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Chris Hesselbein, Paolo Bory & Stefano Canali

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Six provocations for metaverse datafication: an emergent cultural, technological, and scholarly phenomenon

Chris Hesselbein [a], Paolo Bory[b] and Stefano Canali[c]

[a]Politecnico di Milano - Dipartimento di Ingegneria Gestionale, Milan, Italy; [b]Politecnico di Milano - Dipartimento di Design, Milan, Italy; [c]Politecnico di Milano - Dipartimento di Elettronica, Informazione e Bioingegneria, Milan, Italy

ABSTRACT

Although the 'metaverse' is still the feverish pipedream of tech companies and venture capitalists, it is also a powerful imaginary for channelling enormous resources towards deepening and extending ongoing processes of digitalization and datafication. It is thus likely that an increasing amount of human activity – both professional as well as leisure-related – will take place in metaversal spaces, and that the paradigm of 'Big Data' is about to be expanded with massive amounts of new and varied or multimodal data that capture even more (corporeal, sensorial, spatial, and temporal) information produced by and about people as well as their interactions as these unfold in (mixed) spaces over time. Much like the rise of big data, the emergence of metaversal data gives rise to important tensions and issues. From the perspective of critical data studies, media studies, and science and technology studies, this paper spotlights the role of data obtained about, in, and through metaverse technologies and environments as well as how this can be understood as both an intensification and extension of the datafication of social life, the quantification of research methodologies, and the exacerbation of social inequality. We discuss these issues through a series of six provocations that each address a distinct tension between metaverse data, the production of knowledge, research methodologies, and various social issues that are central to the datafication of contemporary societies.

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Introduction

The era of Big Data is well underway. Although important discussions about the precise nature and use of data as well as their associated threats and benefits are taking place, it is clear that the process of converting all aspects of human life and its environment into digital data for quantified analysis and decision making – datafication – is continuing unabated. This process of datafication was initially enabled largely by the emergence of relatively cheap and ubiquitous methods of data collection, transfer, storage, and

CONTACT Chris Hesselbein christopher.hesselbein@polimi.it Politecnico di Milano - Dipartimento di Ingegneria Gestionale, Via Lambruschini 4/b, Milano (MI) 20156, Italy

analysis (Ruckenstein & Schüll, 2017; Van Dijck, 2014). The ends to which the widespread collection of data about people have been put to use have long been clear, namely targeted advertising, operational efficiency, cost reduction, and the training of machine-learning models and AI systems. In the last decade, datafication has further specialized and branched into producing a range of datafied entities, such as quantified selves, smart cities, and digital twins of systems, factories, machines, and bodies, which are each underpinned by the employment of sensory devices and computer modelling techniques that allow individuals, manufacturers, and policy makers to better monitor, adapt, and intervene in bodily, industrial, and urban processes and activities.

The relationship between these ongoing processes of datafication and the recent push towards what is commonly referred to as the 'metaverse' as well as associated technologies, such as headsets, smart glasses, haptic interfaces, and virtual worlds, is still emergent and unclear. This uncertainty is due to several factors. For example, a consensus has not yet emerged regarding a definition of the metaverse (Boellstorff, 2024) and its constitutive components and essential characteristics as well as its potential uses or drawbacks. It remains therefore unclear whether the metaverse should be characterized as a platform or 'world', or instead as a combination of connected wearable devices that blend 'traditional' human perception with newer, digital objects and experiences. Despite these uncertainties, it is nevertheless clear, given the actions of many of the technology and media companies that are driving the development of metaverse technologies and platforms – e.g., Meta, Alphabet, Microsoft, Tencent – that the 'imperative' of collecting data (Fourcade & Healy, 2017) lies at the centre of this push (see also: Egliston & Carter, 2021; 2024; Ewers & Kangmennaang, 2023). Indeed, as Evans notes, the 'unparalleled immersion' that metaversal technologies purport to deliver is an attractive proposition for large technology companies to establish 'monopoly positions in terms of hardware and operating platform', particularly on the level of digital infrastructure and computational devices such as microchips. More importantly, however, these technologies and platforms are particularly attractive not only for their capacity to 'dictate content and closely monitor and measure user preference (through means and methods not achievable with current media devices)', but especially for their ability to isolate 'attention', capture and manipulate sensory perception, and mass harvest data 'of a new kind' (2019, pp. 33–44).

It is precisely this increase in 'new' data with which our critical questions and provocations are concerned. Metaversal technologies open a new frontier for extending ongoing practices of 'data colonialism' (Boellstorff, 2024; Couldry & Meijas, 2019; Harley, 2024) that seek to capture and claim ownership over ever larger sets of varied data for the purposes of value extraction and capitalist exploitation (Sadowski, 2020; Srnicek, 2017). The 'metaverse' thus provides a powerful narrative for channelling enormous resources from 'big tech' companies and venture capitalists towards the creation of metaversal technologies and spaces in and through which an increasing amount of human activity – both professional as well as leisure-related – will take place. In other words, it is likely that the paradigm of big data is about to be expanded with massive amounts of new and varied data collected by a multitude of data-rich sensing technologies (Egliston & Carter, 2022; Evans, 2019) that capture even more intimate information (corporeal, sensorial, spatial, and temporal) produced by and about people as well as their actions and interactions as these unfold over time. And whereas past processes of datafication mainly involved textual and visual data from online platforms and mobile or connected devices,

