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How do brands exploit behavioural data in virtual spaces, and what regulations curb manipulative practices?

***Brighton Nyagadza**
Department of Business, Management & Health Studies, York St John University, London Campus, City of London, England, United Kingdom.
Email: *b.nyagadza@yorksj.ac.uk*
ORCID: https://orcid.org/0000-0001-7226-0635

Abu Bashar
College of Communication & Media Technologies, Gulf University
City of Sanad, Kingdom of Bahrain.
Email: *dr.abu.bashar@gulfuniversity.edu.bh*
ORCID: https://orcid.org/0000-0003-1415-5591

Eugine Tafadzwa Maziriri
Department of Management & Entrepreneurship, Faculty of Economic & Management Sciences, University of the Western Cape, Bellville, South Africa.
Email: *eemaziriri@uwc.ac.za*
ORCID: https://orcid.org/0000-0002-8047-4702

Tamer Alkadash
College of Communication & Media Technologies, Gulf University
City of Sanad, Kingdom of Bahrain.
Email: *dr.tamer.alkadash@gulfuniversity.edu.bh*
ORCID: https://orcid.org/0000-0002-5012-4170

***Corresponding Author:** Brighton Nyagadza. Email: *b.nyagadza@yorksj.ac.uk*

Abstract
This article assesses how brands increasingly exploit behavioural data generated in virtual and immersive spaces to personalise experiences, push user options, and deploy subtle forms of manipulation. It outlines the methods through which behavioural, biometric, and interaction-level data are harvested and translated into predictive marketing strategies, highlighting the rising opacity and influence asymmetries inherent to virtual spaces. The viewpoint paper reviews emerging regulations, particularly on platform governance, data protection, and advertising. It offers practical implications for regulators, brands, and platform designers, emphasising the need for more transparent, user-friendly and centric design forms. It contributes to original insight by bridging digital marketing, behavioural economics, and cyber-regulation to articulate a coherent framework for the responsible use of data in rapidly changing virtual environments.

Key Words: predictive marketing strategies; influence asymmetries; regulators; brands; platform designers; behavioural economics; cyber-regulation

JEL Code: D91; L86; K24

Paper Type: Practical Viewpoint.

Introduction

With the rise in the change to virtual platforms such as the metaverse typology of social media environments, augmented reality (AR), and gaming in immersive worlds among others, brands are gaining access to behavioural data of different levels and granularity (Slater and Sanchez-Vives, 2022). Such environments are not merely recording history of purchase or general transactions, they are attracting and capturing behaviours in micro forms such as navigation spatiality, emotional cues, and haptic interactions. For professional and/or practitioners in this field, this kind of hybrid rich data is changing customer experience design, leading to real-time personalisation, adaptive digital display advertising, and pricing models which are very dynamic, which respond to elements that are contextual and user states.

Competitive advantage created by the associated capabilities exposes brands to heightened risk linked to regulation and ethics, especially if the data-driven influence crosses the boundaries into manipulation. Virtual environments can increase vulnerability to behaviours due to the integration of continuous data capture, embodiment, and presence, which can change the way decisions are made, often in ways that are less known to users. The methods and approaches, such as immersive dark patterns (Federal Trade Commission (FTC) 2022; Mathur *et al.* 2021), reinforcement-learning-based content sequencing, and emotion-responsive ad placement, increasingly block the difference between persuasive design and influence exploitation (Davenport *et al.*, 2021). For professionals and practitioners, these developments may create strategic dilemmas. While personalisation enhanced by intensive data can improve engagement, more intensive behavioural targeting can trigger regulatory scrutiny, erode trust, and disturb long-term brand equity (Helbing 2023).

Regulatory authorities are now intending to intervene in these issues. The General Data Protection Regulation (GDPR) has established some limits on how to handle decision-making automatically and profiling, while the Digital Services Act (DSA) (European Commission 2024), and the soon-to-come AI act unveil novel restrictions on manipulative high-risk data uses and user interface design. Advertising codes in various industries and platform-specific policies are now championed to deal with minors' vulnerability, permissible in-experience commercial placements and use of biometric data (IAB (International Advertising Bureau) 2023). For the brands that are operating at a global scale, it can be a very complex compliance landscape.

