# STATE-CHANGE TECHNOLOGY: AN IMMERSION INTENSITY AND PLASTICITY SCALE FOR EMERGING GENERATIVE XR

Daniel Mirante[1]
Carl Hayden Smith[2]

## Abstract

Emerging extended reality (XR) and artificial intelligence (AI) systems constitute a disruptive inflection point in art and media: platforms can iteratively model perceiver responses and dynamically reconfigure perceptual input. We address an upstream educational and governance gap: artists, developers, and curators lack a shared, auditable vocabulary for describing immersive leverage and proportionate safeguards in bioadaptive generative work. We situate generative XR within an 'archaeo-futurist' framework that reads contemporary immersive art alongside ritual architecture, sacred ceremony, and historical spectacle. We then specify two coupled mechanism families—capture potential (supernormal stimulation and prediction-error-rich reinforcement) and plasticity potential (awe-linked accommodation windows)—and argue that dual-use risk rises sharply where systems combine both. We propose an Immersion Intensity & Plasticity Scale (IIPS-8+X) as a platform-neutral diagnostic instrument, provide an arts-facing scoring protocol (Maker vs Audience signatures, range reporting for adaptive works), and demonstrate applicability through a structured artefact case study and worked comparative examples. Finally, we instantiate a governance matrix mapping each IIPS dimension to specific, implementable safeguards for curatorial and production practice.

**Keywords:** *immersion; XR; dual use; governance; hyperhumanism;*

[1] School of Arts and Creative Industries, University of East London. Daniel Mirante is an artist and practice-based doctoral researcher exploring the history, anthropology and art-theory of Immersive Media.
https://orcid.org/0000-0001-8410-5472
London, United Kingdom
danielmiranteartworks@gmail.com

[2] School of Arts and Creative Industries, University of East London. Carl Hayden Smith is Associate Professor of Media at UEL and is the former Head of Research and Director of the Learning Technology Research Centre (LTRC) at the Institute for Creativity & Technology, Ravensbourne University London. Raising over £10 million in research funding, he has led numerous teams on large-scale international projects including Erasmus+, FP7, Horizon 2020, Innovate UK and the XPRIZE. He has 30 years' experience conducting R+D into the application of hybrid technologies for perceptual, cognitive and creative transformation. His research focuses broadly on the relationship between technology and the human condition.
https://orcid.org/0000-0001-8490-4864
London, United Kingdom
csmith7@uel.ac.uk

## 1. Introduction: Immersion as Reality-Shaping Infrastructure

> "The concept of man as mass robot was both an expression of and a powerful motive force in industrialized mass society. It was the basis for behavioural engineering in commercial, economic, political and other advertising and propaganda; the expanding economy of the 'affluent society' could not subsist without such manipulation. Only by manipulating humans ever more into Skinnerian rats, robots buying automata, homeostatically adjusted conformers and opportunists (or, bluntly speaking, into morons and zombies) can this great society follow its progress toward ever increasing gross national product."
>
> - General System Theory (von Bertalanffy, L. 1968. p.206)

This paper adopts an archaeo-futurist and media-archaeological stance (Zielinski, 2006): media histories are layered recurrences of techniques of seeing, hearing, and world-making. Immersion is a technique for shaping consciousness and social order. Across epochs, human societies have invented 'reality-shaping' spaces, experiential and sensorial envelopes, such as ritual temple architectures, shamanic and entheogenic ceremonies, theatre, mass spectacle, and now XR and generative AI. These are expressions of technologies for the transformation of mind and social structure (Turner, 1969; Collins, 2004). The core problem addressed in this paper is 'dual-use': because immersion increases suggestibility and meaning-plasticity (Keltner & Haidt, 2003; Valdesolo & Graham, 2014), the same mechanisms can support healing, prosocial cohesion, and emancipatory meaning-making, or can be instrumentalised for behavioural steering, ideological enclosure, and extractive retention. The dual-use of immersion recurs across its deployment in archaic shamanistic forms, religious institutions, political spectacle, and commercial media (Wang et al., 2024; Bojić et al., 2025). What makes the present moment significant is immersion has acquired new properties: scalability, bio-adaptivity, closed-loop personalisation, and platform distribution under engagement-optimised incentive regimes.

## 2. Dual-Use Structure of Immersion: Ritual Containment and Platform Spectacle

Across radically different historical formations, painted caves, Greek mystery cults, medieval cathedral architecture, Baroque opera, nineteenth-century panoramas, twentieth-century cinema-human societies have built contexts that reorganise attention, perception, and meaning through multi-sensory envelopes, embodied participation, and interpretive framing (Grimes, 2014; Böhme, 2017; Huhtamo, 2013). This cross-cultural and historical scope yields two analytically important consequences. First, it permits a comparative vocabulary for what is recurrent and what is novel in present systems. Second, it grounds the dual-use problematic in structural observation rather than moral reaction.

The paper's central analytic contrast is between two ideal-typical configurations of immersive practice. Ritualised immersion is transformation-oriented, intention-focused, context-sensitive, integration-aware, and consent-based. It operates through what Turner (1969) termed the tripartite structure of separation, liminality, and reintegration-a bounded arc in which altered attention is contained, purposefully directed,

and resolved back into ordinary social time. Platform spectacle immersion is, by contrast, conversion-oriented, asymmetrically authoritative, escapist in design logic, data-extractive, and retention-optimised. Its governing telos is maximal engagement duration, not developmental transformation (Zuboff, 2019; Wang et al., 2024). 'Walled garden' ecosystem gatekeeping concentrates authority over access, parameter control, and interpretive legitimacy in platform operators whose revenue depends on continued engagement. Understanding this incentive architecture is prerequisite to governance design.

## 3. Adaptive Reality Engines: Scalable Immersion and Novelty in Generative XR

Digital XR provides apparatus-level scaling of immersion across six dimensions that were previously constrained by social, material, or geographic limits: sensory occlusion (total substitution of the perceptual field), spatialised embodiment (proprioceptive entrainment), interactive agency (real-time responsiveness to user action), bioadaptive data-driven responsiveness (physiological signal integration), continuous context scripting (persistent narrative control across sessions), and platform distribution at population scale (Bojić et al., 2025).

The most significant emerging capacity is the coupling of supernormal stimulation to closed-loop personalisation. Prior immersive media-cinema, theatre, installation art-delivered a fixed or semi-fixed stimulus envelope to diverse audiences. Generative AI-driven XR can model the individual perceiver and iteratively tune the stimulus environment to that individual's vulnerability profile, predictive priors, and physiological state.

Dystopian science fiction from Neuromancer (Gibson, 1984) and Snow Crash (Stephenson, 1992) to Black Mirror (Brooker, 2011-) and Devs (Garland, 2020) influence the zeitgeist around AI and XR, forming perception of risk (Cave et al., 2023). Media historians have described recurrent episodes of 'media panics' - moral and existential struggles accompanying technological modernity that concentrate anxieties about character formation and social order (Drotner, 1999). A historical precedent lies in mid-century psychedelic research, which was simultaneously entangled with Cold War cybernetic imaginaries of behavioural modification and as toolkits for agency and self-transformation during the 1960s cultural revolution (Williams, 2019). John C. Lilly's (1967) framework of 'programming and metaprogramming the human biocomputer' articulates dual-use tension, with *intention* and *design* as the determining variables.