metaverse technologies will allow for the increasing datafication of physical bodies and the environments in which they move and live. In many ways this development can be seen as an unsurprising continuation of the historical trend in data accumulation by large corporations. As such, metaverse data does not represent a radical rupture from the era of Big Data, which, as just noted above, emerged from the confluence of various key technological advances as well as specific socio-economic circumstances. Nevertheless, we believe that metaverse datafication does involve a qualitative change in terms of the types of data are collected, which will be discussed in further detail below. This signifies an important intensification vis-à-vis current data collection practices and can thus drastically exacerbate the socio-political implications of datafication. Although the precise nature and consequences of metaverse datafication are, as yet, uncertain, the types of data involved and their epistemological and political value for future developments demand critical analysis in the present.

As noted in the introduction to this special issue, we define metaverse technologies as, first, encompassing an emerging range of wearable (often head-mounted) and sensory (i.e., spatially-aware as well as body tracking) computing devices. Such technologies are frequently referred to under a range of different names, such as virtual reality (VR), augmented reality (AR), Mixed Reality (MR), and extended reality (XR), which all refer to the mutual incorporation of physical and digital dimensions as it is presented to users. Such devices are capable of tracking not only the behaviours and actions of wearers of these devices as well as a variety of biometric characteristics and processes, but – equally importantly – also the features and characteristics of the environments in which wearers are situated as well as their interactions with other beings in this space. A second definition of metaverse technologies encompasses the efforts being made to create persistent and immersive virtual environments or 'worlds' in which a range of professional, social, and leisure activities will purportedly take place. Although Zuckerberg's proposal of 'The Metaverse' as a massive, interoperable, and synchronous as well as overarching platform will for the time being remain a futuristic vision, many 'microverses' (Evans et al., 2022) already exist in which a range of social activities are taking place, such as gaming and commerce. Much like the rise of big data, the emergence of metaversal data gives rise to important tensions and issues, particularly for the social sciences and humanities. From the perspective of critical data studies, media and communication studies, and science and technology studies, this paper explores and confronts various promises and pitfalls of data obtained and analyzed about, in, and through metaverse technologies and environments as well as how these developments might contribute to shifts in the definition of knowledge, the quantification of research methodologies, and the datafication of social life. Like datafication in general, metaverse datafication has the potential for making many contributions to various fields and practices, such as medicine, education, and leisure, and as such the metaverse is not necessarily an unwelcome phenomenon. However, we consider the potential negative implications of metaverse datafication to be the most pressing issue to discuss at this moment, and hope that future research will explore the more positive contributions of this form of datafication. Despite our multidisciplinary approach, moreover, this paper presents only a partial perspective on the phenomenon of metaverse datafication, which we hope will be complemented in the future by additional work in, among other fields, media history, philosophy, economics, as well as screen, game, and surveillance studies. We address these sets of issues by means of six provocations that each address distinct tensions between metaverse data, the

production of knowledge, and ongoing concerns about the power of 'big techs' to shape central dynamics of contemporary societies.

Metaverse data will alter the definition of knowledge

Much recent discussion has rightfully concentrated on datafication in terms of resource extraction and capitalist accumulation, or in other words, as a form of 'data colonialism' (Couldry & Meijas, 2019; Thatcher et al., 2016). We believe that the metaverse should be firmly positioned within this discourse as metaversal technologies open up an important new frontier for the datafication of everyday life, body, and space. Datafication, however, is not just a process that concerns data and information but ultimately also the constitution of knowledge more broadly. As noted by Densua Mumford, for example, analyses within the framework of data colonialism tend to focus more on resource extraction and its relationship to capitalist goals, but less on the epistemic nature and consequences of data colonialism for establishing a specific conceptualization of objectivity and for marginalizing 'other ways of knowing and being' (2022, p. 1513). That is to say, although critiquing the extraction of economic value from human life through data is crucial, it is equally if not perhaps more important to examine and critique the ways in which datafication establishes itself as the primary form of epistemic objectivity, and therefore as a universal 'zero-point epistemology' at the expense of non-modern and non-Global North knowledges. It is precisely for this reason that Mumford employs the term 'data coloniality' to underscore the imbrication of capitalist extraction processes with both the 'colonial matrix of power' and claims about 'objective and universal knowledge' (Mumford, 2022, p. 1515). In similar terms, according to Leonelli (2016) datafication and big data should be seen as specific epistemic approaches based on mechanical views of objectivity, which have emerged in distinction to other research repertoires and paradigms and that run the risk of producing knowledge that reduces and reifies phenomena in pernicious ways (see also Beaulieu & Leonelli, 2021; Dupré & Leonelli, 2022).