There two main questions guiding the current practical viewpoint article are:

- *How are brands exploiting behavioural data in virtual spaces today?*
- *Which regulatory frameworks apply to these practices, both in terms of constraints and opportunities?*

It establishes the behavioural data exploitation strategies ecosystem that is embedded in virtual spaces, differentiating the creation of value practices from manipulative techniques. Secondly, it integrates regulatory cross-jurisdictional and benchmarks related to immersive environments, clarifying areas of legal uncertainty. Finally, it shows the guidance for practitioners and/or professionals that is actionable in terms of ethics of design, auditing, governance and risk management cross-functionally, to assist brands innovate responsibly while reducing and avoiding pitfalls in regulatory and reputational practices.

The current practitioner article positions virtual spaces' behavioural data not only as a regulatory matter but also as a strategic imperative, which will increasingly affect competition of differentiation, sustainable immersive brand engagement and trust of consumers.

Virtual spaces and behavioural data

There are many ways to classify behavioural data. However, the biggest question is what counts as behavioural data in the virtual world and how it is different from the traditional websites (Bailenson 2018). This is so because in the immersive and virtual world environments, data related to behaviours goes beyond the discrete and intentional actions typically controlled on websites, and it is inclusive of signals triggered by engagement, presence, and motions. These actions are content-rich and multi-modal in nature, which capture the way the users physically inhabit and interactively navigate within the virtual worlds. Under normal circumstances, behavioural data is created from environmental engagement and original natural motions, which produces a vivid picture of user experience (UX), more ambient and highly granular (Nassirtoussi and Lee 2023). Virtual Reality structured systems capture gaze direction, manipulation of objects, voice data, micro-behaviours created by emotions, spatial positioning, head orientation, gesture trajectories, and spatial positioning (Rospigliosi 2022). Further to this, virtual environments tend to amplify behavioural granularity by recognising and recording every micro movement with deeper precision and the regular times which go beyond what is observable in the natural world, these interactions are costly to code, difficult to observe and generally intermittently created (Jerald 2015). This type of volume of data rises exponentially because of frequent types of embodied interaction, permitting brands to determine signatures of behaviours, forecast decisions, and personalise experiences with uncontrolled fidelity (Rosenburg 2022).

Virtual and immersive environments are built through sophisticated spatial design, avatar systems, social presence features, and engagement affordances, all of which act as active mechanisms that influence and shape behaviours. Since these environments are created through programming the designers can establish some pathways, proffer guidance to user movements, decision making and attention. The designer, on its own, defines the nature of behavioural grammar of the environment, determining what actions are effective, ways in which they are expressed and where brands can intervene to influence the outcomes (De Guzman and Bos 2023; Maziriri *et al.* 2026). In this direction, the virtual and immersive environments cannot only capture behavioural patterns, but they also create the architecture, cause and amplify the approach that makes persuasion, assessment and evaluation systematic and strategically actionable.

Manipulative potential and brand strategies

The use of behavioural data has fast become more strategic to deciphering advertising, which makes it more personal and tailored to meet the needs and expectations of the target market, since brands are now increasingly venturing into immersive platforms and virtual worlds. How brands can observe user behaviour, in terms of virtual locations, the items they buy or examine and they interact, is dependent on hyper personalised campaigns which reflect user tastes, identities relevant to individual inspiration and social status. This type of data offers greater granularity than traditional web or social media data (Monga 2025; Nyagadza *et al.* 2025).

These immersive advertising campaigns now combine storytelling, interactive and spatial design, and real adaptation. As a result, brands are now able to leverage predictive analytics and Machine Learning (ML) to surface goods which are related to the user's demonstrated preferences, in anticipation of the needs of users before explicitly expressing them (Wu *et al.* 2023). There are many mechanisms that can be used for influence, related to how the immersive platforms and virtual worlds enable prediction and steering. These include, but are not limited to sensory cues and multi-sensory design (Virtual Reality (VR) ecosystems which are more than visuals and audios),

avatar-based targeting and identity effects (virtual worlds which allow users to adopt avatars), dynamic ad-serving and predictive personalisation (in immersive environments which continuously create streams of data related to user behaviour), narrative and gamification nudges (narrative storytelling, gamified content, and narrative arcs) (Panagiotis 2024), among others.

