly connected to the "in web presence" feature.

Some of the examined features are more prominent in specific use cases. For instance, different enabling technologies allow for different levels of immersivity (that is, AR grants lower levels of immersivity compared to VR). Services and user experiences can be tailored to the users needs, allowing them to access the services either at full or lower level of immersivity. In gaming, as is the

[33] See Di Porto&Foà, fn 7, para. 2.1.3 for an extended analysis of virtual worlds' features.

case for PokemonGo, for example, users' apps may be operated both with VR (via visors) and AR[34] (through mobile phones), thus enabling different degrees of immersivity.

Technology may also enable various levels of persistence: for instance, AR may be employed to help cultural heritage restorers perform their job by letting them visualise the deterioration of an ancient artefact. Information regarding the degradation of the object (due to some atmospheric agent) continues to update even when the restorer is not connected. In such a case, both the physical world and objects linked to it change no matter who is ccted and when.

With VR, the degree of persistence is highest, as the user might be impacted directly from changes in the environment that took place while off-line, without having any control over them because other users may also interact with the same objects, modifying the (virtual) reality and impacting the user's sphere, even when disconnected. In AR experiences, instead, the user maintains a degree of control and can selectively and consciously decide to engage in a certain experience. Persistence exists in MR as well. Taking the example of restorers mentioned above, one can think of several collaborators working on a broken statue restoration, with 3D holograms featuring the statue's missing parts, built based on historical research. Not only the physical object but also the hologram can change over time, due to new discoveries and progress in historical research, and the way reconstruction work is advancing.

[34] Ji-Young An, C. R. Nigg (2017), *The promise of an augmented reality game—Pokémon GO*, Annals of Trasnational Medicine, Vol 5, Supplement 1.

4. POLICY ISSUES OF VIRTUAL WORLDS

In the following, we identify a number of distinctive policy issues of virtual worlds that follow from the definition given above. The issues do not coincide with the individual characteristics of virtual worlds described above (Section 3). They are rather problems that we identified based on the literature review, the responses to our questionnaire, and materials received from CERRE members.

Relevant policy issues of virtual worlds relate to user experience, mass content creation, technology and connectivity infrastructure, and governance. We analyse them each below.

4.1 User Experience

User experience (UX) indicates both the set of activities that users can engage in within virtual worlds as well as the effects that these may have on the user, their preferences, and assets.

The kind of UX deployed in virtual worlds is different from that of other 2D digital spaces, due especially to synchronicity and three-dimensionality. More than other characteristics, those two raise concerns for the perceived quality of the whole UX and highlight issues that are strictly dependent on the efficiency of the technologies (software and devices) employed.

4.1.1 Attractiveness

Synchronicity of shared experiences is key to making the virtual worlds appealing for users. In virtual worlds, users can perform social and collective activities (like receiving health assistance, making in-game purchases, or even political participation) feeling as if they were in the same common virtual space. Shopping can be also enhanced through VR. For instance, the luxury brand D&G participated in the Metaverse fashion week, organised by Decentraland, and auctioned their digital wearables there. To make the auction acctractive, the brand guaranteed buyers the right to have access to drops with priority or receive the physical version of the virtual item they bought.[35] Community building dynamics are thus essential in reinforcing the attractiveness of virtual worlds. Enhancing relations through cross-virtual worlds engagement can be done by several means, such as the transferability of assets across virtual worlds (see Section 4.2.3).

4.1.2 Perceived quality

The perceived quality of the user experience impacts the attractiveness of virtual worlds and their ability to retain the user base. The factors that influence the perceived quality clearly vary depending on the use case and individual user. Therefore, personalisation is a key to maximising quality perception. The graphic quality of digital content is another factor and should be maintained, where technically feasible, once the token or digital object is moved from one virtual world to another. However, challenges may arise: for instance, if quality has to be maintained, the minimum specification requirement for hardware to join virtual worlds may increase. Games today already employ varying framerates, dynamic resolutions, and other technologies to support lower-power devices. Something similar could be implemented by each provider to keep engagement rates high

[35] D&G ensured consumers who were auctioned a virtual dress one year to receive the physical version of the item. Less than 40% of buyers claimed the real object.

within its own virtual world and, where technically feasible, across virtual worlds. Similarly, security, safety, and data protection (both personal and non-personal), as well as digital rights protection, are factored in the perceived quality of the UX.

4.1.3 Devices

The user experience in virtual worlds is, at least to date, strongly influenced by the devices available to the user, which represent the entry portal to virtual worlds. There is wide consensus on the idea that virtual worlds may enable experiences not 'in front of the web' but 'within the web' (that is, in-web presence).[36] It is debated, however, whether computers and mobiles should also be considered as enabling devices for virtual worlds. Although these tools can be used as entry points to access virtual worlds, they are in front of the users' eyes, and only suitable for providing a minimal degree of 3D experience to the user. Screen-based devices (like PCs) might also be used for their computational power (see Section 4.3 below). However, there is a progressive shift towards more immersive modes of interaction (from 2D to 3D interactions).[37]

At the current state of technology, the smartphone represents the most commonly used entry point to AR experiences for everyday purposes (entertainment, shopping), whereas AR/VR glasses are most commonly used for gaming or professional education/training purposes.

4.1.4 Efficiency vs accessibility and inclusiveness: Virtual worlds in health, education, and city planning

Virtual worlds have enormous potential to enhance social inclusion, as they can remove territorial distances to access in-person services. One well-known example is virtual health labs.[38] Other examples include the creation of software for converting audio to visuals for real-time translation to support people with hearing difficulties.[39] When used for educational purposes, virtual worlds can make training more effective[40] while also improving digital literacy. For instance, in university law classes, legal clinics may be deployed through VR or MR, reaching a higher level of engagement by students (who will be less anxious in meeting the clients) and less advantaged people (who would feel more comfortable to speak of their legal problems and receive pro bono assistance). In another example, history students can visit historical locales or investigate artefacts, wherever the students may be based.[41]

In one geographic use, France National Mapping Agency (IGN) is planning to develop a digital twin world that is a "living" digital 3D model of France country and towns with online visualisation, navigation, interaction, and simulation. This may, notably, help government and local authorities with ecological planning, including aspects of evaluation land use projects, deployment of renewable energy, risk management, sustainable cities, water and forest management.

[36] See above 1.1.3.A.
[37] EC (2023b) at 33.
[38] The University Hospital of Vienna in Austria uses XR-1 SmartView to show live sensor data in real-time during ventilation of newborns to facilitate life-saving neonatal and infant healthcare.
[39] This has been implemented by XRAI Glass.
[40] Avantis Education brings VR lessons and experience to students by visiting historic places or investigate rarest artefacts virtually.
[41] This is implemented by the Colegio Escalaplos Spria in Spain.

In this case, a public digital twin shall be a core infrastructure guaranteeing sovereignty and public missions, involving data, 3D mapping and basic simulation services. Such digital twin must meet the local authorities' needs. Furthermore, it has to facilitate uses and accessibility both economically and practically. It also ought to rely on public-private partnerships to develop services with added value and boost business sectors (start-ups, SMEs, insurance companies, planners…)."

However, the accessibility and inclusiveness of virtual worlds may be affected by different factors. First, **connectivity** requirements, given latency, may play a large role in rendering 3D worlds in real-time. Second, devices come with different **prices**, **sensor suite**, and **processing power** allowing for diverse degrees of immersion.

Accessibility may be prevented by differing quality of network connection (for instance, two people might not be able to share an experience if one is using AR and the other a 2D screen). Or, more importantly, if the latency between two users is too long, they would not be able to engage in a synchronous experience. Not intervening on these issues may impact on the most remote or grey areas, where virtual worlds may prove essential to enhance public services provision like health.

Inclusiveness may be affected in several ways. On the one hand, more sophisticated devices can be unaffordable to many, who will remain excluded to more advanced UX; however, the price of devices is likely to fall significantly in the future, and cheaper ones have already landed on the market. On the other hand, those who want to disconnect might feel invaded. Therefore, technical product requirements aimed at ensuring a (minimum) acceptable level of UX, including the offline option, are welcome.

Thus, because technologies are still at an early stage of development, the industry, as part of the usual process of emerging markets, will likely need to work on technical product requirements to ensure interconnection and a (minimum) acceptable level of UX, and do so in a self-regulatory cooperative way (in Standard Setting Organisations - SSOs, for instance). Where this is not happening, policymakers may consider incentives.

4.2 Mass Content Creation

Content creation is increasingly moving towards mass production by users in combination with edge computing, cloud computing, and generative AI. Virtual worlds will more and more feature a content economy at created mass scale that will help populate it,[42] and therefore it is relevant to assess what makes mass content creation profitable and how to incentivise it.

4.2.1 Technology

There are already several technologies (and further are constantly being developed) that play an enabling role and whose functionalities allow for content creation (self-produced NFTs, gamification, apps, digital art, and fashion). Open and cross-device platforms also engage developers and manufacturers – from small to large enterprises – to collaborate in the co-creation and building of immersive apps and new technologies for virtual worlds experiences (such as Snapdragon Spaces™).

[42] McKinsey & Company (2022), Value creation in the metaverse, The real business of the virtual world. Available at https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/value-creation-in-the-metaverse.

Advancements in technology and tools available to users, such as generative AI, can also improve the ease with which content is generated or how content can reactively adapt to user input. Developers in the market are fully engaged to offer the new hype application that may make creating new content easy for users.