As we consider metaverse data as an extension of the 'data imperative' already noted by scholars of big data, many, if not all, of the original critiques put forward by boyd and Crawford (2012) continue to apply. Before turning to the implications of collecting and mobilizing metaverse data in the following provocation, it is necessary to re-emphasize how metaversal technologies – as both sites and instruments of knowledge production – will continue to shape how we think about producing knowledge and carrying out research. Metaverse data not only present an unprecedented expansion of the breadth, depth, and scale of big data but also a further intensification of the computational turn in thought and academic research. MR headsets are already being used in various fields of medicine, cognitive science, psychology, engineering, education and training, healthcare, and the social sciences (e.g., Garrett et al., 2018; Hamad & Jia, 2022), thus giving rise to new questions about epistemology and ethics. For example, the inbuilt limitations and restrictions of metaversal technologies, which are often produced by 'big tech' companies such as Meta, are yet to be identified and understood. In a similar vein, it is likely that APIs provided by such companies, if indeed made available, will suffer from many of the same drawbacks already noted by studies on social media platforms, such as poor or non-existent archival and search tools.

The rise of metaverse research and data also ties in two other previously identified and interrelated issues, namely the temptation to consider quantitative or computational data as more objective than other possible sources of information, and the potential for further marginalization of the qualitative social sciences and humanities as equally legitimate producers of knowledge. Much like big data, metaverse technologies will make many more social spaces and practices quantifiable, and once again, computational scientists will employ mathematical techniques and models, which are increasingly considered to be under the purview of AI, to try and make sense of these large amounts of newer and more varied data. Although such computational methods are often presented as less subjective and therefore better capable of providing factual insights, particularly when applied to large amounts of data, this certainly need not be the case. Instruments, devices, models, and representations have long been employed by scientists to bolster claims of objectivity by ostensibly removing messy or subjective aspects from the process of knowledge production (e.g., Daston & Galison, 2007). The privileging of certain scientific methods for the production of facts has fed into long-standing divisions about methods and forms of legitimacy between the sciences and the humanities as well as social sciences. For instance, during the COVID-19 pandemic many governments claimed that they were 'following the science' and engaging in 'evidence-based' and 'data-driven policy-making', but this was mainly based on biomedical knowledge and evidence that largely excluded key insights from the social sciences (Lohse & Canali, 2021). However, as with Big Data, and as recently demonstrated through so-called 'hallucinations' by generative AI models, questions of data provenance, cleaning, interpretation, gaps, errors, and biases, remain central and need to be addressed. This is even more true for the larger and more varied datasets that metaverse technologies promise to produce in order to avoid issues such the identification of non-existent and spurious patterns or the fabrication of falsehoods. It is precisely for this reason that critical scholarship from the social sciences and humanities remains deeply relevant. This is not only a matter of contributing to the quality of data and insights that are produced through computational approaches but especially also to re-emphasize the fundamental importance that qualitative research has for understanding the co-construction of knowledge, technology, and society.

More and more varied data will not lead to greater accuracy and quality

Among the many promises of metaversal technologies, a primary one is that more data will be collected. More significantly though, the prospect here is that these data will cover phenomena that have not yet been tracked and datafied, at least not in quantitative and 'accurate' terms – consider for example sensory data that metaversal technologies promise to collect in large volumes and their possible significance for scientific research and beyond. As such the metaverse follows and expands the rhetoric of big data: more data will be collected and these will provide a stronger basis for understanding various phenomena. For example, the metaverse promises to expand the datafication of the environments in which individuals use metaversal technologies, with significant implications for the collection of more data on the physical and digital environments in which users move, live, and work. This includes haptic, kinaesthetic, and physiological data, which are currently not available on a large scale. This can be seen as a way of

increasing accuracy and providing a stronger basis for our understanding of a variety of phenomena that emerge at the intersection of individuals and the environment – from health to marketing, from psychology to design. And yet, our provocation here is that datafication through metaverse technologies will not lead to greater accuracy and quality.

First of all, in most cases using more data to study a specific phenomenon means having to deal with more correlations and false positives – precisely the opposite of accuracy and quality. For example, screening campaigns in public health constantly face this issue and must consider how to balance accuracy and volume of data (Ferretti et al., 2017). This issue has only become more complicated and severe as the use of larger volumes of data in personalized and precision medicine has created the risk of more overdiagnosis and overdetection (Vogt et al., 2019). A constant issue in big data is that it is often difficult to distinguish between spurious correlations and causal relations. Collecting more data through screening campaigns, for instance by screening more people or doing so at earlier points in their lives, inevitably leads to the identification of more correlations and possibly also overdiagnosis. Such issues matter greatly for discussions on metaverse datafication as this will further expand the volume of data that can be used to expand and improve scientific research, and yet this will not necessarily be on a more accurate basis.

In addition, bigger data thanks to metaverse datafication need not mean better or higher-quality data. Having more data can complicate the work that is needed for quality assessment as well as raise concerns on the overall quality of data from variegated and new sources. For example, big data has already created a need for more management, curation, and handling of data infrastructures, and has also raised concerns about the accessibility and sustainability of larger data infrastructures (Leonelli, 2016). Moreover, although variegated datasets (i.e., combining text, image, and video, and more) might allow for the development of better AI systems, they also give rise to questions about data quality and the potential inferences and predictions that might be made based on such data. Variegated datasets go hand in hand with multiple devices (e.g., VR, haptic gloves and interfaces, among others) through which companies may collect, organize, and use various data in different ways. This can further complexify the degree of accessibility or integration and, in turn, affect the quality of the data collected, both for technology companies and for quantitative researchers. Furthermore, variability at the level of types of devices can result in the implementation of significantly different sensors and modes of data collection as well as handling, which can be problematic for assessing the quality and interoperability of the collected data. Consider current discussions around the significant mistakes that 'generative AI' models are making when prompted to give answers about historical events, current news, or specific individuals. These models are clearly developed on the basis of very large and variegated datasets, and yet this does not immediately translate to an absence of somewhat straightforward errors, and the cause of these errors often remains unclear.