On the other hand, immersive advertising offers genuine value, have clear legitimate uses ranging from entertainment, social connection, educational, retail, social, but they may cause some dangers such as privacy violations, user profiling, public opinion manipulation and addiction tendencies. Covert influence and persuasion can in fast-paced blur because of when brands deploy sensory nudging, predictive analytics and avatar-based targeting without transparent user content. In addition, virtual reality platforms are typically affected by data governance, privacy, and consent issues (Mishra *et al.* 2023). Due to this, persuasion may exploit biases related to cognition, users' immersion, and awareness lack.

A key question for professionals and practitioners is whether users can recognise when their behaviour is being influenced or infiltrated, or when immersion hides intentions to persuade (Khan and Nilsson 2023). Creation of sense of presence and emotional engagement is what VR power lies upon. Prior research studies have proven that the young digital natives who use VR experience immersive brand experiences that evoke strong cognitive, behavioural and emotional engagement (Balik 2024; Bashar *et al.* 2025). This implies that practitioners must ensure transparency about how the behavioural data is used, designing the immersive environments with respect for user independence, application of ethics to make sure consent, privacy and agency remain central, monitor the long-term impact of the immersive advertising experiences on trust of users, mental wellbeing and authenticity perception (Dwivedi *et al.* 2023).

Power asymmetry and consumer vulnerability: The engine of exploitation

The concept of power asymmetry refers to the imbalance of power and information between consumers and businesses (Mantelero and Esposito 2024). In the digital sphere, the companies possess superior consumer data, have vast financial resources, deep market insights and sophisticated tools to learn consumer behaviour and exploit them as and when possible. It is more than just incidental as it became more dangerous when firms leverage on the deep '*dark patterns*' or big data analytics to bypass the rational deliberation of the consumer, so basically, they transform the consumer into a target for making more profit rather than a value provider or a partner in the exchange process (Bashar *et al.* 2021).

The exploitation practices are further aggravated because of the unavailability of the right set of the regulations to prevent fallacy and misuse of consumer's innocence. The consumers are offered lengthy and complex contracts that they must read and agree to, and it asks for certain approvals which are not in the consumers ' favour. So, disparity in bargaining power simply helps the powerful firms to exploit the consumer and get maximum profit as much as they can (Schwenteck and Pürer 2024).

The power dynamics of traditional digital marketing are greatly increased by the immersive nature of virtual environments. Dynamic power asymmetry is produced by real-time behavioural tracking. VR/AR systems are allowing brands to analyse and respond within the same psychological moment in contrast to the delayed feedback loops of web analytics (Hilken *et al.* 2022). For example, using biometric cues or interaction speed to detect user hesitation enables the instantaneous serving of a discount or a scarcity nudge, resulting in a marketing loop that functions more quickly than conscious consumer reflection. Because of this real-time adaptation, the environment becomes a dynamic Skinner box in which user behaviour is constantly shaped by

data-triggered reinforcements. Certain populations that are vulnerable to exploitation are disproportionately affected by this asymmetry.

Children and adolescents: They are particularly vulnerable to embedded persuasion because their developing prefrontal cortices are unable to recognise immersive native advertising as commercial content (Nelson *et al.* 2023). It is particularly acute for children who exhibit a unique '*ontological vulnerability*' due to their developing cognitive and emotional capabilities (Mantelero and Esposito 2024). The younger children are often lacking in the ability to distinguish between informational content and commercial intent, which makes them vulnerable to 'stealth marketing' and 'dark patterns' that bypass the human rational filters and deliberations before making an important purchase decision (UNICEF 2021). The impulsive nature of adolescents is another critical aspect that marketers are exploiting, as they know that they remain vulnerable on digital platforms and could be exploited via influencer marketing and peer-driven data profiling (UNCTAD 2024). Consequently, the imbalance between corporate data-mining power and a minor's growing autonomy making young users into permanent targets for economic extractions.