4.2.2 Education for content creation

At the same time, digital education has the potential to empower users and enable them to better master content creation. Content creation is, in fact, among the key indicators of digital literacy and is employed as a teaching tool in learning-by-doing practice.[43.]

4.2.3 Monetisation and other incentives

Allowing monetisation is typically a means to foster user engagement. The same holds with mass content creation. However, according to certain sources, the prevailing scheme for incentivising engagement (that of social networks), which is based on the verticalised 'influencer-follower' model, does not remunerate followers' time and attention, only those of influencers (through ads and resale).[44] In virtual worlds users are also creators and therefore employ their time and attention to ameliorate virtual environments. These efforts could be compensated. Since the pyramidal 'influencer-follower' model is rapidly reaching its peak in popularity, new tools to remunerate engagement that are different from mere 'likes' are needed in addition to monetary incentives (proposals in this regard are made below, in Section 5.2 and the following).

4.2.4 Fostering seamless movement of items

It follows from the character of a 'unified 3D experience'[45] that content creation in in virtual worlds would be strongly incentivised if users were allowed to move their creations (avatars, data, currency, and items) seamlessly. This pursues the dual purpose of employing them within a virtual world (as it happens already) and monetising them by selling to other users in other virtual worlds.

To create a secondary market for virtual goods (such as avatars, NFTs, AI-generated apps, skins, and so on) currencies and identities, it is necessary to generate user-friendly models for their transfer. Such models should be based on interoperability standards (see 4.4 and 5.4 below), as acknowledged by the Communication 2023[46].

4.3 Technologies and Connectivity Infrastructures

To make virtual worlds reach their full functionality, many different technologies are needed. Each of them has specific features that can impact the structure, interconnection among virtual worlds, the ways in which users interact, and – not least – virtual worlds' capacity to express and exploit all their potential features.

[43] T. Lynde, K. Beaumie (2015) Learning by Doing in the Digital Media Age, available at 10.1007/978-981-287-326-2_12.

[44] T. Di Bartolo (2023), How Phygital Takes The Metaverse Into Mass Adoption, And What That Means For Businesses, February 8 available at the following link https://www.forbes.com/sites/forbesbusinesscouncil/2023/02/08/how-phygital-takes-the-metaverse-into-mass-adoption-and-what-that-means-for-businesses/

[45] See definition above, Section 2.4

[46] EC (2023b), fn 2 at 4: "interoperability "between platforms and networks and freedom of choice for users, and sustainability, inclusion and accessibility."

Besides technologies, *connectivity* is another essential enabler of virtual worlds. Connectivity can be delivered by several infrastructures, among them: fixed high-speed networks, mobile high-speed networks (including 5G mmWave for dense urban areas, and future 6G), edge computing,[47] or Bluetooth.

Connectivity infrastructures. To enable persistence as well as full (and seamless) mobility between virtual words and the sharing of content among them, their IT infrastructures should be made compatible. To do so, connectivity infrastructures (such as Application Programming Interfaces - APIs) would require some common features. Even if no standardisation initiatives are undertaken, at least certain minimum technological aspects that enable compatibility (with reference to both hardware and software) might be defined. Considering that the EC announced a parallel initiative aimed at studying a performant and resilient infrastructure for connectivity needed for the functioning of virtual worlds,[48] we do not elaborate further on this topic.

Technology. Among the many, technologies used in video games, such as cloud gaming services,[49] could be viewed as necessary to facilitate persistent environments and user connection. Similarly, AI, display technologies, and blockchain engineering can be functional to achieve such objectives.

When dealing with blended real-virtual realities (MR hypothesis), persistence requires a bidirectional flow of information that makes the environment evolve continuously, considering both the changes that have taken place in the real world, as well as those specific to virtual worlds or virtual elements that are plugged into the real world.

4.4 Governance Issues

Currently, the EC is fostering a governance structure of virtual worlds that is based on a network of interconnected virtual worlds (like the World Wide Web,[50] Fig. 2, above). However, three aspects are not entirely clear:

- What degree of interconnection/interoperability is optimal to attain a network of interconnected virtual worlds (Infancy). It is probably too early to figure this out, and that may explain why the EC intends to support the creation of a technical multistakeholder governance process to address essential aspects of virtual worlds and Web 4.0[51].

[47] EC (2023c) fn 3, at 37.

[48] On February 23rd 2023, the EC presented "new initiatives, laying the ground for the transformation of the connectivity sector in the EU". On the same day, it published the Gigabit Infrastructure Act Proposal (COM(2023) 94 final 2023/0046 (COD)) and Impact Assessment (SWD(2023) 46 final).

[49] "Cloud gaming" means playing a game remotely from the cloud (i.e. a network of data centers filled with servers that deliver content to whomever is trying to access it). Signing up for this kind of services means to buy access to remote a server empowered with hardware for running games. Once launching the game, video stream of the game is sent to the user's machine. See: J. Roach (2024) The Best Cloud Gaming Services of 2024: Wave of the Future, available at: https://www.cloudwards.net/top-five-cloud-services-for-gamers/, 10 January; J. Rietveld (2023) Cloud Gaming Is Not A Distinct Market. A Typology of Cloud Gaming Services and What It Means for Microsoft's Proposed Acquisition of Activision Blizzard, Submission prepared for the UK's Competition and Markets Authority concerning its Microsoft / Activision Blizzard merger inquiry, 31 March (available at: assets.publishing.service.gov.uk/media/642e9e29fbe620000c17dde1/Cloud_gaming_Opinion_.pdf).

[50] T. Di Bartolo (2023), How Phygital Takes The Metaverse Into Mass Adoption, above under fn. 23 describes Phygital as the most mature phase of the metaverse, where digital and physical realities will overlap: we will no longer use headsets or type an address to navigate it, but simply "where we stand is where the metaverse will be".

[51] EC (2023b), fn 2, at 11.

- Whether interoperability is limited to the user experience or extends to the underlying technologies.
- Finally, due to the different technologies and protocols each virtual world uses, there is no consensus as to whether virtual worlds, once interconnected, should be based on proprietary standards and centralised governance, or an open decentralised framework will prevail (using blockchain, P2P, and so on). At present, virtual worlds employing centralised structures (like many social networks) tend to prevent users from contributing to the development of the platform itself. On the other hand, decentralised virtual worlds[52] are community-based environments where users can deploy content creation (above, Section 4.2) to develop software on a distributed basis. However, as cautioned by Europol, decentralised technologies are being taken up by big tech to support their platforms and centralised services too.[53] Therefore, it is hard to foresee what governance structure will prevail.

What is emerging instead is a high degree of cooperation, where centralised and decentralised operators are collaborating on the most innovative portions of virtual worlds'-related technologies and services. This testifies that collaboration is needed to make virtual worlds a success. Such collaboration is especially open and visible among technology developers and can be appreciated at the level of interoperability and standard setting.[54]

This cooperative model will possibly have a direct impact on the timing of virtual worlds' full development as well as in their final governance structure. It is not by chance that the EC recalls that it is crucial for the EU to be present in the development of virtual worlds and their governance, and lead the way through the setting of open standards by reinforcing the EU Strategy on Standardisation and drawing on the work of the High-Level Forum on European Standardisation[55].

We will return on the issues of interoperability and standard setting in virtual worlds below (Section 5.4).

[52] Like gaming platforms, decentralized 3D browser-based virtual worlds, and new entrants like innovative start-ups or SMEs

[53] Europol (2022), Policing in the metaverse: what law enforcement needs to know, October, p. 12, available at the following link https://www.europol.europa.eu/publications-events/publications/policing-in-metaverse-what-law-enforcement-needs-to-know.

[54] See e.g. the Metaverse Standards Forum (https://metaverse-standards.org/), counting over 2000 members coming from the industry, SDOs, Universities, institutions, and advocacy organizations (including consumers).

[55] EC (2023b) fn 2, at 11.

5. REGULATORY GAPS

As an introductory note, we highlight the lack of certainty that lies on the future paths for development of virtual worlds, with or without different types of rule structures, given the rapid pace of technological development. As a result, it is worth emphasising a general principle of defining rights (notably property rights and low-cost dispute resolution structures) clearly so that expectations are aligned, terms of trade can be developed and the virtual world development be assured without monopoly but with respect for property rights that will incentivise innovation and create diversity.

From a policy perspective, a first challenge concerns whether policy makers should consider an overarching policy that covers all possible use cases/virtual worlds, across both consumer and enterprise segments, or whether policy should be distinct for each user experience showing similar characteristics. For instance, should virtual worlds in the health sector be tackled through the same policy as entertainment ones? Would a policy aimed at addressing all at once be preferable?

We believe it might be too early to take a final position on the issue of general-vs.-case-specific policy given the current stage of development of virtual worlds. Use cases already exist, such as for shopping, gaming, and health delivery at a distance, but many more are in development, and others likely to be developed in the years ahead. For this reason, we deem preferable to focus on the policy issues discussed above (Section 4), that are shared by all virtual worlds and to provide, in this Section 5, a preliminary assessment of the possible regulatory gaps related to each of them. This preliminary assessment is based on considerations on the economic and legal rationales for intervening in virtual worlds, and some policy options are proposed.

These considerations then feed into the formulation of policy recommendations under Section 6.