Conspiracy theories of mass hypnosis and subliminal programming are persistent. The empirical scientific picture is nuanced: laboratory research does not support claims of omnipotent subliminal control but does demonstrate that below-threshold priming can bias preferences (Karremans et al., 2006; Bermeitinger et al., 2009). For immersive systems, the governance implication is significant: personalisation, repetition, and closed-loop adaptation can increase the number of 'matching' moments, scaling exposure to small persistent nudges in ways that produce social conditioning even without any single episode of dramatic manipulation (Drotner, 1999; Kelly, 2024).

## 4. Developmental Vulnerability and Proportionate Safeguards

Although adult susceptibility to coercive behavioural modification is contested in the literature, children and adolescents constitute demonstrably higher-stakes population in immersive contexts because of developmental plasticity, strengthening the case for proportionate safeguards in high-intensity or highly adaptive systems. During adolescence, the neural and psychosocial systems implicated in reward learning, social attunement, and self-concept are highly impressionable (Giedd, 2012; Blakemore & Robbins, 2012). These systems may be entrained by repeated exposure to highly salient, feedback-driven media. Longitudinal neuroimaging work has linked pubertal trajectories of responsivity to positive social feedback with later patterns of 'addiction-like' social media use and-particularly among adolescent girls-elevated depressive symptoms (Nagata et al., 2023; Coyne et al., 2020).

Developmental vulnerability is not uniformly distributed across the population or uniformly constant across developmental phases. Governance frameworks could therefore be calibrated to chronological age and to system intensity, personalisation depth, and bioadaptive coupling-the precise dimensions captured by the IIPS framework introduced in Section 8.

## 5. Supernormal Stimulation and Prediction-Error Learning as Capture Mechanisms

Public discourse on digital is currently awash with the terms 'attention capture' and 'dopamine hijacking.' These phrases register a genuine concern about behavioural extraction and optimisation, but they risk treating sustained attention as intrinsically pathological. Attentional capture is a basic precondition of aesthetic and transformative experience. Long before XR, arts and narrative media-literature, theatre, music, cinema-routinely induced absorption, temporal distortion, and transformative states (Csikszentmihalyi, 1990; Mar & Oatley, 2008). The task is to distinguish forms of attentional holding that expand agency from those engineered for retention, compulsion, and covert steering.

‘Supernormal stimuli’ are exaggerated cues that elicit stronger responses than the natural cues for which those responses evolved; evolutionary psychology formalises this as measurable 'supernormal preference' (Tinbergen, 1951; Goodwin et al., 2015). Neuroimaging provides direct evidence that interactive digital content can engage dopaminergic reward circuitry, capable of becoming disproportionately attractive and time-consuming relative to naturally occurring alternatives (Barrett, 2020). In a landmark PET study, C-labelled raclopride and positron emission tomography scans provided evidence that endogenous dopamine is released in the human striatum during video game play relative to baseline: consistent with endogenous dopamine release during a goal-directed interactive task (Koepp et al., 1998). This finding, replicated by subsequent fMRI work (Kuss & Griffiths, 2012), grounds the attentional capture problem in established reward neuroscience.

Reward systems evolved under ecological constraints: scarcity, slower novelty rates, limited social quantification. Whereas contemporary digital environments can deliver amplified, personalised cues at scale. We speculate that emerging VR, AR, and AI-generated 'infinite novelty' spaces will be capable of

delivering supernormal stimulation along multiple dimensions simultaneously via sensory enclosure, scale and vastness simulation, felt presence, social reward, and personalising content. Additionally, VR reliably increases 'presence' (the subjective sense of 'being there') which amplifies emotional and transformative power (Slater, 2009; Slater & Sanchez-Vives, 2016).

Immersive environments are becoming capable of adapting to the user such that novelty is procedurally endless and personalised (as compute scales). Once the system registers psychological predilections and physiological state-heart rate variability, respiration, electrodermal arousal, then the platform, seeking continued engagement, can optimise the users internal state trajectory toward whatever function it is designed to maximise. Such modalities represent the modification of another person's psychological state, which raises the issue of informed consent.

## 6. Cyberdelic Technologies of State-Change: Awe and Meaning Plasticity

Cyberdelics are immersive technologies designed explicitly to produce altered states of consciousness (ASCs) such as presence, awe, and transcendence, considered hallmarks of the mystical-type states afforded by psychedelics (Hartogsohn, 2023; Griffiths et al., 2006; Johnson et al., 2019). via VR is an effective tool for reliably inducing awe via perceptual vastness simulation (Chirico et al., 2017; van Elk et al., 2019). In the canonical contemporary model, Keltner and Haidt (2003) define awe through two core appraisals: perceived vastness and a need for accommodation: a demand to update mental models when existing schemas are inadequate. I.e., ‘Awe’ makes the interpretive frame unusually consequential by opening an ‘accommodation window’. When accommodation is triggered, attention and interpretation become plastic, and this plasticity constitutes both the therapeutic potential and the governance risk of states of immersion. Research suggests that awe can increase supernatural belief and intentional-pattern perception. Consumer and decision research frames awe as an epistemic shock that shakes confidence in existing mental structures and increases openness to persuasive messages-particularly among individuals high in need for cognitive closure (Griskevicius et al., 2010). Whomever *frames* an awe experience has unusual interpretive leverage over the participant at that moment. The person in an awe state is more receptive to being told what the experience *means*, mediated by effects on uncertainty tolerance (Valdesolo & Graham, 2014). Who authors, who curates, who frames meaning, who owns the data exhaust, who is accountable when state-change occurs?

## 7. Feedback-Loop Personalisation, Sycophancy, and Epistemic Fragmentation

Generative bioadaptive systems iteratively learn the user as they deliver content and then shape the user's epistemic environment. An example is the adaptive listening of the Instagram recommender algorithm, and LLM (Large Language model) chatbot sycophancy - the excessive affirmation of user views (Perez et al., 2022). At the macro-level, recommender algorithms operating across billions of users can

contribute to the familiar left/right political polarisation of filter bubbles (Pariser, 2011; Flaxman et al., 2016). and to micro-segmented, idiosyncratic world-models-bespoke metaphysics, private grievance cosmologies, niche identifications, and highly personalised normative scripts. Collective life depends on shared symbolic grammars: common rites, shared myths, and mutually intelligible 'worlds' within which disagreement remains negotiable (Habermas, 1984; Taylor, 2004). Closed-loop personalisation threatens this substrate by manufacturing bespoke realities at scale: private cosmologies in which meanings are stabilised by machine responsiveness rather than communal contestation. The risk resembles what might be termed a 'Babel condition': polarisation around shared slogans, the collapse of epistemic coordination as personalised systems generate increasingly idiosyncratic vocabularies, priors, and plausibility structures. The result is a growing incommensurability in which interlocutors lack shared frames for adjudicating claims, such that public deliberation degrades into parallel monologues (NIST, 2023).