Gamers and addictive individuals: For these individuals, power asymmetry is really weaponised through 'predatory monetisation' and '*neuro-architectural exploitation*'. Gaming firms utilise 'dark patterns' and 'variable ratio reinforcement schedules, ' the same psychological mechanisms found in slot machines that ask to bypass the executive function of vulnerable users (Zendle and Bowden-Jones 2023). The convergence of gaming mechanics like '*loot boxes'* and '*Pay to Win*' uses immersive flow conditions and does not disclose the actual cost of involvement unless the user is not fully committed economically and psychologically. It is most dangerous for people with internet game disorder because the game's algorithmic capabilities to track spending in real time and the frustration state help them to exploit the gamers.

The emotionally vulnerable: It is especially very dangerous for people going through difficult emotional times, such as grief, loneliness or high stress levels. Companies use '*emotional tracking*' and '*sentiment analysis'* to deep dive in one's conditions and find out when a person is at their lowest point (Maitland and Quinn 2024). Once the companies found some cues of a person's sadness or anxiety based on their search history or social media posts, firms use '*predatory timing*' to show ads to help them out and fix their problems, offer expensive '*self-care*' products to get self-esteem based on look and beauty or offer a very high-interest loans to help them come out of their financial distress (Nill and Schibrowsky 2023). The process of exploiting these people is quite easy for them because an emotionally drained person has less '*cognitive energy*' and they struggle to think clearly about the long-term costs of a purchase or its effect on their overall financials etc. This allows businesses to exploit the '*affective gap*', the space where a person makes a choice based on a temporary feeling rather than a logical need (Riquelme *et al.* 2025). The digital platforms and companies use the emotional pain of the users as a data signal that is then algorithmically processed for excessive profit earning, which transforms a person's private struggles into a tool for financial extraction.

Crucially, the delusion of urgency is the foundation for this exploitation. The concept of choice and control is the foundation of virtual worlds which brands opt and adopt accordingly. A false sense of control over one's information and choices is created by the act of personalizing an avatar or freely browsing a virtual store. Every decision is a high-fidelity data point that directs the user toward anticipated profitable results. While being guided by a hidden architecture of behavioural puppetry the user feels in charge.

Regulatory questions: A framework playing catch-up

A framework for catching up on regulatory questions. The technical and experiential realities of immersive spaces pose a fundamental challenge to current regulations. The exploratory

omnivorous data collection inherent in VR conflicts with the GDPR's core principles (purpose limitation, data minimisation). Although it addresses dark patterns, the Digital Services Act (DSA) does not address spatially deceptive design. The opt-out of sale clause in the CCPA/CPRA is vague when it comes to internal real-time behavioural profiling, in which data is weaponised by using it for hyper-personalisation rather than sold. Regulators are using 2D frameworks to solve 3D issues.

Key regulatory gaps

While statutes such as BIPA and GDPR govern static identifiers like fingerprints, they provide little defence against the constant flow of motion-tracking data (which can disclose medical conditions) and affective biometrics (emotional valence) produced in virtual environments. This is a crucial flaw (Mantelero and Esposito 2024). The law is too vague to differentiate between manipulative exploitation in virtual environments and moral persuasion. Because there is no clear precedent, there is room for increasingly deceptive A/B testing. Is employing gaze-tracking to position a product at the eyes' natural resting point a clever design or a subtle exploitation of biological instinct? In a 360-degree virtual reality setting that requires a Sponsored label, it is frequently both technically impractical and disruptive to the user experience. The current ad disclosure paradigms are not only inadequate but also fundamentally incompatible with immersive presence resulting in a gap in accountability (Schwenteck and Pürer 2024).