5.1 User Experience: Behavior Moderation, Accountability, Security, Children, and Data Protection

As discussed, cybersecurity, safety, and data protection (both personal and non-personal) as well as digital rights (including intellectual property rights) protection are essential elements for the perceived quality of the UX (for both users and creators). As those elements may vary notably across virtual worlds, there is room for spillover effects (that is, the perceived quality of all virtual worlds may be negatively affected by one single bad experience).

As outlined by the EC, the current EU regulatory framework already tackles many of these issues through (among others) the General Data Protection Regulation (GDPR), the Digital Markets Act (DMA), the Digital Services Act (DSA), and the Data Act. Other tools are in the pipeline, such as the AI Act and eIDAS2 (European Digital Identity).[56] The latter is particularly essential to providing users with control over the data they want to share. However, it is worth noting that some clarity is needed regarding data 'inferred' from personal data (such as metadata inferred by the provider of virtual

[56] See the proposed revision of the eIDAS Regulation (No. 910/2014): COM/2021/281 final, of 3.6.2021. Provisional agreement reached among co-legislators on 8 November 2023.

worlds from the interaction of users), and to what extent these data can be considered as 'personal' and thus covered by the GDPR.[57]

On the other hand, there are some issues that might call for specific consideration by policy makers, such as behaviour moderation, accountability, protection of children, and privacy. Other possible concerns are terms of use, codes of conduct, community guidelines, and user expectations.

5.1.1 Behaviour moderation

Concerning behaviour moderation, the current EU legal framework already tackles illegal and harmful content online (through the DSA, for example). The notion of content refers to products and services, as well as hate speech or fake news. It is not clear, however, whether behavior of people (in MR contexts) or of avatars would fit and, therefore, be moderated. That might have different impacts on the perceived safety of virtual worlds and thus require special attention. Therefore, this area may need further consideration, taking into due account the points raised above (Section 4.1).

Moderation of behaviour can itself be seen as about the relative 'non-material property rights' of self-expression and prevention of offence. The full extent of the balancing between these rights is beyond the scope of this paper, however, balancing between the mixture of private (or publicly demanded) censorship inevitable with behaviour moderation and the social impacts, or offence, created by lack of censorship is complex.

The existing major Internet platforms have developed standards for the moderation of written content. These may ultimately be **expanded to consider behaviour moderation**. A key point to keep in mind, though, is that behaviour exclusively within a virtual world is completely different from that in the physical world. For example, video games that involve violence are common. However, this does not mean that they should be governed by physical-world rules constraining violence. Moreover, the likelihood that offence-based rules will constrain free speech is high, due to the likelihood that almost any political or social view is offensive to at least a small proportion of the population. So the extent to which behaviour moderation should occur will require delicate balancing that will, inevitably, leave some whose views are not respected feeling offended.

Building on the principle that what is illegal or harmful offline should also be considered legal or harmful online, liability rules should fully apply to virtual worlds. The problem arises especially with virtual worlds that run on decentralised technologies as it is extremely challenging to hold tortfeasors accountable with reference to their behaviours. Decentralised autonomous organisations (DAOs)[58] in most countries are not recognised as legal entities (although there are some exceptions, such as Malta and the U.S. states of Wyoming, Tennessee, Vermont, and Utah [59]). Where the DAO is not recognised

[57] The CJEU (decision in case C-184/20: *Vyriausioji Tarnybinės Etikos Komisija*) of 01 August 2022 established that inferred data that reveal the sexual orientation of a data subject are equated to "special categories of data" defined in article 9 of the GDPR (i.e. super personal data, like health conditions or union membership) and that the Controller must not process unless the GDPR article 9 exclusions apply). What we are discussing in the text, on the other hand, is whether data inferred in one virtual world that do not necessarily reveal "special categories of data", could be assimilated to personal data provided that they are used to profile individuals for the sake of providing a given service in another virtual world,.

[58] WEF (2023), Decentralized Autonomous Organization Toolkit, Insight Report, available at https://www3.weforum.org/docs/WEF_Decentralized_Autonomous_Organization_Toolkit_2023.pdf.

[59] For example the US state of Wyoming proves to be a 'crypto-friendly' state, having introduced a "beneficial legal status for blockchain technology firms" organized as DAOs, recognizing them as a type of limited liability company. Utah and Tennessee adopted similar

as a legal entity, members may face personal liability – without recourse rights – with respect to the damages created by the DAO. Although the EU legislator recently approved the Markets in Crypto-assets Regulation (MiCAR)[60] (which regulates the market in cryptoassets, including their issuers), it does not address the issue of the legal personality of DAOs.

Therefore, it is advisable that the EC harmonises the rules on the legal personality of DAOs operating virtual worlds in the EU, or that the EC establishes common principles on the legal personality of DAOs, so that once entrusted by one member state, it is recognised by all other member states.

5.1.2 Accountability and enforcement

Meanwhile, it seems appropriate to consider specific accountability of users and service providers for their harmful or illegal conduct, which possibly **employs technological tools**. Technology may ease the detection of harmful and illegal behaviour and the respective enforcement. In that sense, one possibility could be to combine technology and robust systems and processes.[61] In that case, technology would need to capture data to attribute actions of users and service providers within the virtual worlds to support analysis and evidence.

On the other hand, technological tools can provide support in the application of sanctions. However, it will be necessary to define the consequences for users when rules are violated; whether the application of ban mechanisms is sufficient, and if so, whether this should also be recognised by platforms other than the one that detected the violation (in the latter case, a clear legal basis will be needed); or whether it is also deemed necessary to embed liability remedies in the technological structure.

In any case, regulation would need to ensure that, regardless of specific technologies employed, systems and processes are robust in identifying behaviour contravening regulation, terms of service, and providing consistent mechanisms for recourse, redress, and where appropriate escalation.

From a legal standpoint, it is difficult to determine what liability scheme would exist that accommodates different virtual worlds, given the variety of technologies they are based on and the absence of legal interoperability.[62] From an economic perspective, the plurality of virtual worlds may make transaction costs high. As noted, some user experiences will likely be virtual-real interactions (like medical care), while others will be fully virtual, resulting in differing contractual means to interact.

solutions. See European Parliamentary Research Service (2023), Non-EU countries' regulations on crypto-assets and their potential implications for the EU, Briefing, available at https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/753930/EPRS_BRI(2023)753930_EN.pdf.

[60] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937.

[61] Proposal made by one of the respondents to the questionnaire we administered to the participants to this project.

[62] Defined by the EC as 'ensuring that organisations operating under different legal frameworks, policies and strategies are able to work together. This might require that legislation does not block the establishment of European public services within and between Member States and that there are clear agreements about how to deal with differences in legislation across borders, including the option of putting in place new legislation.' Annex 2 to the EC Communication on Interoperability framework – Implementation strategy, SWD (2027)112 and 113 final, of 23 March 2017.

Therefore, it would be desirable to have appropriate liability and default contracting rules (including certification of expertise) to enable efficient transactions.

In order to ensure that parties involved in virtual worlds are accountable, one can imagine several layers of legal and regulatory oversight, including, from the beginning, virtual-world-specific rules and potentially national or international rules[63], with international rules being relevant exclusively for cross-border activities to the extent that those are not covered by virtual world-specific rules.

According to the European Parliament,[64] virtual worlds based on decentralised technologies give rise to problems when it comes to ensuring the applicability of EU law and the protection of the rights of consumers and businesses.[65]

The rules of accountability can, to a large extent, focus on property rights. Assignment of property rights and obligations in market economies is often considered as a precursor to ensuring the best social allocation of property. The combination of a clear assignment of property rights and a predictable enforcement structure for property rights could be a prerequisite for full development of virtual worlds to their socially optimal extent.[66]

Operationally, the degree to which the 'platform' that runs the virtual world provides investigation, enforcement, and punishment has implications for national police and court operations. A first preference might involve platforms being self-policing, otherwise costs of law enforcement will be spread across users of virtual worlds and non-users. An argument for self-policing is that there is no default reason to see why non-users should be forced to pay for such constrained policing and enforcement costs. Another reason to accept self-enforcement is that competing virtual worlds do have incentives themselves to develop reputations for running acceptable property and enforcement structures.

However, a reason to prefer external enforcement could be that giving private companies the equivalent of law enforcement mandates is an outsourcing of what should be a government function and imposition of a public cost on private companies. These reputational concerns will play out, in particular for marginal and newly arriving users.[67] Note that, at the same time, there may be broader public interests that would influence the virtual world rules that would apply and that the users of multiple virtual platforms may not fully appreciate the value of certain rules when deciding to engage with a virtual world, suggesting that some external oversight may be valuable.

In this regard, the Digital Services Act already introduces various layers of obligations on intermediary service providers, online platforms, and very large platforms to remove illegal and harmful content. In particular, the DSA "contains rules on how platforms moderate content, on advertising, algorithmic

[63] Interpol (2024), Metaverse. A law enforcement perspective. Use Cases, Crime, Forensics, Investigation, and Governance, White paper, available at: https://www.interpol.int/en/content/download/20828/file/Metaverse_a law enforcement perspective.pdf. The white paper at 6 highlights that there are already a number of use cases of "Metaverse for law enforcement".

[64] European Parliament, Committee on Legal Affairs (2023) (in the following, EP (2023)) Draft Report on policy implications of the development of virtual worlds – civil, company, commercial and intellectual property law issues (2023/2062(INI)), of 10 October.