This reframing is decisive for governance design for emerging generative XR art media because it concerns the structural impact of self-reinforcing personalised algorithms upon the epistemic commons and upon individual cognitive autonomy. Given platform incentive structures in which revenue depends on engagement optimisation, corporate responsibility cannot be treated as a reliable baseline assumption; structural governance mechanisms are recommended (Zuboff, 2019; Gabszewicz et al., 2022).

## 8. The Immersion Intensity & Plasticity Scale (IIPS)

The Immersion Intensity & Plasticity Scale (IIPS) is introduced as a diagnostic framework for describing immersive artworks across media forms including literature, theatre, cinema, installation art, XR/VR, and generative cyberdelics. The 'eight' in the name indicates that the framework scores eight dimensions, expressed as a configuration signature [E, C, Fr, T, Au, R, I, K], optionally supplemented by a somatic catalyst modifier (+X). Borrowing the logic of ASC (altered states of consciousness) intensity scales (Shulgin & Shulgin, 1991; Studerus et al., 2012), IIPS treats rising immersive intensity as increasing the probability of state-change and accommodation: shifts in arousal, attention, self-model, and interpretive updating that shift immersive artefacts from 'content objects' toward set/setting events, where envelope, entrainment, framing, authority, and aftermath conditions become constitutive of meaning.

The framework treats immersion as a multidimensional configuration. The point of formalising these dimensions is to give conceptual handles upon an ambiguous emerging field, enable comparison across historical and contemporary media forms, and generate testable predictions.

**Limitations:** IIPS-8+X is presently theoretical and has not been validated with empirical audience data. Scores should be treated as structured analytic judgements rather than empirical measurements. The framework is designed for iterative refinement through interdisciplinary research, including ethnographic study of immersive contexts, HCI evaluation of interaction and incentive architectures, microphenomenological interviews of lived experience (Petitmengin, 2006), and psychophysiological measurement where appropriate.

## 8.1 Dimensions of the Scale

### 8.1.1 Sensorial Envelopment (E)

*Definition:* How strongly the immersive work encloses and conditions the sensory field: space, sound, light, occlusion, and proxemics.

*Theoretical rationale:* Immersion is anchored in sensorial envelopment: shaped by darkness or light, acoustic resonance, spatial compression, and proxemics so that the participant's ordinary perceptual field is reorganised into a bounded world. Such envelopment may be architectural (cave, temple, theatre, cinema), atmospheric (sound fields, acoustic drones), or technical (head-mounted vr).

*Scale levels:*

- E0: No designed envelope (ordinary environment).
- E1: Single-channel capture (small visual frame; minimal atmospheric design).
- E2: Staged attention field (cinema or theatre with designed lighting and sound; partial atmosphere).
- E3: Multi-sensory environment (installation with spatial audio and projection; constrained space).
- E4: High enclosure and occlusion (VR HMD; strong place illusion; sensory substitution).
- E5: Pervasive/continuous envelope (always-on AR; ambient computing; persistently mediated environment).

### 8.1.2 Coupling and Entrainment (C)

*Definition:* How strongly bodies are recruited via interaction, synchrony, or entrainment, whether in solo or collective configurations.

*Theoretical rationale:* Immersion intensifies through coupling, directed attention, and entrainment. Whether through collective synchrony (chanting, drumming, choreography, shared gaze) or solitary pacing (walking routes, controlled stillness, repetitive gesture), entrainment stabilises attention, reduces discursive noise, and produces a coordinated attentional field.

*Scale levels:*

- C0: No coupling beyond basic viewing (passive reception).
- C1: Minimal coupling (page-turning, track choice; weak bodily recruitment).
- C2: Participatory coupling (singing, dancing, responsive theatre; collective attention cues).
- C3: Interactive navigation coupling (walkthrough installation; movement meaningfully changes experience).
- C4: Embodied coupling (tracked body and hands; haptics; co-presence; strong sensorimotor loop).

• C5: Bioadaptive or collective entrainment system (breath/HRV biofeedback; AI adapts in real time; explicit synchrony protocols).

### 8.1.3 Framing and Interpretive Load (Fr)

*Definition:* How strongly the experience guides, suggests, or imposes meaning through myth, doctrine, voiceover, UI scripts, or adaptive prompts.

*Theoretical rationale:* Immersive environments establish what kind of reality is being entered through cosmology, myth, institutional narratives, or UI scripts and algorithmic prompting. Framing matters because awe and state-change are meaning-plastic windows. In archaic forms, interpretive authority was carried by institutions or charismatic guides; in contemporary systems, it can be carried by curatorial texts, facilitation practices, or adaptive recommender logics.

*Scale levels:*

• Fr0: Open field; minimal framing; interpretation is largely self-authored.
• Fr1: Light authorship; plural readings structurally supported.
• Fr2: Strong narrative guidance (clear storyline, voiceover, didactic cues).
• Fr3: Institutional framing (museum, education, clinic; authoritative context shapes interpretation).
• Fr4: Ritual or charismatic framing (facilitator administers experience; high suggestion potential).
• Fr5: Personalised or algorithmic framing (recommender logic; dynamic prompts; meaning cues adapt to user data).

### 8.1.4 Threshold Design and Boundedness (T)

*Definition:* Whether the experience has a rite-like arc (separation → liminality → reintegration), including titration and structured closure.

*Theoretical rationale:* Immersive environments often employ threshold structures - a temporal grammar of separation, liminality, and return (Turner, 1969; van Gennep, 1909/1960). Many ceremonial forms include explicit openings and closings because the 'complete arc' returns participants to ordinary life with a residue of reorganisation.

*Scale levels:*

• T0: No threshold; continuous feed/loop; no clear entry or exit.
• T1: Weak threshold (start/stop exists but not felt; easy drift; no meaningful closure).
• T2: Clear beginning and end (standard performance runtime; basic closure cue).
• T3: Designed threshold arc (entry gate and pacing; liminal middle section; deliberate return).
• T4: Titrated intensity (waves of arousal; structured decompression; 'ritual completeness' cues).
• T5: Explicit ceremonial architecture (intention-setting, containment rules, structured closure, and reintegration).

### 8.1.5 Authority Architecture (Au)

*Definition:* Who controls access, parameters, and interpretation, and how asymmetric and opaque that control is.

*Theoretical rationale:* Immersive systems involve an authority architecture. Someone or some automated system controls access, parameters and captured data. Authority conditions what participants can question, what they can refuse, and how meaning is stabilised. In immersive culture, authority may be institutional, charismatic, or infrastructural.