These concerns on accuracy and quality are particularly relevant to metaverse datafication, as in many cases these technologies will not necessarily have a point of reference against which to check their accuracy and quality, precisely because they collect data on new phenomena and aspects of our lives and experiences. Expanding datafication can potentially lead to the discovery of new and different types of phenomena, which might not be correctly interpreted by existing classification systems. But without points

of reference it can be very difficult to check the accuracy and quality of the data we are collecting in these new areas and make sure that we are actually discovering something. This problem has already been discussed in other contexts of datafication, where the use of 'real-world' data collected from self-tracking and digital technologies for scientific research has led to discrepancies with existing classification systems. For example, new cases of atrial fibrillation detected by wearable devices such as smartwatches in large populations might not produce the same clinical symptoms as what is classified as atrial fibrillation in current diagnostic classification systems (Predel & Steger, 2021). In these cases, it is not clear at all how we should assess the quality of these new data, considering that the standard points if reference and diagnostic criteria are based on smaller datasets and specific points in time. Furthermore, conditions identified earlier in life or in the broader population might just not be the same and might not require the same types of treatment.

Finally, it is (still) important to note that – even with metaverse data – bigger data are still not 'total' or 'whole data' but merely a particular sub-set, sample, and limited representation. This has been a crucial tension at the centre of big data, where failures to see gaps in the large datasets have led to misinterpretation and harm. For instance, using wearable technologies in digital health studies is a crucial way of including more and traditionally under-represented people and groups in biomedical research. But this has sometimes created the false impression that these technologies could track and include everyone, thus collecting 'all data' on health. This is clearly not the case; older adults and individuals from lower socio-economic status backgrounds tend to be excluded from these types of data collection (Zinzuwadia & Singh, 2022). Even if the possibilities of constant monitoring are increasingly expanded by metaverse technologies, data practices will still be based on specific assumptions and choices at the level of who wants to collect the data and for what, as well as at the level of users of metaversal technologies. While these may be implicit and unconscious choices, misinterpretations will proliferate if such biases are not critically interrogated.

The politics of metaversal data demand conceptual and methodological reformulation

The term 'metaverse' denotes a shift away not only from now-common conceptualizations, such as digital apps or social media platforms, but also from more recent computational technologies and techniques, such as virtual or augmented reality headsets and spatial computing, towards something that is altogether more infrastructural and all-encompassing. As the suffix '-verse' suggests, the drive towards developing *the* Metaverse indicates a future world in which, it is argued, most, if not all, economic, cultural, and social activities are subsumed into an infrastructure in and through which all these activities are mediated and take place. Especially in the sense of a 'world', the metaverse is less a tool to use than a space to occupy and live in. Metaverse technologies are thus part of the drive towards 'infrastructuralisation' (Plantin et al., 2018) – making the economic well-being of societies dependent on its functioning – which is clearly a dominant vision underpinning its development as 'the next big thing' if not 'the future'. Above all, such visions shape and justify practices of data accumulation (see also Beer, this issue). As such, we as critical scholars and analysts need to develop an adequate vocabulary for

studying and critiquing such imaginaries, particularly in terms of their infrastructural aspirations and totalizing tendencies.

The development of metaversal technologies also challenges us to return to previous and unresolved debates in the study of digital technology and media. An issue that has long plagued analyses of digital technologies is the oft-rejected yet nevertheless persistent dichotomy between offline or 'real life' activities and their relationship with online or 'virtual' activities. Regardless of whether metaversal worlds will actually be created and populated, it is clear that metaversal technologies such as MR headsets will further break down the boundaries between embodied activities in physical spaces and their virtual counterparts. Although marketing buzzwords such as 'phygital' might appear helpful for describing the purportedly seamless and frictionless dynamics between various mediated experiences, it strikes us as crucial to underscore the unavoidably embodied and material relationships and practices that constitute our selves, technologies, and societies.

A related issue is that terms such as 'users' or 'consumers' or 'data subjects' have not proven helpful for conceptualizing the breakdown of boundaries between offline/online, material/immaterial, virtual/real, and embodied/disembodied practices, which are increasingly untenable and analytically unhelpful notions that nonetheless persist when talking about the 'usage' of digital/virtual/metaversal technologies. To be sure, the move in social studies of technology and media from focusing on designers and producers to studying users and consumers was an important analytical shift that underscored the agency of people and their ability to actively influence the development as well as meaning of technologies (Oudshoorn & Pinch, 2005; Silverstone & Hirsch, 1992). However, both 'user' and 'consumer' are terms that have largely been co-opted by (tech) companies – generally to obfuscate the 'real' users of their platforms, i.e., advertisers and data brokers – and are therefore perhaps increasingly losing relevance in their ability to meaningfully describe the implications of 'wearing' or 'living with' metaversal technologies. An obvious alternative for describing these hybrid and mediated identities is Donna Haraway's 'cyborg' (1985), which is a concept that has found broad appeal among academics in STS and other fields. Widespread enthusiasm notwithstanding, the emancipatory potential of the cyborg for engendering a more radical and inclusive politics has, however, been found lacking (Siebers, 2008; Wajcman, 2004). It remains to be seen whether it is necessary to coin a new term to describe the evolving relationship between metaverse technologies, datafication, and the social world or whether recourse to older, humanistic terms might suffice.