[65] European Parliament, Committee on Legal Affairs (2023) (in the following, EP (2023)) Draft Report on policy implications of the development of virtual worlds – civil, company, commercial and intellectual property law issues (2023/2062(INI)), of 10 October.

[66] See Coase, R. H. "The problem of social cost." *The Journal of Law and Economics,* Vol. III, 1960, pp. 1–44.

[67] For example, Article 21 of the DSA involves out-of-court settlements for dispute settlements with online platforms.

processes and risk mitigation, the infringement of which may make platforms – in particular the very large ones – are deemed accountable for the actions they take and the systemic risks they pose, including on disinformation and manipulation of electoral processes."[68]

Further thought is needed on the nature of 'personal penalty' (world-specific standards for equivalent of criminal, or misdemeanor conduct) and financial liability schemes for non-delivery of contracted goods or for damage. There is a risk that virtual world operators under-enforce against users that are, to some extent, 'important' for the platform and who might, if subject to penalties, move their primary activity to other platforms and potentially take more users with them to other competing operators.[69]

A practical aspect of virtual worlds operation may involve banning of individuals. Should this occur, the appropriate mechanisms for sharing such information across platforms and determining whether a banishment should be extended to another platform raise further questions to which thought needs to be given. In particular, larger and more complex virtual worlds may be expected to develop more full and complete enforcement systems, while smaller platforms, if required to implement a full and complete system, may either go out of business or not be created in the first place.

Thus, some balance may be needed between extent of expected law enforcement system, platform size, financial and technical resources available, and potential harms in such a way that the approach adopted does not prevent development of small new platform alternatives. Virtual-real world interactions, such as medicine applications, may require a different legal and enforcement procedure, due to the need to have a real-world law application for at least part of the interaction.[70]

Moreover, cross-border activity is inherently possible within virtual worlds, as the user of two avatars/token producers engaged in a dispute may be based in two different physical countries and the platform potentially in a third. Resolving the jurisdictional complexity may require some standards that are yet to be developped, and, given the complexity of international negotiations, may be difficult to do so. A potential default in the meantime may be that platforms are the rule makers and rule enforcers within their given world. If outside decision makers were needed, external arbitration that would operate on the virtual world rules could be provided. It is worth noting that, with respect to cross-border activity, interoperability may raise further complications as a token or avatar feature acquired on one platform then does not work well on another.

In this regard, the position of the Committee on Legal Affairs of the European Parliament is reasonable in suggesting to amend the existing provisions of private international law "to guarantee that citizens and businesses do not have to systematically litigate in foreign courts or under foreign laws".[71]

[68] EC (2023c), fn 3, at 78.

[69] There is also a time consistency problem with operators who may wish to appear with user-desired rules when the world is building up its activity but then to abandon the initial commitments after the world is developed at a time when user movement is more difficult. This time inconsistency problem could also be deterred by interoperability that allows full movement of users. However, as discussed, later, the practical problems of achieving inter-operability may be severe and could penalise innovators and be impossible to implement with highly differentiated worlds or with the existence of intellectual property rights that prevent all worlds from offering the same product.

[70] The (different) charachteristics and social relevance of the virtual worlds in different sectors brings also the question on whether a hierarchy between worlds, and their rule enforcement, may also need to be considered. Similarly, a hierarchical structure of rule enforcement may also be expected to develop within virtual worlds.

[71] EP (2023), fn 65, at 8.

5.1.3 Detection of misbehaviour and enforcement

Rules for the detection of harmful behaviour and related enforcement can be achieved either by means of binding regulatory initiatives or by virtue of commercial initiatives taken by individual service providers. In the latter case, the terms and conditions will reflect the level of user protection. However, in an interconnected/interoperable virtual worlds scenario, a minimum level of protection common to all virtual worlds could be considered, as spillover effects might arise (that is, the protection provided in a single virtual world would be easily frustrated if not 'transferred' to another one).

Again, technology might help in this regard. Specific technological safeguards could be put in place to ensure the full enforcement of liability rules and codes of conduct. For instance, the detection of certain harmful conducts could be coded directly into the avatar's metadata, so that the avatar would not work in another virtual world – and in the most severe violations it could scale up to its cancellation. That would prevent regulatory arbitrage based on some virtual worlds' (or countries') more facilitating regimes.

More broadly, moving and interacting across virtual worlds might entail cross-border activity between a person in two different countries, creating jurisdictional frictions (such as which country's law is applicable). Although these problems have already been tackled in the current world wide web, there are more challenges that need to be considered, like 'new products' and 'mixed virtual worlds' products' that go across multiple virtual worlds or between a virtual world and our world (for instance, how to grant protection to 'phygital' assets that consist of physical goods that feature also a digital extension, such as a broken statue complemented by a hologram that reconstructs the missing part, see Section 3 above). Questions might arise as to who would provide police and courts for such cases between private entities or the states.

5.1.4 Children

Virtual worlds may require higher levels of protection targeted at specific users. Based on the audience, the environment, and activities that are carried out, there may be a need to create walled-gardens (or protected 'nests').[72] For instance, an important toy manufacturer has launched a virtual world for children, who clearly have unique needs for safety and security that must be specifically tackled. Means to cope with such needs are several: for instance, one way could be to create child-specific spaces with special safeguards; alternatively – or in addition – communication and privacy preferences for child accounts could be adjusted to limit certain interactions.

In any case, the legal threshold for minors to provide valid consent to data treatment should be reconsidered. In addition, as suggested by the EC, the EU should promote actions aimed at protecting and empowering children in the virtual worlds environment as provided for by the Better Internet for Kids (BIK+) strategy.[73]

[72] Interpol (2024), fn 63, at 24. UNICEF (2023), The Metaverse, Extended Reality and Children, Report, May, available at the following link https://www.unicef.org/globalinsight/reports/metaverse-extended-reality-and-children; Europol (2022), Policing in the metaverse: what law enforcement needs to know, cited under fn. 29, at 17.

[73] EC (2023a) at 8.

5.1.5 Consent and data protection in virtual worlds.

Since the GDPR is mainly based on consent as a legal basis for data treatment, several issues might arise that are not necessarily covered by the regulation. First, users might engage in several virtual worlds through the same virtual identity (such as an avatar). Each time they interact, their virtual identities are enriched with new data: for instance, one can use health services in one virtual world (having health information added to its avatar) and then seek for a life insurance in another. To what extent can the insurance operator access such health information? If in full (because avatars' metadata are transparently shown as a condition to access the insurance virtual world), then there can be a breach of the limitation purpose principle established in the GDPR.

Hence, guidelines are needed to allow easy consent to certain treatment of personal data, but not others, when users cross virtual worlds.

More generally, if avatars become the tool for interacting in virtual worlds, the processes and data protections related to moving data that could reasonably be used on alternative platforms and allow 'cross-platform memory' raise important questions on transferability of data.

5.2 Mass Content Creation

One of the main legal issues related to mass content creation is **intellectual property protection**. The EC's Communication acknowledges that the unauthorised reproduction and distribution of virtual assets can pose a significant threat to both consumers and intellectual property owners, eroding the trust and integrity of virtual worlds.[74] In this regard, the DSA already establishes liability rules that are applicable to the uploading of user-generated content in virtual worlds. For instance, the upload of NFTs using third parties' IPRs without 30uthorization (that is, licencing) is prohibited under the DSA. A problem may arise given that usually NFTs do not provide IPRs over the protected content underlying the token (although they might eventually provide IPR on the token itself);[75] hence, effective measures to detect unauthorised content and remove it are essential. The creation of a specific toolbox against counterfeiting – suggested by the EC - would be welcome to give IPR holders guidance and recommendations on how to enforce their rights in virtual worlds, given the difficulties in identifying infringers.[76]

Virtual world environments present even more challenges – with reference to IP protection – than other online environments. This is the case for AI-generated content, to which EU copyright law does not apply.[77] Consider for instance virtual assistants that, thanks to conversational AI, will gradually

[74] Among the threats it poses, for intellectual property owners, counterfeiting in virtual worlds presents a substantial risk of revenue loss and dilution of brand value. See EC (2023a) at 11 and, more broadly, EC (2023b) at 80 ff.

[75] A further problem is highlighted by the EC (2023c), at 80, that regards whether minting or storing NFTs on the blockchain is an exploration of a copyrighted work or not. "If so constitutes copyright infringement, the full destruction of the infringing NFTs may be difficult. However, blockchain may be useful tool for evidentiary purposes in copyright infringement cases."

[76] EC (2023b) fn 2, at 11.

[77] This is because copyright requires for the work to be the (human) "author's own intellectual creation". That means that only creations that are made by humans with the assistance of AI are covered by copyright law.

evolve to 'digital humans', that is, 3D versions of present chatbots that will interact with humans in virtual worlds producing new content.[78] Further clarifications in this regard would be welcome.

In addition to monetary incentives and 'likes', increased visibility may also create incentives for content creators. One way to do that would be to expand the audience as much as possible or to enhance the possibility to massively create (for example through generative AI), for instance, by allowing users to create more content about a company's brand. This way, the company's digital footprint and brand's reach may grow exponentially.[79] Risks would need to be recognised about the way users, and especially users acting with malicious intent, could damage brand investments. Here disputes might arise that involve the territorial use of a trademark across virtual worlds, and the solution is at this stage unclear.

In general, it is important to ensure that incentives exist for developing products that will provide mutual benefit. Recognition may be needed in the area of patent, copyright, and trademark, in particular, as suggested by the EC's Staff Working Document.[80] Application challenges would include, for example, the ownership of an asset, as with NFTs, which may or may not provide ownership of the underlying object or token.