*Scale levels:*

- Au0: Participant-led; no central authority beyond the artefact.
- Au1: Author-led (artist/creator control) with visible, bounded authorship.
- Au2: Curatorial/venue authority (institution controls framing and access; mostly transparent).
- Au3: Facilitator authority (guide administers experience; power asymmetry legible).
- Au4: Platform authority (ecosystem gatekeeping; content rules; monetisation power).
- Au5: Opaque behavioural authority (black-box optimisation; hyperpersonalisation; covert steering).

### 8.1.6 Reintegration versus Retention Dynamics (R)

*Definition:* Aftermath design: degree to which the system provides integration supports versus engineered dependency and continuation loops.

*Theoretical rationale:* This dimension distinguishes immersive systems structured for bounded, assimilable state-change from those structured for prolonged attentional capture. Reintegration-oriented systems provide clear closure, decompression, and structured reflection allowing the experience to resolve into ordinary cognitive and biographical context. Retention-oriented systems minimise exit and promote recursive engagement through mechanisms such as infinite scroll, autoplay, variable reinforcement scheduling, and adaptive personalisation (Alter, 2017; Zuboff, 2019).

*Scale levels:*

- R0: Retention loop dominant (endless feed; no exit affordance; compulsion engineered).
- R1: Weak release (experience ends but nudges continuation; minimal decompression).
- R2: Neutral release (clean ending; little to support integration).
- R3: Soft integration (decompression space; reflection cue; gentle 'return' design).
- R4: Structured integration (guided reflection; aftercare resources; community witnessing).
- R5: Full reintegration ecology (preparation and integration protocols; follow-up pathways; accountability structures).

### 8.1.7 Interiorisation and Co-generation (I)

*Definition:* How much the work opens inner generativity and co-generation versus saturating attention with externally supplied salience.

*Theoretical rationale:* When immersion attenuates discursive self-talk and opens an interior depth-horizon, participants actively elaborate experience through associative, affective, and reflective processes-supporting integration and preserving autonomy. When immersion instead saturates attention with externally supplied salience, it binds cognition to stimulus contingencies, increasing susceptibility to behavioural steering.

*Scale levels:*

- I0: External stickiness dominant; little interior space for reflection.
- I1: Mild association; experience is mostly stimulus-following.
- I2: Intermittent interiorisation (gaps allow reflection but are not central to design).
- I3: Designed inward invitations (pauses, ambiguity, contemplative pacing).
- I4: Strong co-generation (imagination must complete the world; inner imagery is primary).
- I5: Sustained interior practice (work functions as a contemplative instrument; interior depth is the primary 'scene').

### 8.1.8 Life-Coupling and Biographical Aftercare (K)

*Definition:* Likelihood that the experience persists in lived biographical time, becoming a durable reference point that reorganises values, projects, and practice.

*Theoretical rationale:* K evaluates whether an experience actually attaches to the participant's longer-term life, irrespective of medium. A 'low-tech' encounter-reading a canonical text, attending a memorable ceremony-can score high on K when it becomes a durable interpretive resource, while a high-intensity immersive system can score low if it remains disposable entertainment. High K is supported by social scaffolding, discussion, community witnessing, and structured integration practices (Griffiths et al., 2006).

*Scale levels:*

- K0: Disposable; no experiential afterlife.
- K1: Pleasant; quickly forgotten.
- K2: Memorable; occasional recall.
- K3: Becomes a reference point; informs conversations and choices.
- K4: Reorganises values and projects; achieves 'life text' status.
- K5: Sustained practice ecology (rereading, study, community, ritual repetition; durable identity coupling).

### 8.1.9 Somatic Catalyst (Modifier X)

*Definition:* The degree to which an immersive work deliberately modulates physiology-arousal, respiration, autonomic tone, sensory gating-as part of its state-change apparatus.

*Theoretical rationale:* Because physiological state influences attention, affect, and meaning plasticity, somatic modulation can increase immersive leverage. This modifier is treated separately from the core dimensions because it represents a layer of state-change amplification rather than immersion structure per se, and indicates increased capacity for both transformative integration and behavioural capture. Modalities include breathwork, movement, sensory deprivation, thermal stress, biofeedback, and pharmacology.

*Scale levels:*

- X0: No deliberate physiological modulation beyond ordinary sitting or standing.
- X1: Light cues (brief breath reminders, posture cues, slow pacing) without sustained technique.
- X2: Sustained entrainment and mild modulation (extended rhythmic or respiratory shaping; continuous drone; repetitive movement likely to shift autonomic state).
- X3: Structured technique and moderate modulation (formal breathwork sequences; guided somatic scans; deliberate thermal contrast; darkness or deprivation used intentionally).
- X4: Closed-loop and high-leverage modulation (biofeedback driving visuals, audio, or haptics; adaptive entrainment tuned to breath or HRV; non-pharmacological stressors inducing altered-state adjacency).
- X5: Pharmacological and/or extreme modulation (psychoactive agents as part of the ceremonial container; extreme physiological stressors). Implies the highest plasticity leverage and the strongest requirements for thresholding, authority clarity, and reintegration support.

## 8.10 Methods: scoring IIPS in emerging "cyberdelic" generative VR (arts-facing)

IIPS is suggested as a structured description tool rather than a lab instrument: a work is scored as a configuration signature [E, C, Fr, T, Au, R, I, K] + X, where each dimension is rated 0–5 as an analytic judgement grounded in observable features and audience experience. Scoring is designed to be feasible within arts practice, so the primary scorers can be the creator/team (Maker score) plus a small test group of 3–8 participants (Audience score). The Maker score documents what was built and intended (including any adaptive logic); the Audience score captures what the work actually does in lived experience.

For each dimension, scorers record (i) a 0–5 rating and (ii) where the work is adaptive, scorers add one plain-language line describing what adapts (visuals/sound/pacing/narrative), what it uses (choices/gaze/voice/breath/HRV), and the apparent aim (e.g., intensity, calm, insight, continued engagement).

Inter-rater logic: Scores are first produced independently (Maker and each participant). Agreement is treated as within ±1 point per dimension; divergences of ≥2 points are flagged and annotated with a single-sentence explanation. Three divergence patterns are handled explicitly: (1) personalisation variance (different participants receive materially different versions), in which case the Audience score is reported as a range rather than a single value; (2) intent–effect gaps (Maker scores differ from Audience scores), treated as actionable design information about what did not land in practice; and (3) opacity gaps (participants feel steered despite Maker claims of transparency), treated as a governance/aesthetics issue requiring improved legibility (clearer disclosure of what adapts, why, and how to exit). Reporting uses either a single signature (stable work), two signatures (Maker vs Audience), or ranges (conditional/adaptive work), alongside brief anchor notes so that the score remains auditable and meaningful within curatorial and artistic discourse.

### 8.10.1 Inter-Rater Feasibility and Validation Pathway

Reviewers noted that IIPS would benefit from evidence of reliability or inter-rater consistency. Because the present paper is an instrument proposal situated in arts and media practice, the appropriate near-term empirical step is a feasibility and agreement pilot rather than a causal outcome experiment.