Besides such conceptual issues, it is also necessary to reconceptualize our methodological approaches. One of the principal challenges is that of 'studying up' (Nader, 1974), or in other words, of conducting research on powerful and privileged actors. Of course, meaningful and important qualitative research, such as ethnographies in metaversal worlds, or using metaversal technologies, and about places in which metaversal technologies or platforms are created (Messeri, 2024) clearly remains possible. Such approaches remain crucial for understanding how emerging technologies and datafication processes inform our subjectivity and sense of embodiment as well as social relationships more broadly. However, so-called big tech companies are notoriously secretive and difficult to access, and increasingly unlikely to provide assistance to researchers. When access is granted, this tends to be under their conditions and through APIs that are

frequently limited in their capacity to serve as independent research tools. Moreover, such powerful companies with large resources are frequently managing to capture, and to some extent control, academic institutions through partnership programs that provide much-welcome financial support to comparatively under-resourced universities. Such programs have been successful at cultivating 'virtue capital' and the appearance of concern with 'responsible innovation' and social justice issues, thus neutralizing some of the potential negative publicity while nonetheless being able to carry on with business as usual (Egliston & Carter, 2024; Phan et al., 2022).

In light of issues such as lack of access and the threat of co-optation, scholars have creatively attempted to find other means of gleaning insights into the culture and social dynamics of technology companies as well as the functioning of their technological products (Bonini & Gandini, 2020). Online traces and public sources, such as websites, privacy policies, white papers, publications, patents, acquisition records, and job advertisements have all been employed in attempts to provide critical insights despite lacking access to corporate actors and their internal practices. On the level of technological products and the objective of 'opening black boxes', critical data studies techniques, such as algorithmic audits, have been employed to examine the cultural biases embedded in such tools and to counter the disproportionate impact that algorithmic decision-making has on a wide range of minorities and marginalized groups. As valuable as these approaches have been in identifying and addressing some of the gravest injustices and for increasing the fairness of automated decisions, they nonetheless remain limited and can sometimes even perform a legitimizing function (Broussard, 2023; Sloane, 2021). As powerful tech platforms manage to shape research and sometimes even obstruct this, we – as purported researchers of such platforms – need to reinvent new techniques for circumventing such obstacles in order to continue the kinds of critical research that can question the ability of such companies to shape our infrastructures and societies.

Metaverse datafication exacerbates privacy, surveillance, and exploitation issues

Metaverse datafication will not only allow for the collection of more and more diverse data, but these data will pertain to more intimate and private aspects of our lives as well as personal spaces and interactions. By virtue of their user-generated nature, these data are likely to be highly monetizable by the companies that collect and control such data. This extension and intensification of datafication processes will exacerbate concerns about privacy and surveillance that have already been associated with the era of big data, but also give rise to new issues with commodification and exploitation, particularly of public and private spaces, embodied practices, and social interactions. Uncritically accepting such new forms of tracking human activities in the 'post-Snowden age' would be a contradiction not only for those doing research in any field of knowledge production, but also and especially for those institutions that have recently been victims and implementers, respectively, of different forms of digital control (Macnish, 2018).

One of the primary concerns is that MR technologies such as headsets can collect data about the body on a far more granular level. As noted by Bailenson, for example, such technologies can 'record 18 types of movements across the head and hands', and

'spending 20 min in a VR simulation leaves just under 2 million unique recordings of body language' (2018, p. 905). What is more, these data on bodily movements are 'diagnostic of personal identity, medical conditions, and mental states' and thus fall under the definition of biometric data (Miller et al., 2020). In addition to kinaesthetic data, MR technologies are also capable of eye-tracking, gaze analysis, voice and facial recognition, and potentially also electrical muscle activity, respiratory or heart rate, and galvanic skin response (Cross & Coby, 2023; XRSI, 2020). Even relatively small amounts of such granular data can be extremely revealing – ranging from age, gender, and (dis)ability to height and motor-response times (Nair, Munilla Garrido, et al., 2023) – and as accurate as fingerprint data for identifying individuals (Nair, Guo, et al., 2023).

Another primary concern is the collection of data about built environments that MR users move through as well as work and live in. Spatial understanding is necessary for the optimal blending by MR technologies of physical environments and people with virtual elements. This allows for the collection of data on, for example, geolocation, the dimensions and layout of one's personal or workspaces, the presence and placement of various type of furniture or devices, and the state and quality of various objects in such spaces (Egliston & Carter, 2022; Nair, Munilla Garrido, et al., 2023). Needless to say, such information can be used to infer one's financial capabilities and aesthetic preferences and is thus hugely valuable for advertising purposes. The collection of such spatial data is not, however, limited to inside spaces but also more public environments. Meta's project Aria, for example, can be characterized as seeking to map and collect data on the 'Commons' through sensory devices such as MR headsets (Applin & Flick, 2021; Saker & Frith, 2020). Once again, these data on a wide range of spaces, people, and behaviours, can subsequently be marshalled for more intense forms of psychometric profiling and subsequently monetization, commodification, and targeted advertising. As a result, the collection of metaverse data will further complicate extant models of informed consent to the collection and sharing of data, which have already been severely limited in their effectiveness for informing and protecting 'data subjects'. Open-ended and still unclear uses of metaverse data are a problem from the point of view of models that rely on 'single-instance consent', which is normally given to single uses and not additional repurposing and inferences on the same data.