A practitioner's call for evolution

According to the EU AI Acts, reasoning AI systems that combine behavioural and biometric data to influence decisions in immersive settings ought to be categorised as high-risk. Strict impact analyses and human oversight are therefore required. Screen-centric regulations need to give way. Regulators, technologists, and ethicists must work together to create codes that control the gathering of spatial data friction-by-design, cooling-off times, and in-world consent procedures. Architecture is the answer. Platforms should be encouraged or mandated by regulations to develop standardised real-world tools like an ambient transparency mode or a data dashboard avatar accessory that gives users a concrete sense of agency.

The main conflict for practitioners is evident as they cannot trade-off between the immersive technologies and real-time data analytics and emotional tracking. These technologies made virtual spaces a potent commercial frontier, also making them vulnerable to serious consumer exploitation. It is necessary to stop applying antiquated regulations to modern technology to close this gap. Rather, it necessitates a proactive collaborative regulatory strategy that incorporates moral values, transparency, user agency, and vulnerability protection into the virtual experiences' architecture itself. The objective must be to promote responsible immersion, where creativity is not suppressed but instead directed toward interesting, non-exploitative experiences (McStay and Urquhart 2024).

Governance and ethical challenges in behavioural data exploitation

The governance of behavioural data exploitation in virtual and immersive environments poses significant ethical and practical challenges due to the dynamic, real-time nature of data capture. Traditional governance methods based on static interfaces and text-based disclosures are inadequate for immersive worlds that continuously monitor user behaviour, such as navigation, gestures, and gaze, to infer personal preferences and emotional states. According to legal scholars, the limitations of text-based informed consent highlight the discrepancy between users' understanding and data processing in virtual environments under current regulations such as the General Data Protection Regulation (GDPR) (Kim 2022).

Immersive design structures incorporate persuasive elements, such as adaptive content sequencing or sensory triggers, which can subtly influence user decisions without explicit awareness. Ethical concerns arise when these mechanisms exploit vulnerabilities rather than promote autonomy. Studies on digital dark patterns suggest that interface designs that manipulate user choices violate the transparency and fairness principles underlying data protection regulations (European Commission 2022; Herbiet 2025).

Platforms and brands face the challenge of balancing user experience optimisation with agency preservation and avoiding exploitation. The GDPR explicitly requires organisations to embed data protection and privacy considerations into the design and operation of systems, services, and technologies (Article 25: Data Protection by Design and by Default), mandating measures such as privacy-by-design and data minimisation to protect data subjects' rights throughout the data lifecycle (European Union, 2016). Scholarly analyses further emphasise that these principles are intended to build ethical safeguards into systems engineering and organisational practices to ensure trustworthy processing of personal data (Cormack 2021). Regulatory guidance elaborates that these obligations require proactive integration of privacy measures at all stages of development, including minimising the amount and scope of data collected (Information Commissioner's Office 2023). However, implementing these principles in immersive environments is complex due to technological challenges and normative uncertainties regarding exploitative versus legitimate persuasion in rich experiential settings.

Governance issues extend beyond organisational boundaries, especially in cross-jurisdictional operations where diverse regulatory expectations must be navigated. Platform providers wield significant control over design and data access, limiting external oversight. Consequently, many organisations establish internal governance structures, such as ethics review committees, algorithmic impact assessments, and multidisciplinary risk audits, to address gaps in existing regulations. These structures serve as interim governance mechanisms until legal frameworks and enforcement mechanisms catch up. Without proactive governance emphasising transparency, fairness, and user autonomy, immersive brands risk regulatory penalties, public distrust, and reputational damage.

Norms, technology and enforcement

The regulation of behavioural data in immersive spaces is shaped not only by formal laws but also by emergent social norms, platform affordances, and uneven enforcement capacity. Formal legal frameworks such as the GDPR and Europe's Digital Services Act (DSA) provide foundational protections against manipulative practices, requiring transparency, user consent, and accountability for systemic risks in digital services (European Parliament 2021). However, enforcement mechanisms lag behind rapid technological change in immersive environments, where behavioural analytics and machine learning adapt in real time, often beyond regulators' visibility.