Pilot design (recommended for camera-ready / follow-on study). Select a small corpus of 8–12 immersive artefacts spanning media types (e.g., novel excerpt reading session; cinema clip; installation documentation; VR experience; AR prototype; generative/bioadaptive demo). For each artefact, collect: (i) a Maker score (creator/team), and (ii) Audience scores from 6–10 participants who complete the experience episode. Scores are produced independently using the IIPS anchors and a one-sentence justification per dimension.

Agreement metrics. Report (a) mean absolute deviation (MAD) between raters per dimension, (b) percent agreement within ±1 point, and (c) frequency of ≥2-point divergences. Where the artefact is adaptive, report ranges (Audience score intervals) rather than forcing a single point estimate, as specified in Section 8.10.

Refinement loop. Use divergence clusters to refine anchors (e.g., Fr3–Fr5 boundary; Au4 vs Au5). The goal is not perfect agreement but stable, auditable use that discriminates configurations in a way that supports governance decisions.

### 8.11 IIPS Evaluation & Recommended Safeguards

The table below shows (i) the dual-use vulnerability that tends to emerge when that dimension scores high, and (ii) corresponding safeguards that are specific, implementable, and scalable across contexts such as galleries, museum installations, clinical/therapeutic prototypes, and commercial platform environments.

| Dimension | Dual-Use Risk at High Intensity | Specific & Scalable Safeguards |
|---|---|---|
| **E - Envelopment** | High enclosure intensifies absorption and awe, reduces counter-cues, and increases vulnerability under strong interpretive framing. Sensory | Intensity labelling: always-available hard exit and pause; environmental awareness cues; comfort and safety protocols; full disclosure of sensory manipulation modalities used. |

| Dimension | Dual-Use Risk at High Intensity | Specific & Scalable Safeguards |
|---|---|---|
| | occlusion removes ordinary reality-testing cues. | |
| **C - Coupling & Entrainment** | Bioadaptive state-steering via reinforcement loops; synchrony amplifies collective affect and interpretive capture; covert haptic manipulation. Minors are at heightened risk. | Explicit consent for adaptive coupling; disable covert haptic interventions; log adaptive interventions and make them auditable; strict caps for minors; human override and 'neutral mode' option. |
| **Fr - Framing & Interpretive Load** | Meaning inscription during plasticity windows; personalised prompts escalating suggestibility; ideological anchoring under awe-induced accommodation windows. | Frame transparency; contestability through alternative frames and reflection prompts; prohibition of deceptive persuasion and dark patterns; disclosure of persuasive intent and commercial interests. |
| **T - Thresholding & Boundedness** | Unbounded feeds create permanent liminality; escalation without closure; retention dynamics replace reintegration. Architecturally resembles an inverted ritual structure. | Default-bounded session arcs; decompression and cooldown periods; explicit stopping points; session budgeting tools; youth protections; 'return-to-life' cues and off-ramp design. |
| **Au - Authority Architecture** | Opaque optimisation authority enables conversion at scale; asymmetric power blocks refusal and critique; gatekeeping forecloses alternative framings. | Authority legibility ('who controls what and why'); independent audit rights; recommender objective transparency; facilitator credentialing requirements for high-X contexts; accessible grievance channels. |
| **R - Reintegration vs. Retention** | Dependency loops; compulsive return triggers; state-dependence; escalation by design default. Engagement-optimised systems structurally disincentivise integration. | Integration supports including journalling prompts and aftercare resources; friction against compulsive re-entry; prohibition of endless autoplay defaults in high-intensity contexts; monitoring for adverse engagement signals. |

| Dimension | Dual-Use Risk at High Intensity | Specific & Scalable Safeguards |
|---|---|---|
| **I - Interiorisation / Co-generation** | External salience saturation reduces reflective distance and increases steerability; suppresses metacognitive distancing; forecloses autonomous meaning-making. | Design for interiorisation: pauses, ambiguity, silence; opt-out from incessant adaptive prompts; contemplative affordances; 'no-prompt' mode in generative systems; space for user-directed exploration. |
| **K - Life-Coupling & Aftercare** | High biographical binding under rigid authority enables coercive identity coupling, exclusivity claims, interpretive monopoly, and social dependency-especially under repeated high-intensity exposures. | Community codes of conduct; transparency on money and power relationships; opt-out and exit norms; independent safeguarding roles; limits on exclusivity and totalising claims; encouragement of external ties and plural interpretive resources. |
| **X - Somatic Catalyst** | Physiological steering amplifies plasticity windows; adverse psychophysiological events; suggestion confounds; power asymmetries in dosing and intensity; biosignal data misuse. | Clinical-grade informed consent and screening where applicable; contraindication protocols; trained and credentialed facilitation; emergency response protocols; strict biosignal data minimisation; structural separation of care aims from monetisation incentives. |

*Table 1. IIPS Evaluation Table. Note: Future research will address inter-rater reliability and convergent validity of IIPS coding.*

### 8.12 Comparative Examples

To illustrate the scale's application and to demonstrate that low-apparatus intensity can yield high long-term transformative power, three contrasting examples are presented with hypothetical IIPS signatures and interpretive notes.

**Example 1: Julius Horsthuis 360° Fractal VR Worlds with Rival Consoles Soundtrack**

*Signature:* [E4, C2, Fr1, T2, Au2, R2, I3, K2] + X1

High sensorial enclosure is achieved through VR occlusion and full audiovisual immersion (E4); coupling is modest, limited to head orientation and affective entrainment via the soundtrack (C2);

framing is light and aesthetically rather than doctrinally directed, supporting plural interpretation (Fr1); temporal boundedness exists but thresholding beyond 'press play' is minimal (T2); authorial and curatorial authority is legible and non-adaptive (Au2); reintegration is neutral-the experience ends cleanly but with little built-in integration support (R2); inward opening is plausible through awe and reverie but not structurally required (I3); the experience tends to be memorable but not life-binding without further intentional practice (K2); mild somatic modulation occurs through sound and enclosure that can shift autonomic tone, but without explicit technique (X1).

Interpretive note: High envelopment can produce strong aesthetic absorption and genuine awe, but durable transformative impact depends on whether the encounter is embedded within a stronger threshold arc and integration ecology. This example illustrates a common configuration in commercial VR: high E, low T and R. The signature suggests significant untapped developmental potential that could be activated through enhanced threshold design and integration affordances.

**Example 2: Reading Homer's Odyssey (Undisturbed Session)**

*Signature:* [E0, C1, Fr3, T3, Au1, R3, I5, K4] + X0

Sensorial envelopment is minimal (E0–1); bodily coupling is restricted to page-turning and postural adjustment (C1); framing is strong but historically legible and culturally canonical (Fr3); a clear temporal arc is present through narrative progression (T3); authorial authority is bounded and non-adaptive (Au1); integration is soft but present (R3); interior co-generation is maximal-the reader must actively construct imagery, felt sense, and emotional engagement (I5); biographical binding is high among engaged readers for whom the text becomes a life reference (K4); no somatic modulation is present (X0).