Both types of datafication – of bodies and spaces – open up users to further potential vulnerabilities and harms, such as corporate and state surveillance as well as sousveillance. This is certainly not only the case for commercial consumers of MR technologies, but especially for workers in, for example, manufacturing and logistics (Delfanti 2021), whose labour has been subjected to processes of quantification, automated decision-making, 'nudging', and remote surveillance through the introduction of so-called assistive technologies that are introduced under the guise of optimization, efficiency, and empowerment. As such, metaverse datafication presents an extension and intensification of the existing business models of 'big tech' companies – perhaps above all of Meta – which consists of a so-called 'ecosystem' in which the exploitation of the free labour and data of 'users' is central (Foxman, 2022). As Evans et al note (2022, p. 29), metaverse technologies 'can act as a fully integrated dataspace' that enable an unprecedented level of measurement, data harvesting, and commodification. Indeed, most business plans for 'the metaverse' appear fixated on the unparalleled levels of attention that immersivity promises to deliver to advertisers (e.g., Hazan et al., 2022). The predominance of large

corporations, such as Meta, not only in popularizing the notion of 'the metaverse' but also defining it in their specific terms has, unsurprisingly, caused researchers and commentators to issues warnings about such unilateral influence (e.g., Au, 2023; Evans et al., 2022). Moreover, the combination of numerous metaversal devices or applications and the complex types of data they produce, can readily lead to forms of data manipulation for specific goals, whether political, economic, or cultural. Such forms of manipulation may be difficult to identify and track, thus increasing the difficulties of opening the 'black boxes' of metaverse technologies and facilitating the emergence of 'undebunkable' information sources.

The threat of exploitation is further exacerbated when biomedical data from MR devices – of which even small amounts can easily be used to identify individuals even in anonymized and de-identified datasets (Miller et al., 2020) – are recombined with other publicly available data sources. In addition to issues of privacy and surveillance, users are also potentially exposed to an increased likelihood of identity theft and reputational harms that might arise from poorly regulated and secured databases, particularly for younger users who are unlikely either to properly consent to the privacy policies or understand the potentials risks and harms that might flow from the use of MR technologies and 'worlds'. Indeed, it is important to note that current proto-metaversal platforms, such as Roblox and Fortnite, are predominantly occupied by children and young adults. Moreover, scholars in the social sciences and humanities who are conducting research in and through metaversal technologies and spaces need to be acutely aware of the potential risks and harms that their research and data collection practices can pose to the people with whom they are working.

Claims about disruption in terms of decentralization, sustainability, and democratization are misleading

Decentralization and redistribution have been among the most powerful buzzwords employed during the emergence of digital technologies and the Internet. However, as historians have shown, decentralized or distributed infrastructures can be easily (re)centralized despite the optimistic premises and promises of their initial creators (Hu, 2015). Although metaverse environments could, in theory, facilitate the formation of grassroots or communitarian movements, it remains unclear – and highly questionable – whether metaverse technologies and infrastructures will distribute power across groups rather than concentrating power in the hands of ever fewer corporations. According to the founding narrative of Meta (after its name change from Facebook), the 'metaverse' should fundamentally be characterized by decentralization and de-platformization. As Mark Zuckerberg argued in his notorious letter of October 2021:

> The metaverse will not be created by one company. It will be built by creators and developers making new experiences and digital items that are interoperable and unlock a massively larger creative economy than the one constrained by today's platforms and their policies. (Meta, 2021)

Somewhat ironically, one of the largest of 'big tech' companies is ostensibly pushing for the de-platformization of society. Or in other words, the *status quo* will supposedly be subverted by those who created it in the first place. What is more, one of the ways in

which corporations such as Meta are creating the 'metaverse' is certainly not decentralized, as can be witnessed from their acquisition of companies and startups producing MR devices and applications. Moreover, the efforts of big corporations to build the 'metaverse' are not just confined to MR devices, software applications, and AI systems. New 'superhighways' need to be constructed because the infrastructures necessary to run MR environments (cables, servers, data centres, switch points, etc.) are more complex and consume more energy as well as human and natural resources than current platforms due to, for example, the real-time rendering of 3D worlds and the elaboration of multiple forms of haptic and visual data. Ideals of decentralization are undermined in other ways as well. For example, only large telecom and technology companies are capable of building metaverse technologies and infrastructures. It is not by chance that Meta and Alphabet are competing with each other as well as with Chinese companies in the crucial global market of undersea data cables, which are fundamental infrastructures for running their platforms (Plantin et al., 2018). A similar development appears to be currently playing out in terms of the development of Graphics Processing Units (GPUs), which are microchips that are central not only to the development of most current AI models but also to the rendering of virtual worlds and digital overlays that characterise the 'metaverse'. The hype around such chips and rapidly rising demand for them has led companies such as Nvidia to grow extremely rapidly and allowed them to increasingly dominate this sector of technological development (see also Smith, this issue).