Products that will create a particular challenge for self-developed regulatory rules of a virtual world include 'new products' and 'mixed virtual worlds products' that go across multiple virtual worlds or between virtual and real worlds. Such goods will face the challenge of having multiple potential jurisdictions.

In that case, a rule of jurisdictional priority will need to be developed. Some adaptation of existing rules to determine jurisdiction may be necessary. In particular, appointing jurisdiction within contracts to use a commonly accepted international base of arbitration may have some value, as this could potentially recover, by contract, a clear basis for allocation of jurisdiction. Absent such rules, or where arbitration is not permitted by national law with respect to a given activity, the challenge of resolving jurisdiction may default to legal standards over allocating conflicts in jurisdiction.

5.3 Technology and Infrastructures: Incentives

As mentioned above, the full deployment of virtual worlds requires several technologies and infrastructures. From a policy perspective, a technologically neutral approach shall be preferred. Nonetheless, one should consider that several layers are affected, including both software (related to each virtual world) and hardware (composed of human-machine interfaces, servers, networks, and so on).

The whole process can either be left to the market (with the risk that some enabling layers will not materialise) or be facilitated by policy intervention (with the risk of incentivising the wrong layer component). Any public intervention to set standards should take the principle of technological neutrality into consideration. We should caution that the EC seems inclined to put neutrality aside: by

[78] Conversational AI and Virtual Assistant Trends for 2022, 3 December 2021 (available at: https://www.cbot.ai/conversational-ai-and-virtual-assistant-trends-for-2022/
[79] Ibid.
[80] EC (2023b) at 48.

financially supporting European start ups and SMEs, it may end up advancing some virtual world technologies over others.[81] It follows that any intervention aimed at prioritising any sector (either infrastructures,[82] or emerging technologies or players) should be subject to prior ascertaining of its indispensability for the functioning of the virtual worlds ecosystem.

With reference to human-computer interfaces (HCI), as of today, no specific standardisation effort has been promoted by public bodies, only private initiatives exist to this end,[83] like the International Electrotechnical Commission.[84]

Some products will likely be virtual-real interactions, such as medical diagnostic care or advice. Appropriate liability and default contracting rules (including certification of expertise) to enable efficient transactions will be desirable. With respect to these , it may be useful to outline some guiding principles. A fundamental principle of law for default contracting rules and for liability may involve consideration of the economic incentives created by the rules. In particular, this may include respect for intellectual property that is delivered either entirely over the new technology or in mixed form over the new and old technology.

5.4 Governance: Interoperability and Standardisation

The Commission has suggested that a form of 'multi-stakeholder' governance is needed with the thought that this "process will aim to address both virtual worlds' interoperability system and the essential components underpinning the functioning of virtual worlds, such as rights management, transactions in virtual worlds, and identity management, as well as topics related to the industrial uptake of virtual world solutions."[85] It seeks to design interoperability 'from the outset' (a sort of interoperability by design).[86] We note that the International Telecommunication Union (ITU) established a Metaverse focus group in December 2022. The need for a truly international approach is high given the potential for cross-border activity, but the fundamental disagreements between different international actors over the appropriate rules for virtual worlds make the outcomes of such a process highly uncertain. Private actors have formed a Metaverse Standards Forum that includes virtual worlds companies and other standards bodies. The Commission has suggested that standardisation to establish full interoperability of virtual worlds should be mandated. Having government dictate that all activities should be interoperable contains many risks for regulatory over-reach, particularly given that private actors already have an incentive to make their worlds broadly used and compatible with access hardware but sufficiently differentiated for the worlds themselves to compete with each other for attracting users.

Nowadays, we still only have walled virtual worlds, insulated one from the next, which are based on different software, not designed to interoperate with each other nor based on compatible

[81] The EC suggest to use, to this extent, both the MediaInvest facility and cohesion funds. EC (2023b), fn 2, at 9.
[82] See above under Section 4.
[83] See above fn 8
[84] IEC TR 63344:2021 Conceptual model of standardization for haptic multimedia systems; IEC TR 63308:2021 Virtual reality equipment and systems - Market, technology and standards requirements.
[85] EC (2023b) at 14.
[86] Ibid.

technologies; they support different human-machine interfaces and do not allow seamless movement of IDs, avatars, or digital objects.

As mentioned, both the WEF and the U.S. CRC, as well as the scholarship[87] and the EC Communication 2023 maintain that in its Infant stage of development (although not at current Birth stage), virtual worlds are interconnected and interoperable. This idea raises challenges with regard to both vertical[88] and horizontal[89] interoperability, as well as harmonised standards that need to be tackled.

Vertical interoperability connecting different components within single virtual worlds is, as mentioned, needed for virtual worlds to expand, and therefore cooperation among stakeholders in this regard is wide (see Section 4.4). Such collaboration across industries should be regarded as positive and possibly sustained via the setting of competitive research and development (R&D) framework conditions, so as to boost innovation and competitiveness. A useful (regulatory) tool aimed at encouraging innovation is represented by regulatory sandboxes.[90]

Horizontal interoperability, on the other hand, would entail interconnection and interoperability across virtual worlds (for instance, by means of Application Programming Interfaces (APIs) or other technologies),[91] and is therefore questionable if, when, how, and to what extent it should be pursued and by whom.

In any event, both types of interoperability are relevant to reach virtual worlds' Maturity (the metaverse in the Web 4.0 environment). As mentioned, horizontal interoperability triggers more challenges than vertical, although it can make all virtual worlds accessible from any point, and especially explorable in their entirety, thus increasing their overall attractiveness (both for experiential and business purposes).

Government mandated interoperability obligations across *all* features may limit the technological development of new solutions – thus limiting the growth of virtual worlds models – and therefore the issue should be handled with care. Some similiarities may exist, in the long run, between virtual worlds and social networks. More generally, virtual worlds may be seen as platforms offering access via an immersive worn video interface rather than a distant screen interface. To the extent these platforms develop, one may note that social networks generally do not have government mandated interoperability.

In particular, imposing early requirements on horizontal interoperability on components (like avatar features and ability to cross from one virtual world to another) that are highly differentiated and where players are innovating to compete, especially at Birth stage of development of these markets and technologies – may affect innovation and incentives. Also, the risk to commoditise a space that is

[87] See above, 2.2

[88] 'Vertical interoperability allows innovative complementors to enter the market and compete on a level playing field with a gatekeeper controlling an essential input, such as an essential functionality of an operating system or hardware device': M. Bourreau (2022) DMA horizontal and vertical interoperability obligations, Cerre Issue paper, November, at 14, available at: https://cerre.eu/wp-content/uploads/2022/11/DMA_HorizontalandVerticalInteroperability.pdf.

[89] 'Horizontal interoperability allows network effects to be shared among competitors and aims at levelling the playing field between small and large players': Bourreau, fn 88, at 14.

[90] EC (2023b), at 11.

[91] See e.g. WebXR, an open protocol API allowing to browse different virtual worlds through the web: https://immersiveweb.dev/

highly competitive at the Birth stage should not be underestimated, especially considering that users' demand is still growing and that use cases of fully interoperable virtual worlds (that is, Infancy stage) have not yet emerged.

At the same time, however, for market operators to develop a wide range of XR technologies, the standardisation of some key features of human-computer interfaces may be beneficial.[92]

Getting to the Infancy stage, in fact, entails the following scenario: to increase accessibility and inclusivity, but also to unleash the full potential of virtual worlds for all industry sectors and for society, it could be desirable that different devices and interfaces be used to access several virtual worlds. In this scenario, establishing open, cross-device, and consumer-centred standards to ensure interoperability may reduce market fragmentation while making virtual worlds an economic and societal success.

It appears desirable, though, that at least some basic elements may be subject to standardisation, in light of the benefit it may generate. In this regard, the Commission[93] higlights that certain features may be easier to standardise than others. For example, providing generally accepted stores and tradeable forms of value for transactions (equivalent to **currency**) is an area in which cross-world standardisation may be relatively feasible, due to a common need and existing possibilities that can be adopted or adapted. Similarly, **personal identity verification** may be another area in which common standards could potentially be developed. The JRC Policy Report also suggests that specific features such as avatars, personal identity, and currencies may have standards developed that allow some degree of commonality of user experience across virtual worlds.

This highlights how the Communication considers standardisation (expressly) as key to enable interoperability between different platforms and networks. As mentioned (above, Section 2.4), ensuring that standardisation is achieved with reference to a specific subset of technologies (payments and identities) is desirable and may speed up the development of virtual worlds.

Considering that virtual worlds at this stage transcend borders, any initiative on standards' harmonisation should focus on cross-jurisdictionality and engage in multi-stakeholder activity.

Interoperability and standardisation can be either imposed by regulation or be achieved upon initiative of market players, aimed at developing common standards, mixes of the two exist as well. Looking at EU initiatives on interoperability and standardisation, the EU already provides many examples of a regulatory approach, both in the DMA and Data Act (which is a horizontal legislation applying to all players except for small and micro entreprises).