Interpretive note: This example demonstrates the fundamental insight that low apparatus intensity can yield high long-term plasticity when interior co-generation and life-coupling are strong. The Odyssey's transformative power derives not from sensory enclosure but from the depth of meaning-space it opens, and from its embeddedness in cultural structures of interpretation and re-reading.

**Example 3: Santo Daime Ceremony (≈8 hours, syncretic religious ceremony with ayahuasca)**

*Signature:* [E4, C5, Fr4, T5, Au4, R4, I4, K4] + X5

The ceremony maintains a strong environmental envelope through music, ritual space, uniform dress, and prolonged duration (E4); coupling reaches maximal intensity through sustained collective rhythm, choreographed participation, and entrainment (C5); framing is high with doctrinal and ritual meaning scripts and hymn-text cosmology (Fr4); explicit ceremonial thresholding is designed throughout, including preparation, opening, sustained liminality, closure, and return protocols (T5); strong institutional and ritual authority is present by design, with clear role hierarchies and interpretive legitimacy structures (Au4); structured reintegration is typically present through communal closure and interpretive containment, though variable across communities (R4); interiorisation is intense through visionary states, affective depth, and self-model perturbation (I4); biographical binding is high through community, repetition, narrative anchoring, and identity coupling (K4); pharmacological catalyst is at maximum level (X5).

Interpretive note: This is a high-leverage state-change architecture. The same features that enable healing and communitas also increase susceptibility to interpretive capture when authority becomes rigid or opaque-a documented risk in high-control religious movements. The IIPS signature clarifies why governance of therapeutic psychedelic ceremonies requires attention to authority architecture (Au) and reintegration design (R) at least as much as to pharmacological safety (X).

## 9. Governance as Curatorial and Production Practice

The EU AI Act's prohibited practices include AI systems that use subliminal techniques or purposefully manipulative and deceptive methods that materially distort behaviour by impairing informed decision-making, especially where significant harm is likely (European Parliament, 2024, Art. 5). IIPS can help operationalise what 'distortion' looks like in immersive contexts, providing regulators and auditors with a structured vocabulary that is contestable and empirically refinable.

Translating the EU AI Act's prohibitions into arts-operational terms requires reframing governance as a dimension of curatorial care and production ethics. The following norms address the specific conditions under which galleries, festivals, and ticketed events present bioadaptive or personalised immersive work. Whilst such governance recommendations may seem overly precautionary for the everyday pleasure of art, they are made on the basis of the unique and distinctive power that rapidly emerging generative bio-sensitive deep immersive systems have the capacity to wield upon the experiencer.

Disclosure norms: Any work that deploys real-time algorithmic responsiveness to audience behaviour, including movement data, biometric inference, or interaction logging, should state this plainly in wall-label or programme text prior to entry. The disclosure need not be technically exhaustive, but must be sufficient for an ordinarily attentive visitor to understand that the work is actively adapting to them. For bioadaptive work (C5, X3+), a pre-briefing conversation with a facilitator should be standard rather than optional. Works that use AI-generated personalised framing (Fr5) should disclose the existence and the general logic of that personalisation.

Meaningful consent: Immersive art frequently operates through deliberate ambiguity, suspension of ordinary interpretive frameworks, and the partial dissolution of self–world boundaries; these are constitutive features of the form. Consent frameworks can be designed to accommodate this aesthetic reality rather than to eliminate it. A workable standard: consent is meaningful if participants are informed before they enter the work's immersive threshold that (a) the environment will adapt to them in specifiable ways, (b) they may pause or exit at any point without social penalty, and (c) data generated by their participation is used or retained as described in a plain-language data statement.

Biosignal data minimisation: For works that infer or record physiological state (heart rate, galvanic skin response, respiration, eye tracking), the minimum viable data minimisation stance compatible with the art is as follows: collect only the signal needed for real-time adaptation; do not persist raw biosignal data beyond the session; do not share or sell biosignal-derived inferences to third parties; destroy session logs at defined intervals unless the participant has actively consented to their retention for stated research

purposes. These requirements are consistent with EU AI Act Article 5 prohibitions on subliminal techniques and with GDPR special-category data protections for biometric data.

Aftercare and institutional accountability: For works scoring IIPS 15+ or X3+, the presenting institution should have a named responsible person (a safeguarding role, not necessarily a clinician) who is available to participants following the experience; an aftercare pathway that participants are informed of before entry; and a review protocol triggered by any participant report of adverse psychological response. These are the curatorial equivalent of a stage manager's first-aid duty.

## 10. Hyperhumanist Governance: Developmental Configuration as Normative Default

Hyperhumanism is a post-transhuman developmental stance in which technologies are treated as contextual scaffolds for cultivating human capacities, preserving agency and cognitive liberty (Smith, N., Lundström F. (2024, cf. Floridi, 2014; Stiegler, 2018). Hyperhumanism functions as a normative counterweight to both salvatory transhumanist hype and techno-moral panic.

If immersive systems are prediction-error-rich learning engines, they can be configured either as capture loops (training dependency) or as practice loops (training capacity). The hyperhumanist argument is that this configuration choice is the decisive ethical variable-and that it is technically achievable. In a hyperhumanist-informed design, the system mechanics are deployed to maintaining enough novelty to drive learning without inducing dysregulation, dissociation, or dependency-a 'zone of proximal development' (Vygotsky, 1978) for beneficial affective and contemplative cultivation.

Such an orientation suggests five developmental design principles for immersive AI and XR systems, belonging to an area referred to as 'context engineering'. First, attentional sovereignty: training voluntary control of attention, using prediction error to teach noticing and reorienting rather than compulsive pursuit. Second, perceptual and aesthetic intelligence: training finer discrimination of pattern, ambiguity, and salience. Third, somatic literacy: training interoceptive awareness and autonomic self-regulation, so that biofeedback becomes error signal for the user. Fourth, epistemic agility: training the capacity to update beliefs under uncertainty without collapse into either delusion or dogma. Fifth, relational intelligence: training empathy and coordination through social interaction, fostering attunement and pro-sociality.

## 11. Conclusion

This paper has framed emerging generative XR and AI immersive systems as state-change infrastructure: technologies capable of modulating attentional capture, affect, learning, identity formation, and value systems by controlling the conditions of perception at individual and population scale. An archaeo-futurist anthropological framing has shown that the dual-use potential is a historically recurrent

constitutive feature of immersive state-change environments. The novel dimensions of present systems are the coupling of supernormal stimulation to closed-loop personalisation, bioadaptive physiological targeting, and engagement-optimised platform incentive structures operating at societal scale.

The IIPS-8+X framework provides a speculative-yet-informed, structured, multidimensional diagnostic for approximating immersive leverage across media types and historical periods, yielding a risk grammar that is contestable, auditable, and empirically refinable.