Industry and societal norms also influence what is deemed acceptable. The widespread adoption of targeted advertising and personalisation in digital settings has gradually normalised intensive tracking and behavioural segmentation. Without a clear normative consensus, technological possibilities tend to define practice boundaries, risking incremental erosion of privacy and autonomy. This is compounded by commercial pressures to deploy data-driven design strategies that increase engagement and revenue, even when they encroach on user independence.

Technical enforcement challenges are acute in immersive environments due to the difficulty of detecting and evidencing harmful behaviours embedded within complex interaction systems. Enforcement bodies often lack direct access to proprietary algorithms, real-time telemetry, or immersive logging, limiting their ability to prove violations or patterns of harm. Moreover, many

regulatory instruments remain screen-centric, relying on disclosures or consent banners that are poorly translated into 3D, embodied settings. Research on immersive privacy regulation highlights the need for regulatory frameworks to evolve beyond text-based consent and incorporate assessments of real-time and biometric data uses (Sorrentino 2025).

Effective enforcement will likely depend on hybrid models that combine legal oversight with technological and normative interventions. Examples include mandatory algorithmic impact assessments, standardised transparency artefacts for immersive interfaces, and platform-level responsibilities to log and expose decision logic. Additionally, shared industry norms, such as in-world disclosures, susceptibility-aware controls, and friction-by-design mechanisms, can operationalise ethical principles as enforcement tools. Integrating technological capability with evolving normative expectations and regulatory guardrails is vital for ensuring that immersive experiences remain both innovative and respectful of user rights.

Implications for Society

The immersive data revolution

Data collection has undergone a paradigm shift as digital interaction has evolved from two-dimensional (2D) web interfaces to three-dimensional (3D) immersive environments, sometimes referred to as the Metaverse or Extended Reality (XR). As researchers and practitioners, we see that the nature of consumer data has changed from deliberate actions (scrolls and clicks) to involuntary micro-behaviours (Patti *et al.* 2025). These include haptic interactions, gaze tracking, physiological reactions and even somatic data that indicates subconscious preferences. Although these developments present previously unheard-of possibilities for customisation and high-fidelity user experiences, they also pose serious risks (Schwenteck and Pürer 2024). After delving deeply into the practical and social ramifications of this new behavioural frontier, the following sections examine how these practices affect user autonomy, brand trust, and the fundamentals of digital citizenship. In the immersive age trust is more about architectural integrity than it is about data security. When brands use emotion-responsive ad placement or reinforcement-learning-based content sequencing, they frequently operate within a rising opacity that prevents the user from being aware of the influence being applied (Zendle *et al.* 2024). The transparency paradox poses a major obstacle for practitioners. A Sponsored tag is distinct and easy to see in traditional media. Such labels may be fundamentally incompatible with the experience in a 360-degree virtual world, resulting in in-world and invisible advertising (Schwenteck and Pürer 2024). The authenticity collapse that occurs when users eventually learn that their surroundings, right from the design of a virtual store to the actions of a non-player character (NPC), have been altered to take advantage of their biometric information can be fatal for brand equity. A hostile ecosystem is created for platforms when dark patterns in the design decisions lead the users to make decisions they did not intend to become commonplace. The trust of consumers is essential for sustainable engagement, while extensive data exploitation may increase conversion rates in the short term, practitioners must understand that it also creates a trust deficit that, in turn, discourages users from fully utilising these virtual spaces, which ultimately devalues the platform (Hill 2022).

The decline in user autonomy: Immersion vs. conventional marketing

This study makes a compelling case that immersive strategies undermine autonomy much more than conventional 2D advertising. The main causes of this are behavioural tracking, granularity and real-time features. In conventional advertising, the feedback loop is delayed. After viewing an advertisement, a consumer may decide to make a purchase. Brands assess and react in the same psychological moment in virtual environments (Canton 2021). A platform can instantly provide a scarcity nudge or a price reduction at the precise millisecond of vulnerability by using biometric sensors to identify a user's hesitation or pupil dilation. All the immersion strategies leverage biological instincts, unlike traditional advertisements, which appeal to the rational mind (even

when they use emotional triggers). Product placement at the natural resting point of the eye circumvents conscious decision making. According to Maitland and Quinn (2024), the environment turns into a dynamic Skinner box where user behaviour is continuously moulded by reinforcements brought on by granular data. Although a user may feel in control because they are manipulating an avatar, they are frequently guided by a hidden architecture in which each interaction and turn is a data point that steers them toward a successful outcome for the brand.