As for vertical interoperability, both the DMA (art. 6) and the Data Act are relevant. The DMA stipulates that gatekeepers must "allow end users to access essential functionalities of operating systems or hardware capabilities of a given device (Art. 6(7)) and install third-party app stores and sideload apps

[92] See in this regard the (already-mentioned) Snapdragon foundation's platform which helps developers collaborate to integrate XR technologies (for instance, they optimized a head-worn AR platform for AR glasses tethered to smartphones with a Khronos OpenXR standards conformant runtime).
[93] EC (2023c), fn 3, at 6.

(Art. 6(4)).”[94] Because the right is entrusted to end users, not operators, it is doubtful that art. 6 DMA will suffice to have vertically interoperable virtual worlds. The Data Act, on the other hand, establishes that interoperability shall be achieved between data processing services, including the ones provided in the context of what are commonly termed platform-as-a-service and software-as-a-service models (Art. 30(3) and Art. 35, Data Act). This way, it seems that the Act generally welcomes mix and match of different sets of data services into service ensembles, as virtual worlds, and fosters open interfaces (under Art. 30(2)) intended to facilitate switching by limiting egress fees of cloud and edge service providers.

As for horizontal interoperability, the DMA only tackles it in messaging services (Art. 7), while the Data Act entrusts the EC with the power to promote interoperability[95] of data spaces (Art. 33) and data processing services[96] (Art. 35). While data spaces consist of purpose or sector-specific or cross-sectoral, interoperable frameworks of common standards (needed to share or jointly process data),[97] ‘data processing services’ are essentially cloud and edge services.[98] From an institutional point of view, the Data Act allows the EC to adopt ‘essential requirements’ on a number of relevant features of data spaces (Art. 33(1))[99] including APIs. In regulatory terms, these requirements are assimilated to harmonised standards and therefore binding.[100] In addition, the EC can request Standard Setting Organizations (SSOs) to adopt harmonised interoperability standards (that comply with its own essential requirements). When exercising this power, the EC shall implement principles of openness, transparency, and technology-neutrality and ensure the widest participation of stakeholders, as laid down in EU Regulation 1025/2012 (on standardisation).[101]

The Data Act will affect horizontal interoperability in virtual worlds, but only to a limited extent, given that Art. 35(1), imposing interoperability obligations on data processing service providers, specifies that they must be services ‘of the same service type’. Essentially, that means that cloud computing and edge services supplied by different providers should become interoperable and interconnect, but only if they offer identical services. This limitation may affect the development of interoperability among virtual worlds, especially if operating in different areas (such as health and financial).

What is worth noting is that, in specifying what standards for data processing services should aim at, Art. 35(1)(b) of the Data Act mentions the need to “enhance portability of digital assets between different data processing services that cover the same service type”[102] which could imply that interoperability among virtual worlds in the same sector will be included.

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[94] Bourreau, fn 88, at 5.

[95] Art. 2(40) Data Act defines interoperability as “the ability of two or more data-based services, including data spaces or communication networks, systems, products, applications or components to process, exchange and use data in order to perform their functions in an accurate, effective and consistent manner”.

[96] Art. 2(1)(8) Data Act defining Data processing services as ‘a digital service that is provided to a customer and that enables ubiquitous and on-demand network access to a shared pool of configurable, scalable and elastic computing resources of a centralised, distributed or highly distributed nature that can be rapidly provisioned and released with minimal management effort or service provider interaction;’.

[97] Art. 33(1), Data Act. See also https://joinup.ec.europa.eu/collection/semic-support-centre/data-spaces

[98] CERRE Report on Data Act: towards a balanced EU data regulation, March 2023, at 79 (available at https://cerre.eu/publications/data-act-towards-a-balanced-eu-data-regulation/).

[99] E,g, content and quality; data structure; licenses, and means to enable interoperability of contracts for data sharing.

[100] If adopted in conformity with EU Regulation 1025/2012.

[101] See the EU Council’s position on the Data Act, proposed amendments to Art. 29(3), P9 TA(2023)0069, 14.3.2023.

[102] Art. 35(1)(b)

Regarding the degree of interoperability that is likely valuable in virtual worlds, the nature and extent of this are likely complex and may vary based on the application considered.[103] For user experiences, certain features may be easier to standardise than others. As mentioned above, one example suggested by the EC[104] is providing of generally accepted stores and tradeable forms of value for transactions (equivalent to currency) is an area in which cross-world standardisation may be relatively feasible, due to a common need and existing possibilities that can be adopted or adapted. Similarly, user authentication techniques may be another area in which common standards could relatively feasibly be developed. Standardisation of these specific elements may allow some degree of commonality of user experience across virtual worlds.[105] Ensuring the existence of basic standardisation can help to guarantee that entry by competing virtual worlds is possible and may prevent the development of closed worlds, like those of the early AOL or Minitel, which ultimately can be argued to have held back innovation and were replaced by more open standards simply due to user movement.

Nonetheless, as the JRC suggests, "at present, it is not possible to converge around a single reference architecture, set of interoperability standards and building blocks for virtual worlds."[106] A fundamental reason for the difficulty of establishing unlimited interoperability is the general uncertainty that exists about what the future features of these worlds would be and how much differentiation would be socially desirable.

The governance of virtual worlds can and should usefully distinguish itself from the operational aspects of interoperability. The creation of a multi-user and international stakeholder group to oversee developments that are not already treated by 'existing internet governance bodies' will provide a valuable base. But the ability of institutions to control operational features of a commercial environment that is rapidly developing and that is likely to experiment by developing in multiple directions is worthy of careful consideration. The full operational implications of government mandated complete interoperability could potentially reduce innovation and product variety that is otherwise desired. Products at an early stage in their lifecycle are particularly unsuited to external efforts to mandate standardisation. As the JRC observes, "the standardisation landscape is still highly fragmented and is rapidly evolving with multiple competing initiatives (both open and proprietary) that are attempting to provide and promote interoperability solutions for virtual worlds."[107] While physical device standards over flexible input and output features may be essential for broad consumer rollout and device competition, government-mandated software-based virtual world interoperability and perfect movement of tokens between them, may be less desirable, and even counterproductive, at an early stage of the innovation cycle. The reasons that software interoperability may be undesirable flow from the value of encouraging maximum innovation, which is difficult to predict, and may need IP protections to motivate. More generally, standards that feed into the technologies and

[103] As a sidenote, it is worth noting that interoperability in telephone or banking networks, which have many fewer features than virtual worlds, have already proven complex.
[104] EC (2023c), fn 3, at 6.
[105] Ibid.
[106] JRC (2023) fn 24, at 47.
[107] JRC (2023) fn 24, at 48.

inputs used to create virtual worlds (AR/VR) and standards over the technical infrastructure that delivers the experiences may be distinguished from user experiences.

A social welfare planner would currently face many informational challenges about the likely technologies that will yield what customers want, particularly due to a combination of uncertainty about technological possibilities, incentives to invest in innovation, and differentiation in known and yet-to-be developed tastes between consumers. The principle of proportionality should be applied in determining which aspects – relevant to the functionality of virtual worlds – are to be targeted for interoperability. For some of them, interoperability may be highly desirable for consumers and capable of fostering development. As noted, there do seem to be areas in which standardisation is likely feasible (like currency and personal identity), and, in fact, there are already efforts underway to achieve such standardisation. Voluntary standards are developed or under development by private actors to solve some technical obstacles that could hamper the further development of certain products. To the extent these self-regulatory efforts are taking into account a desire to grow platforms to achieve greater scale, reliability, and user buy-in, there is less need for government intervention at an early stage.

On the one hand, it appears possible that current virtual worlds, without a push towards standards and interoperability, will unilaterally select standards that would not be those of a fully informed social planner. In any case, the government imposition of broad interconnection standards for user experiences, as suggested by some European Commission statements, that would run across every aspect of virtual world features may be extremely difficult to operationalise and risk negative outcomes. Safety concerns could also be exagerated by interoperability (think, for instance, of safety considerations and the spread of harmful content), which creates additional risks that should not be neglected and that would not necessarily be a socially desirable outcome.

These difficulties can be illustrated with a few conceivable use cases and are multiplied by the likely fact that many use cases remain to develop and might never develop if interoperability standards make them too difficult to implement or define away any commercial gain from their implemention. The following use cases exemplify how different degrees of desirability of interoperability may occur within sectorial virtual worlds.

> *Medical applications that combine devices, physical presence of the patient, and AI*. For future diagnostic and treatment purposes, patients without easy access to in-person physicians may encounter doctors within virtual environments. In these environments, it is still uncertain what the parameters for functioning will be, as there will likely be interactions with patented physical devices. Moreover, it is challenging to conceive that a patient can enter any virtual world to engage in their diagnostic or treatment capabilities as well as that medical centres could be established in any virtual world. Some virtual worlds may prefer not to have medical capacities built in. Others will support such capacities with company-specific software and AI

that are built into the underlying infrastructure of virtual world's and are not easily ported from one virtual world to another.

Gaming and historical worlds. Part of the focus of future worlds may be gaming worlds or historical worlds. One can imagine and expect that specialised worlds may contain token products that are suited mainly to that world (or type of world) and not to all worlds. Similarly, avatars in one game world may not be appropriate for another. The desired restriction on the use may come from token makers (for instance, luxury bag makers not wanting their bags to be used in violent situations) or from other users (participants in a historical Rome world not wishing to see any modern goods among users, for example). This means that not only platforms but also at times users and token providers may not want interconnected movements of goods across worlds.[108] Requiring the possibility of universal movement to be possible could distort legitimately desired options of users to rest in a coherent environment, making the potential for movement across virtual worlds or lack thereof seem to be an important feature for users to understand if they are purchasing or investing within a given virtual world. One can imagine that an avatar and tokens for a particular game provided within a room of one virtual world might then reasonably apply to the same game in a room hosted by another virtual world. But noting that programming environments may differ across worlds, one could also imagine that even in the case of a single brand of game across virtual worlds, achieving full interoperability could be a challenge.