At the same time, claims about 'green' and 'sustainable' metaverse technologies are similarly misleading. Narratives presented by technology companies and metaverse boosters focus more on the potential of the 'metaverse' for reducing, for example, international travel and material consumption rather than on the socio-technical systems that underpin it. This deflects the attention to devices and uses neglects the material reality of digital infrastructures as well as the natural resources they require to construct, run, and maintain (Crawford, 2021). A related narrative surrounding metaverse platforms – a hype that not coincidentally emerged once the Covid-19 pandemic first appeared to subside and videoconferencing had become a relatively normalized practice – is that of 'remote work'. Although it is clear that work practices have undergone a change since this pandemic, the focus of Meta and other tech giants on new opportunities for remote work is belied by technological, material and immaterial impediments as much as by the unlikely promise of a more sustainable and socially-rich work environment. Remote work, in fact, can be less accessible and socially sustainable for those who cannot easily separate, for whatever reason, private life and work practices. Indeed, new forms and organization of remote work can contribute to the production of 'new spaces of labour market inequality' as well as the further isolation and atomization of work (Ewers & Kangmennaang, 2023).

The issue of sustainability goes hand in hand with the promise of democratization that is ostensibly embodied by technological advancements. However, social sustainability and democratization are global, not just local, phenomena, and it is far from clear how metaverse technologies might solve existing issues in terms of accessibility and discrimination (e.g., Noble, 2018; Vallor, 2018). Similarly to the imaginaries surrounding previous technologies such as the Internet or radio broadcasting (Streeter, 2010), the redeeming power of the metaverse and MR as new 'technologies of freedom' (Aouragh

& Chakravartty, 2016) has promptly been questioned by critical scholars and concerned communities. For example, disability organizations have highlighted the potential emergence of new forms of discrimination and risks for disabled people in MR environments (Felix, 2022), while authors such as Nakamura (2020) argue that MR experiences can convey a false idea of a technologically mediated redemption or 'toxic empathy' of white users with a wide range of 'others' (e.g., ethnic and sexual minorities or marginalized groups). This process can lead to a banal form of technological solutionism that oversimplifies how racism, sexism, and ableism permeate our societies as well as the political actions necessary to address such issues.

Metaversal technologies will aggravate existing infrastructural and geopolitical inequalities

Metaverse technologies and data threaten to widen existing divides in numerous fields of research, labour, public health, economics, and national sovereignty. First, differences between 'rich' and 'poor' research labs, companies, and institutions are likely to increase because of metaverse datafication. The economic costs of researching MR practices, in terms of computational power, devices, software, and data collection tools or skills, are much higher than for current empirical research. Scraping data, for example, will take on a completely different dimension in terms of complexity and costs. Similarly, MR headsets and labs for studying metaverse practices are not going to be cheap either. This will further concentrate the ability to conduct research on metaverse practices in the hands of a few private companies and well-resourced universities. Taking university research as an example, institutions that already hold greater technological, cultural, and symbolic capital will have a clear competitive advantage; the resources and computational power necessary for collecting and analysing metaversal data will be their sole prerogative, thus leaving other institutions (and countries) behind.

The risk of producing and exacerbating existing or new forms of injustice and inequality through metaverse datafication does not only affect the social sciences and humanities. Similar forms of inequality may affect all fields of professional and academic knowledge production, starting with the resources and skills required to build and manage metaversal databases or, for example, the moderation of content. Existing and new forms of digital labour, as is already happening in the case of AI (Graham & Ferrari, 2022), could be delegated to armies of click workers, thus replicating the exploitation of underpaid and precarious workers in low-income countries in the Global South. Moreover, concrete concerns can also be raised in the context of health, where metaversal technologies have already been implemented for education and training as well as personalized medical interventions (Liao et al., 2020). Furthermore, metaverse datafication also has the potential for exacerbating exploitation and data harvesting, and carries the risk that personalized interventions will first go to those who can afford them rather than those who might benefit the most. Indeed, digital infrastructures and devices can be understood as a new social determinant of health in a manner similar to wealth, education, and housing (Sieck et al., 2021).

The expansion of metaversal infrastructures and datafication processes can also have significant consequences at the level of governance and geopolitics, reiterating – if not reinforcing – the 'infrastructures of empire' that characterize our information

ecosystems. Notably, the massive appropriation of the means of data extraction, diffusion, and control by 'big tech' companies is often masked by purported acts of altruism that coincide with new forms of digital colonialism. The power of these companies perpetuates not only the concentration of data infrastructures but also the consumption patterns, business practices, and organizational models that replicate inequalities between rich and poor nations and continents. US-based companies such as Meta and Microsoft – and more recently countries such as China, especially since the development of the 'digital silk road' – have for decades pursued an ostensibly humanitarian goal of bringing connectivity and computation to poorer countries 'for free' (Kwet, 2019). However, even if such infrastructures and digital technologies are increasingly available in the poorest places in the world, the fact that they are managed and controlled by powerful, foreign companies or governments entails a clear long-term risk. Some national, regional, and local communities may be excluded from metaverse infrastructures, or even when included, neither be in control over such digital environments nor benefit from the economic, social, and policy benefits that these might provide. The economic opportunities due to the ownership of digital properties, metaverse 'lands', and Non-Fungible Tokens (NFTs) are in fact already being co-opted by powerful actors, thus making the 'metaverse' a new space for commodification and financial speculation (Belk et al., 2022). Furthermore, resorting to blockchain technologies and cryptocurrencies for the economic governance and management of metaversal platforms appears to be just another means of perpetuating the unequal governance models and economic infrastructures of the current financial system. Cryptocurrencies in particular appear to serve mostly as vehicles for financial speculation, which is dominated by venture capitalists and investment bankers, thus increasing, again, their economic and political power. Such an uneven distribution of networked resources and opportunities gives rise to important questions about network or 'metaverse' neutrality (Goldsmith & Wu, 2007) as well as the inclusion of imaginaries and visions from other parts of the world that might allow for the constructions of metaverse technologies and 'worlds' that are not strictly informed by the business models and interests of large platforms and dominant nations (Girginova, 2024).