The capacity of these emerging technologies can orientate toward prosocial and ecological outcomes by reliably eliciting awe and perspectival expansion otherwise contingent on rare, high-barrier contexts such as pilgrimage, traditional ceremonial practice, and extraordinary natural environments. The decisive variable is not technical capability but the configuration of incentives, authority architecture, and reintegration design. Future research priorities include empirical validation of IIPS coding reliability and convergent validity; ethnographic studies of immersive contexts scoring high on multiple dimensions; HCI evaluation of dark-pattern identification using IIPS criteria; longitudinal studies of the K (Life-coupling) dimension. This research will aim to assist emerging immersive XR and AI systems to express their potential as developmental-capacity-oriented, integration-supportive, and directed toward what the hyperhumanist orientation may call cognitive liberty and human flourishing.

**References**


ALTER, Adam. Irresistible: the rise of addictive technology and the business of keeping us hooked. New York: Penguin Press, 2017.

BARRETT, H. Clark. Supernormal stimuli in the media. In: WORKMAN, Lance A.; READER, Will; LAHAM, Simon (Org.). The Cambridge handbook of evolutionary perspectives on human behavior. Cambridge: Cambridge University Press, 2020. p. 374–384.

BERMEITINGER, Bernhard; GOELZ, René; JOHR, Nadine; NEUMANN, Melanie; ECKER, Ullrich K. H.; DOERR, Robert. The hidden persuaders break into the tired brain. Journal of Experimental Social Psychology, [online], v. 45, n. 2, p. 320–326, 2009. ISSN 0022-1031. Retrieved from: https://doi.org/10.1016/j.jesp.2008.10.001. Accessed on: 22 Feb. 2026.

BIELO, James S. Ark encounter: the making of a creationist theme park. New York: New York University Press, 2018.

BLAKEMORE, Sarah-Jayne; ROBBINS, Trevor W. Decision-making in the adolescent brain. Nature Neuroscience, [online], v. 15, n. 9, p. 1184–1191, 2012. ISSN 1097-6256. Retrieved from: https://doi.org/10.1038/nn.3177. Accessed on: 22 Feb. 2026.

BÖHME, Gernot. Critique of aesthetic capitalism. Milan; Udine: Mimesis International, 2017.

BOJIĆ, Lidija; BULATOVIĆ, Ana; NEDELJKOVIĆ, Jovan; PETRONIJEVIĆ, Milica. The dual impact of virtual reality: addictive potential and therapeutic applications of immersive media in the metaverse. Information, Communication & Society, [online], 2025. Preprint arXiv:2401.03461. Retrieved from: https://arxiv.org/abs/2401.03461. Accessed on: 22 Feb. 2026.

CAVE, Stephen; DIHAL, Kanta; DILLON, Sarah (Org.). AI narratives: a history of imaginative thinking about intelligent machines. Oxford: Oxford University Press, 2023.

CHIRICO, Alice; CIPRESSO, Pietro; YADEN, David B.; BIANCO, Federico; RIVA, Giuseppe; GAGGIOLI, Andrea; BARTOLI, Giulio. Effectiveness of immersive videos in inducing awe: an experimental study. Scientific Reports, [online], v. 7, n. 1, art. 1218, 2017. ISSN 2045-2322. Retrieved from: https://doi.org/10.1038/s41598-017-01242-0. Accessed on: 22 Feb. 2026.

COLLINS, Randall. Interaction ritual chains. Princeton: Princeton University Press, 2004.

COYNE, Sarah M.; ROGERS, Alexandria A.; ZURCHER, J. D.; STOCKDALE, Laura; BOOTH, Madison. Does time spent using social media impact mental health? An eight year longitudinal study. Computers in Human Behavior, [online], v. 104, art. 106160, 2020. ISSN 0747-5632. Retrieved from: https://www.sciencedirect.com/journal/computers-in-human-behavior. Accessed on: 22 Feb. 2026.

CSIKSZENTMIHALYI, Mihaly. Flow: the psychology of optimal experience. New York: Harper & Row, 1990.

DROTNER, Kirsten. Dangerous media? Panic discourses and dilemmas of modernity. Paedagogica Historica, [online], v. 35, n. 3, p. 593–619, 1999. ISSN 0030-9230. Retrieved from: https://doi.org/10.1080/0030923990350303. Accessed on: 22 Feb. 2026.

DYCK, Erika. Psychedelic psychiatry: LSD from clinic to campus. Baltimore: Johns Hopkins University Press, 2008.

EUROPEAN PARLIAMENT. Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act). Official Journal of the European Union, [online], 2024. Retrieved from: https://eur-lex.europa.eu/eli/reg/2024/1689/oj. Accessed on: 22 Feb. 2026.

FLAXMAN, Seth; GOEL, Sharad; RAO, Justin M. Filter bubbles, echo chambers, and online news consumption. Public Opinion Quarterly, [online], v. 80, n. S1, p. 298–320, 2016. ISSN 0033-362X.

FLORIDI, Luciano. The fourth revolution: how the infosphere is reshaping human reality. Oxford: Oxford University Press, 2014.

GABSZEWICZ, Jean J.; RESENDE, José; SONNAC, Nathalie. Media economics and the digital economy. Cambridge: Cambridge University Press, 2022.

GEERTZ, Clifford. The interpretation of cultures. New York: Basic Books, 1973.

GIEDD, Jay N. The digital revolution and adolescent brain evolution. Journal of Adolescent Health, [online], v. 51, n. 2, p. 101–105, 2012. ISSN 1054-139X. Retrieved from: https://doi.org/10.1016/j.jadohealth.2012.06.002. Accessed on: 22 Feb. 2026.

GIBSON, William. Neuromancer. New York: Ace Books, 1984.

GOODWIN, Benjamin C.; BROWNE, Matthew; ROCKLOFF, Matthew. Measuring preference for supernormal over natural rewards: a two-dimensional anticipatory pleasure scale. Evolutionary Psychology, [online], v. 13, n. 4, 2015. ISSN 1474-7049. Retrieved from: https://doi.org/10.1177/1474704915613914. Accessed on: 22 Feb. 2026.

GRIFFITHS, Roland R.; RICHARDS, William A.; MCCANN, Una; JESSE, Robert. Psilocybin can occasion mystical-type experiences having substantial and sustained personal meaning and spiritual significance. Psychopharmacology, [online], v. 187, n. 3, p. 268–283, 2006. ISSN 0033-3158.

GRIMES, Ronald L. The craft of ritual studies. Oxford: Oxford University Press, 2014.

GRISKEVICIUS, Vladas; SHIOTA, Michelle N.; NEUFELD, Stephanie L. Influence of different positive emotions on persuasion processing: a functional evolutionary approach. Emotion, [online], v. 10, n. 2, p. 190–206, 2010. ISSN 1528-3542.

HABERMAS, Jürgen. The theory of communicative action: v. 1. Reason and the rationalization of society. Translated by T. McCarthy. Boston: Beacon Press, 1984. Original work published 1981.

HAIDT, Jonathan. The happiness hypothesis: finding modern truth in ancient wisdom. New York: Basic Books, 2006.