Shopping worlds. Some worlds may include or entirely be based around shopping. In real-world shopping centres, there is differentiation between centres, with some being more luxury and high-end oriented. Certain brands will only sell their products in high-end locations to maintain the luxury associations of their brands. This is related to EU competition law cases concerning restrictions on selling luxury products on certain internet marketplaces (for instance, Coty[109], Guess[110]). The Coty case, for example, permitted luxury goods manufacturers to prohibit members of their selective distribution networks from subsequently contracting for sales with unapproved third parties. At the same time, in its final report of the e-commerce enquiry, the EC admitted the possibility that restrictions on the use of a brand's name on the internet could raise concerns under Article 101 TFEU if they restricted the effective use of the internet as a sales channel. These cases can be argued to leave open the possibility of luxury brands having legitimate concerns about their brands being devalued via unconstrained sales or trades between avatars and across worlds. Thus, there may be another reason to constrain the interconnection of goods and tokens across worlds. Preventing exclusivity contracts between a virtual world and token good providers may prevent an intermediate point between a blanket requirement of interconnection, which could be viewed as unduly restricting users, sellers, and goods, and an effort by virtual world

[108] It is worth noting that unlimited movement across worlds may also foster movement of harmful content and would not always be socially desirable.
[109] EU Court of Justice, Judgement ECLI:EU:C:2017:941, Case C-230/16.
[110] EC decision (2018), AT.40428, C(2018) 8455 final.

providers themselves to establish widespread constraints that prevent the development of competitive virtual world providers.

These examples illustrate that some types of worlds may have very substantial differences from each other that would in turn merit a different standard, comparable to a sector-specific regulation. Historical worlds of the same epoch might be able to enable highly comparable avatar movement, while worlds with substantial differences may not so easily have interoperability.

This is comparable to the idea that general regulations may be difficult to introduce while sector-specific regulations may be much more practicable and closer to those that a social planner would pursue. Overall, 'basic' interoperability standards that do not apply to all features of a virtual world object or avatar can maintain incentives to achieve innovation and recognise the complexity of the product. The presence of some degree of interconnection can reduce the risk of creating closed worlds that restrict competition and, perhaps more importantly, do not end up moving in the direction desired by users, as occurred with the French Minitel experience and the U.S. closed AOL platform, which was ultimately eclipsed by the open-system internet. But government mandated full interoperability across every conceivable world feature and requirement (such as a user's avatar in one world being able to have access to all the same features in another world run by a different company) could, in practice, mean that companies are required to disclose information (metadata) over their intellectual property.

Hence, we would suggest that IPRs be recognized in full by all virtual worlds and, thus, that such recognition is transposed in standardisation.

As a practical matter, as pointed out by Ennis and Evans[111] with respect to the cloud, interoperability is made more difficult in high differentiation and high innovation products, which can be considered those with high levels of unique product features or variation among product features, as well as with those products that exhibit high degrees of innovative activity, and whose future structure of offering is unknown, thus making early adoption of standards likely to constrain innovation. Virtual worlds should, like cloud services, be considered highly differentiated products. This raises the general point that, for highly differentiated products, interoperability requirements are particularly risky, as they will inherently reduce the differentiation that would otherwise arise. However, it should be noted that most digital services encompass several layers of functionality and components, some of which may be relatively similar across services, and others that are more differentiated. One of the paper's contributors pointed out that "even where significant differences exist between services overall, a case for greater interoperability may still exist if there are certain features or functionalities that are somewhat comparable across services and are valued by users".[112]

Some high-level principles may reflect the difficulty of currently achieving interoperability standards in the face of differentiation and uncertainty, but greater ease in setting a core set of standards of

[111] See Ennis, Sean F. and Evans, Ben, Cloud Portability and Interoperability under the EU Data Act: Dynamism versus Equivalence (March 22, 2023). Available at SSRN: https://ssrn.com/abstract=4395183 or http://dx.doi.org/10.2139/ssrn.4395183.

[112] Ofcom (2023) Mandated interoperability in digital markets. Economics discussion paper series, Issue 8, November, available at: https://www.ofcom.org.uk/research-and-data/economics-discussion-papers/mandated-interoperability-in-digital-markets#:~:text=Interoperability%20is%20often%20fundamental%20to,competition%20in%20some%20digital%20markets.

interoperability with a focus on modularity and comparability in purpose and implementation between certain types of world.

After dealing with interoperability in the DMA and Data Act (and providing exaplems of virtual worlds use cases where interoperability issues may be relevant), we now discuss market power in and contestability of wirtual worlds to see if the DMA and EU antitrust rules are fit.

In fact, a highly debated issue is that of market power and whether, at their Infancy or Maturity stages, virtual worlds will be dominated by a handful of big players, or one of its features[113] tipped.[114] The market tipping scenario is taken into consideration by the EC, which highlights the "risk of having a small number of big players becoming future gatekeepers of virtual worlds, creating market entry barriers and shutting out EU start-ups and SMEs from this emerging market".[115]

In this regard, although it is true that some of the services enabling virtual worlds, like cloud computing, might be at risk of market power consolidation and thus justify special attention,[116] the same does not necessarily hold for others. In general, because of the large costs involved in the development of virtual worlds, it may not be easy to reach tipping scenarios.

Nonetheless, the EC Communication highlights that large distribution platforms, and early movers in the market, may contribute to the creation of closed ecosystems by setting de facto standards, and may potentially become gatekeepers exploiting network effects and creating new market entry barriers.[117] In any event, however, the European Commission proves to be aware of the extensive investments required to develop Web 4.0 platforms and the underlying technologies. The EC considers that there is a risk of lagging behind in the development of these products. In consequence, the EC committed to foster a "competitive and sustainable ecosystem of European technology providers in interactive technologies".[118]

In the context of virtual worlds competition law issues may exist either between different virtual worlds thus realising the EC's concern of the dominance of some platforms to the detriment of others, or within virtual worlds, when virtual worlds service providers behave to restrict the use of and access to services offered by competitors.

Against this background, one may agree that legislative tools exist that could impact contestability of virtual worlds. As contended by the EU DG Comp, "the Digital Markets Act (DMA) provides tools to foster contestability in the metaverse should it be at risk, either because relevant services are within

[113] See above Sect 2. We refer specifically to the following features of virtual worlds: user experience, mass content creation, infrastructure, and technology.

[114] Market tipping occurs when a firm pulls away from its competitors once it gains an initial advantage. The market tips when a winner takes most, if not all, of the market. See N. Petit (2021), The Proposed Digital Markets Act (DMA): A Legal and Policy Review, May 11, available at the following link https://ssrn.com/abstract=3843497.

[115] EC (2023a) at 10 reiterates the relevance of the support to SMEs and start-ups, as they may be drivers of the European Web 4.0. EC (2023c) also adds that "Despite growing AI and XR ecosystems, start-ups and SMEs face multiple challenges in achieving their potential .. and uptake of technologies facilitating the transition towards Web 4.0.". Some of the main challenges are: "the fragmentation of the EU's Web 4.0 industrial ecosystem, challenges in accessing funding, gatekeeping by large tech players, difficulties to win customers and commercialise technology solutions as well as challenges in attracting skilled employees." (p. 16)

[116] Being cloud qualified as a Core Platform Service under the DMA, gatekeeping companies providing such services are already subject to its provisions, as well as antitrust scrutiny.

[117] EC (2023b), at 11.

[118] Through the XR4ALL. See EC (2023c), at 74.

its scope or through the provisions that ensure future proofing of the Act".[119] The services provided in the context of virtual worlds could fall within the definition in Art. 2(3) DMA of 'information society service' and thus be subject to the relevant discipline.

Similarly, some service providers for virtual worlds might qualify as gatekeepers and be subject to the relevant rules contained in the DMA. Moreover, this regulatory framework might be subject to change over time, as under Article 12 DMA the EC may exercise delegated powers for updating obligations for gatekeepers.

It should also be noted that Art. 14 DMA relating to information obligations in connection with mergers provides that gatekeepers are required to notify the transaction to the European Commission. It may then inform the member states, which in turn may activate the mechanism provided for by Art. 22 of the Merger Control Regulation in order to refer a merger implemented by gatekeepers to the EC, even if below the Community threshold.

5.5 Scepticism and Sustainability

5.5.1 Scepticism

Scepticism has been surrounding virtual worlds for some time,[120] leading to unripe development and relatively low demand.[121] However, notwithstanding this, massive investments have been made in virtual worlds over the years and many are ongoing with new technologies landing the market[122] that promise to make the user experience easier, more engaging, and richer. Such a considerable interest, make investors, developers and users (at least those with a higher level of specific skills) generally engaged and enthusiastic.[123] Surely, IT literacy should be fostered so to empower users, enabling them to more adequately understand the opportunities (as well as the risks) related to virtual worlds (such as privacy, cybersecurity, or prolonged connectivity) and enjoy effectively their virtual world experience (either as recipients of services or content creators).