Conclusion

This paper has sought to anticipate several of the most pertinent issues tied to metaversal technologies and the expansion of processes of datafication. The potential promises and benefits contained in the collection of more, more varied, and multimodal data are not illusory – these data can have the potential to fundamentally shape, for the better, not only research in the medical as well as social sciences and humanities, but also the monitoring of and intervention in a wide range of bodily, social, industrial and regulatory processes. Such potential benefits notwithstanding, we deem it of crucial importance to reflect on and warn against some of the possible adverse consequences that might arise from metaversal technologies and their role in processes of datafication.

As mentioned in the introduction, metaverse datafication does not appear to us as a radical rupture from the era of Big Data. This new frontier of datafication does, however, involve a qualitative change in terms of the types of data that are collected and in the

intensity with which they are collected. Particularly concerning is the granularity of data both on the level both of bodily processes, individual actions, and social behaviours, as well as in terms of the features and characteristics of the built environment both public and private. As we hope has become clear, such data and the processes with which to collect them will not only challenge our definitions of knowledge, research methodologies, and conceptual frameworks, but also exert an effect on and threaten to exacerbate a wide range of social and political issues as well as inequalities.

To address these issues, further study and discussion among researchers and policy makers are needed, and we hope that our provocations can provide guidance in this direction. Yet governance initiatives are sorely needed too. As seen in other industrial sectors involving emerging technologies, particularly AI, the 'metaverse' industry has started to lay out technological standards, called for regulation, and organized itself around industry organizations (e.g., XRSI, 2020). Similarly, civil society groups, national governments, and supranational bodies such as the EU, have issued calls for governance initiatives to safeguard privacy, safety, equity, and inclusivity for users as well as to secure economic competitiveness and commercial opportunities for companies and states. As noted by other scholars (Egliston, Carter, & Clark 2024; see also Martini in this issue), such initiatives tend to emphasize self-governance or co-governance (in conjunction with civil society groups rather than states), are often funded by dominant industry players, and tend to rely either on existing (and often inadequate) governance frameworks or on speculative and somewhat aspirational initiatives that assume a linear and deterministic development of metaversal technologies and that fail to address currently emerging issues.

Our hope is that our provocations will kick off a new critical debate on two levels. First, to determine the trade-offs involved in deciding between the risks and advantages of the datafication process that the metaverse – or whatever its next name will be – entails on a sociotechnical, cultural and political level. A key point here, already often repeated in the context of Big Data, is the question of who gets to define and decide on the ends to which such new data will be put to use. Another point is the question of which limits should be put on datafication, that is, whether in some cases quantifying and datafying a phenomenon is not helpful for our understanding, could be harmful for multiple actors involved, and should therefore simply not be done. This is clearly a complex issue but one that is becoming ever more pressing with the metaverse and related datafication processes. Second, and perhaps equally importantly, to provide new impetus to discussions about who gets to decide on the future development of metaversal technologies, besides the largest corporate players currently leading the way, so that both the benefits as well as responsibilities of the datafication process are shared in an equitable manner. Put differently, how can developments in metaversal technology break out of their current narrow technocratic and commercial framing and be re-appropriated and guided towards the achievement of a much broader and inclusive set of social goals? Is it possible to imagine a different developmental path, or even, if necessary, a socially shared and responsible response and/or refusal to the imposition of the metaverse? These are, admittedly, big questions that are at the core of all discussions about emerging technologies, but they nonetheless bear dogged repeating.

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Notes on contributors

Chris Hesselbein is an assistant professor of Science and Technology Studies in the Department of Management Engineering at the Politecnico di Milano. As an ethnographer who studies how knowledge and technology are co-constructed with conceptions of social order, he is particularly interested in exploring how the production and consumption of technoscience inform, and often naturalize or normalize, our understandings of embodiment, materiality, and aesthetics.

Paolo Bory is an assistant professor of Sociology of Culture and Communication at the Department of Design, Politecnico di Milano. His research focuses on the role of the imaginary and narratives in the history and contemporary development of digital media such as computer networks, AI, supercomputing and the metaverse.

Stefano Canali is an assistant professor at the Department of Electronics, Information and Bioengineering of the Politecnico di Milano and works in philosophy of science, with particular interest in the philosophy of data, medicine, and digital technology. His current research focuses on the epistemic role and ethical and social implications of wearable technology for biomedical research and AI and ML for personalized care.

ORCID

Chris Hesselbein http://orcid.org/0000-0003-4258-6671

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