Long-term effects on digital citizenship

The digital citizen could become a target for economic extraction if these practices become more commonplace. This change will significantly impact society's future. The power asymmetry that exists between individuals and corporations is becoming untenable. Businesses now have better means to take advantage of consumer innocence, especially in vulnerable populations like children or people with internet gaming disorders. Choice and control are fundamental democratic principles; they become a myth when neuro-architectural exploitation becomes the norm.

Normalization of vulnerability

There is a risk of a future where, if manipulation becomes commonplace, there can be an inability to discern commercial intent from the immersive narrative, and children are permanently targeted. Emotionally vulnerable are weaponised by using sentiment analysis which identifies consumers at their lowest points (Nelson *et al.* 2023) (such as grief or stress). Privacy can be obsolete. The collection of semantic data (body language and physiological reactions) results in a permanent record of an individual's subconscious that can be utilised to forecast and regulate future behaviours, rendering privacy obsolete (Mantelero and Esposito 2024).

Implications for Practice

Social policy and corporate strategy must be drastically rethought, considering the integration of behavioural data in virtual spaces. It is imperative that practitioners adopt a human-centric approach instead of a data-maximalist one. Current frameworks, such as the Digital Services Act (DSA) and the GDPR, are frequently screen-centric and fail to consider the subtleties of three-dimensional spaces. It is not advisable for practitioners to wait for regulations to catch up. Instead, they must adopt ethics-by-design, which includes creating novel commercial intent signals appropriate for 3D environments, ensuring they are understandable to users, and providing users with data dashboards in the virtual environment that instantly display the biometric information being collected and how it affects their experience. According to the EU, AI Act systems that integrate behavioural and biometric data ought to be classified as high-risk and subject to stringent impact analyses (Hollensen *et al.* 2023). Prioritising responsible immersion will help brands stand out in a market where consumers are growing more tech-savvy and privacy-conscious.

Social Implications and Policy Needs

The biometric data governance in virtual environments needs to go beyond privacy toward human dignity (Mantelero and Esposito 2024). It is necessary to update regulations to acknowledge somatic data and affective biometrics as particularly sensitive categories that must be fully protected from exploitative manipulation. Vulnerability-aware algorithms are urgently needed. This is particularly true for kids whose ontological vulnerability prevents them from fending off the metaverses intricate marketing loops. The policies must require cooling-off periods and prohibit the use of variable ratio reinforcement schedules (loot boxes and similar mechanisms) that circumvent young users' executive functions (Zendle and Bowden-Jones 2023). There is a need to ensure that the virtual world remains a place of active participation rather than passive consumption to maintain digital citizenship. This calls for a proactive collaborative regulatory strategy in which brands, platforms, and civil society collaborate to incorporate moral principles into virtual experience architecture.

Conclusion

Although the reliability of behavioural data in virtual environments presents amazing commercial benefits to an organisation, there is also a great risk, linked to regulation and ethics. Responsible immersion should be creating experiences that are interesting and customised without being exploitative, and it should be the main practitioner's aim. The objective for society is to make sure that we do not lose our independence and dignity as we are transitioning into these new immersive 3Ds worlds. Our ability to uphold moral values, transparency, and user agency must guide us and keep us ahead of the temporary benefits of behavioural manipulation, which, in turn, will determine the future of the ever-transforming immersive marketplace.

LIST OF DECLARATIONS

Ethics approval and consent to participate

This study did not involve human participants, human data, or human biological material. Therefore, ethical approval and informed consent were not required in accordance with institutional and national research ethics guidelines.

Availability of data and materials

Not applicable.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Authors' contributions

All authors equally contributed, read and approved the final manuscript.

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