[119] F. Wenzel Bulst & S. De Vinck (2022) (both working at the DG Comp) DG Comp. Understanding the metaverse - a competition perspective, intervening at the European American Chamber of Commerce, 18 October, available at: https://eaccny.com/news/chapternews/dg-comp-understanding-the-metaverse-a-competition-perspective/

[120] E. Zitron (2023), RIP Metaverse, An obituary for the latest fad to join the tech graveyard, 8 May, available at: https://www.businessinsider.com/metaverse-dead-obituary-facebook-mark-zuckerberg-tech-fad-ai-chatgpt-2023-5?r=US&IR=T. While the EU is taking steps in the area of virtual worlds, in other world regions (e.g. the U.S. mainly) the hype around metaverses is dying down: users seem to be more interested in other types of experiences and/or very specific immersive technologies' use-case. See L. Harris (2022), The metaverse: is it alive or is it dead?, 1 March, available at the following link https://www.thedrum.com/opinion/2022/03/01/the-metaverse-it-alive-or-it-dead; and A. Hasnain (2023), The Uncertain Future of the Metaverse: Trends and Skepticism, 12 May, available at the following link https://www.digitalinformationworld.com/2023/05/the-uncertain-future-of-metaverse.html

[122] See J. Dalton (2023), PwC's Metaverse Deals Tracker highlights the investments that a broad range of players are making in the next digital platforms, April 5, available at the following link https://www.pwc.com/gx/en/industries/tmt/media/outlook/metaverse-investments-tracker.html

[123] Accenture (2023), Growing Consumer and Business Interest in the Metaverse Expected to Fuel Trillion Dollar Opportunity for Commerce, Accenture Finds, January, available at the following link https://newsroom.accenture.com/news/growing-consumer-and-business-interest-in-the-metaverse-expected-to-fuel-trillion-dollar-opportunity-for-commerce-accenture-finds.htm; see also the recent survey conducted by PwC reporting consumer and business expectations on the development of virtual worlds: PwC (2022) US Metaverse Survey, available at https://www.pwc.com/us/en/tech-effect/emerging-tech/metaverse-survey.html.

5.5.2 Economic and environmental sustainability

Other challenges pertain to sustainability, both referring to its economic and environmental dimensions.

With regard to the economic sustainability of business models, each use case has its own specificities, but in all cases the investments for the creation (and management) of virtual worlds need to be economically viable. Taking into account the current limited user base, policy makers should evaluate the estimated growth based on the data of market players. Consideration should also be given to whether, in the case of the transfer of assets from one virtual world to another, pricing schemes should be envisaged to reduce transactional costs.

As for environmental sustainability,[124] a number of concerns arise: first and foremost, the high energy consumption of the servers on which virtual worlds are based. As the quality of the product graphics increases and the number of interactions and user-created content grows, the use of energy will also increase. However, in this respect, much will depend on the type of technologies and protocols used, which have very different levels of energy consumption. For instance, there has been a significant reduction in energy consumption by the chip industry in recent years[125]. Decentralised technologies tend to result in higher energy consumption than centralised ones, for instance.[126]

Manufacturing of equipment and devices (headsets, servers, and so on) may also have a significant environmental impact.[127] Such devices are composed of many elements that are complex to dispose of. Moreover, given the rapid technological change, products become very soon obsolescent, making the environmental impact of such waste something that should be assessed. In this regard, it may be useful to measure their impact on the environment on a ongoing basis and upon specific events (such as following the increase in server capacity). Moreover, it would be important to take initiatives aimed at including equipment related to virtual worlds in the circular economy.[128]

The digitisation effort may not only fail to be energy sustainable, but also undermine the ecological transition goals pursued by the European Green Deal and Next Generation EU. Therefore, due consideration must be given to environmental sustainability objectives in the design of virtual worlds and their characteristics as well as in the manufacturing of physical interfaces (such as visors). In this regard, the EU Ecodesign legislation[129] sets obligations to significantly improve circularity, energy performance, and other environmental sustainability goals for physical goods placed on the EU

[124] See M. Birkebæk Jensen, S.G. Lauridsen (2022), Shaping the metaverse towards sustainability, KPMG available at the following link https://kpmg.com/dk/en/home/insights/2022/12/shaping-the-metaverse-towards-sustainability.html; P. Chakrabarti, H. Ogunyanwo, F. Isaac, T. Aguiar (2023), ESG in the Metaverse: An Opportunity to Rethink Sustainability, Bloomberg Law, March, available at the following link https://www.bloomberglaw.com/external/document/XD81F1N4000000/esg-professional-perspective-esg-in-the-metaverse-an-opportunity.; The Commission Staff Working Document dwells at length on issues of environmental sustainability for virtual worlds. Specifically, see under p. 10; 99.

[125] For a good practice in terms of chips' energy consumption see: https://www.qualcomm.com/news/onq/2021/02/how-our-power-efficient-technologies-benefit-smartphone-users-and-earth.

[126] P. De Giovanni (2023) Sustainability of the Metaverse: A Transition to Industry 5.0. *Sustainability*, 15, p. 6079. Available at: https://doi.org/10.3390/su15076079

[127] N. Kshetri, Y. K. Dwivedi (2023), Pollution-reducing and pollution-generating effects of the metaverse, International Journal of Information Management, Vol. 69, available at https://doi.org/10.1016/j.ijinfomgt.2022.102616.

[128] EC (2023c), fn 3, at 111.

[129] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.

market. The proposed AI Act imposes sustainability obligations on AI. However, it is likely that sustainability goals can also be pursued outside the specific scope of these regulatory provisions.

6. RECOMMENDATIONS

Recommendations arising from the prior discussion are listed below. These could change over time due to the rapidly evolving features of the technology. Nonetheless, based on our current understanding of virtual worlds and their likely trajectories of development, these recommendations provide a useful basis for consideration in near-term policy discussions and, in many instances, may have enduring value.

- *Definition*. We suggest that the EC definition of virtual worlds is extended to incorporate the key features identified in our proposed definition, especially mass content creation and interoperability. We also suggest drawing a distinction between the characteristics of the different development phases of virtual worlds (Birth, Infancy, Maturity). Third, we suggest avoiding the word metaverse to describe the Infancy stage and instead use the phrase 'network of interconnected virtual worlds'. Metaverse should only refer to the final (Maturity) phase of development of virtual worlds (that is, in the Web 4.0 scenario). In this way, the use of the word metaverse by the business and press communities, as well as society, would no longer be a means of confusion.The policy discourse on virtual worlds should be built on the policy challenges related to them rather than focusing (solely) on their principal characteristics (immersivity, persistence, synchronicity) or technology (AR, VR, and so on). Features that raise distinctive policy challenges should include: user experience, mass content creation/production, technology and infrastructure, and governance. Therefore, it is recommended to adopt a functional definition of virtual worlds, similar to the one we have proposed, to assess the desirability of harmonised standards, connectivity requests, the setting of incentives, and evaluation of collaborations.

- *Incentives.* Incentivise the development of virtual worlds as a whole (through the setting of incentives to foster collaboration, projects, and infrastructure) and sustainable technologies.

- *Policy instruments.* Consider a plethora of possible policy tools, beyond just rules and harmonised standards, when assessing if and how to address the highlighted policy issues (for instance, accountability of users and providers of virtual worlds). In this respect, industry-developed technological tools (elements implemented by design in the structure of virtual worlds that could allow users to be held liable for actions performed by avatars, for example) or incentives of different kinds (monetary, but also community-based remuneration of interaction) could be considered in the first place.

- *Interoperability and standards.*

  - Consider promoting (in a cooperative fashion) forms of harmonised standardisation (on minimum enabling elements), including through the definition of open standards. The role of institutions in guiding this could be significant, as it could facilitate the transition of virtual worlds from their current Birth state towards a network of interoperable virtual worlds (Infancy). Government-mandated harmonised standardisation should be limited to specific and essential features and not constitute a limitation for development of private investment and innovation more broadly.

- Avoid universal interoperability requirements (those that apply across all user experiences in virtual worlds or enabling technology and infrastructures) to respect legitimate user preferences favouring differentiation of products and services, differentiation required to explore and create new goods and ensure IP protection of innovations.
- Note that interoperability for technologies and inputs (AR/VR, and so on) and underlying technological infrastructure may have distinct needs than interoperability for the user experience. At this stage of development, forms of standardisation that have a direct impact on user experience should be encouraged.
- Endorse interoperability for some 'standardised' aspects of operation and for highly similar modular entities. However, modular standardisation should not be required where it would interfere with the coherence of an experience or of a combination of user and seller preferences or reduce incentives for innovation and development of new experiences that are otherwise not obvious. Examples of elements on which standardisation appears to be desirable already at this stage (which are also expressly mentioned by the Commission itself) are user verification and means of payment.

- *Enforcement.* Consider introducing specific rules on enforcement that take into consideration the transferability of avatars and goods from one virtual world to another. The possibility of appealing to neutral decision-makers may be worth ensuring. For administrability, there might be arbitrators within the worlds. Where worlds are located within the broader context of other worlds, rules may cascade, with higher-level rules taking legal priority over lower-level rules.
- *Minimum scale*. Any regulatory oversight should duly consider the need of virtual worlds to achieve minimum scale to be efficient and cover their costs of operation, thus ensuring that smaller operators have a chance to grow.
- *Cost-benefit application*. In the context of introducing possible new rules envisaged in the Communication, consider that any costly regulations placed on operators of virtual worlds should consider their full implementation costs and social benefits.

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