HARTOGSOHN, Ido. Cyberdelics in context: on the prospects and challenges of mind-manifesting technologies. Frontiers in Psychology, [online], v. 14, art. 1077719, 2023. ISSN 1664-1078. Retrieved from: https://doi.org/10.3389/fpsyg.2023.1077719. Accessed on: 22 Feb. 2026.

HUHTAMO, Erkki. Illusions in motion: media archaeology of the moving panorama and related spectacles. Cambridge, MA: MIT Press, 2013.

KARREMANS, Johan C.; STROEBE, Wolfgang; CLAUS, Jasper. Beyond Vicary's fantasies: the impact of subliminal priming and brand choice. Journal of Experimental Social Psychology, [online], v. 42, n. 6, p. 792–798, 2006. ISSN 0022-1031.

KELTNER, Dacher; HAIDT, Jonathan. Approaching awe, a moral, spiritual, and aesthetic emotion. Cognition and Emotion, [online], v. 17, n. 2, p. 297–314, 2003. ISSN 0269-9931.

KOEPP, M. J.; GUNN, R. N.; LAWRENCE, A. D.; CUNNINGHAM, V. J.; DAGHER, A.; JONES, T.; BROOKS, D. J.; BENCH, C. J.; GRASBY, P. M. Evidence for striatal dopamine release during a video game. Nature, [online], v. 393, n. 6682, p. 266–268, 1998. ISSN 0028-0836. Retrieved from: https://doi.org/10.1038/30498. Accessed on: 22 Feb. 2026.

KUSS, Daria J.; GRIFFITHS, Mark D. Internet gaming addiction: a systematic review of empirical research. International Journal of Mental Health and Addiction, [online], v. 10, n. 2, p. 278–296, 2012. ISSN 1557-1874.

LILLY, John C. Programming and metaprogramming in the human biocomputer. Miami: Communication Research Institute, 1967.

LUHRMANN, Tanya M.; NUSBAUM, Howard; THISTED, Ronald. The absorption hypothesis: learning to hear God in evangelical Christianity. American Anthropologist, [online], v. 112, n. 1, p. 66–78, 2010. ISSN 0002-7294.

LUTZ, Antoine; SLAGTER, Heleen A.; DUNNE, John D.; DAVIDSON, Richard J. Attention regulation and monitoring in meditation. Trends in Cognitive Sciences, [online], v. 12, n. 4, p. 163–169, 2008. ISSN 1364-6613.

MAR, Raymond A.; OATLEY, Keith. The function of fiction is the abstraction and simulation of social experience. Perspectives on Psychological Science, [online], v. 3, n. 3, p. 173–192, 2008. ISSN 1745-6916.

NAGATA, Jason M.; CORTEZ, Christine A.; CATTLE, Caitlin J.; GANSON, K. T.; IYER, P.; BIBBINS-DOMINGO, Kirsten; BAKER, Fiona C. Screen time use among US adolescents during the COVID-19 pandemic. JAMA Pediatrics, [online], v. 176, n. 1, p. 94–96, 2022. ISSN 2168-6203.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY. AI risk management framework (AI RMF 1.0). Gaithersburg, MD: U.S. Department of Commerce, 2023. Retrieved from: https://doi.org/10.6028/NIST.AI.100-1. Accessed on: 22 Feb. 2026.

PARISER, Eli. The filter bubble: what the internet is hiding from you. New York: Penguin Press, 2011.

PEREZ, Ethan; HUANG, S.; SONG, F.; CAI, T.; RING, R.; ASLANIDES, J.; GLAESE, A.; MCALEESE, N.; IRVING, G. Red teaming language models with language models. arXiv, [online], 2022. Retrieved from: https://arxiv.org/abs/2202.03286. Accessed on: 22 Feb. 2026.

PETITMENGIN, Claire. Describing one's subjective experience in the second person: an interview method for the science of consciousness. Phenomenology and the Cognitive Sciences, [online], v. 5, n. 3–4, p. 229–269, 2006. ISSN 1568-7759.

SLATER, Mel. Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. Philosophical Transactions of the Royal Society B, [online], v. 364, n. 1535, p. 3549–3557, 2009. ISSN 0962-8436.

SLATER, Mel; SANCHEZ-VIVES, Maria V. Enhancing our lives with immersive virtual reality. Frontiers in Robotics and AI, [online], v. 3, art. 74, 2016. ISSN 2296-9144.

SMITH, N.; LUNDSTRÖM, F. Hyperhumanism in the age of generative AI: the impact on human creativity and identity. In: EVA LONDON, 2024. Proceedings… London: BCS, 2024. Retrieved from: https://doi.org/10.14236/ewic/EVA2024.27. Accessed on: 22 Feb. 2026.

SRNICEK, Nick. Platform capitalism. Cambridge: Polity Press, 2017.

STEPHENSON, Neal. Snow crash. New York: Bantam Books, 1992.

STIEGLER, Bernard. The neganthropocene. Edited and translated by Daniel Ross. London: Open Humanities Press, 2018.

STUDERUS, Erich; GAMMA, Alex; KOMETER, Michael; VOLLENWEIDER, Franz X. Prediction of psilocybin response in healthy volunteers. PLOS ONE, [online], v. 7, n. 2, 2012. ISSN 1932-6203. Retrieved from: https://doi.org/10.1371/journal.pone.0030800. Accessed on: 22 Feb. 2026.

TAYLOR, Charles. Modern social imaginaries. Durham, NC: Duke University Press, 2004.

TINBERGEN, Nikolaas. The study of instinct. Oxford: Clarendon Press, 1951.

TURNER, Victor. The ritual process: structure and anti-structure. Chicago: Aldine Publishing Company, 1969.

VALDESOLO, Piercarlo; GRAHAM, Jesse. Awe, uncertainty, and agency detection. Psychological Science, [online], v. 25, n. 1, p. 170–178, 2014. ISSN 0956-7976.

VAN ELK, Michiel; KARINEN, Arie; SPECKER, E.; STAMKOU, E.; BAAS, Matthijs. "Standing in awe": the effects of awe on body perception and the relation with absorption. Collabra: Psychology, [online], v. 2, n. 1, art. 4, 2019. ISSN 2474-7394.

VAN GENNEP, Arnold. The rites of passage. Translated by M. B. Vizedom; G. L. Caffee. Chicago: University of Chicago Press, 1960. Original work published 1909.

VON BERTALANFFY, Ludwig. General system theory: foundations, development, applications. New York: George Braziller, 1968.

VYGOTSKY, Lev S. Mind in society: the development of higher psychological processes. Cambridge, MA: Harvard University Press, 1978.

WANG, C.; XU, Y.; ZHAO, Y.; LI, J. The dark side of augmented reality: exploring manipulative designs in AR. International Journal of Human–Computer Interaction, [online], 2024. Retrieved from: https://arxiv.org/abs/2303.02843. Accessed on: 22 Feb. 2026.

WILLIAMS, Michael T. Psychedelic experience and the politics of consciousness: LSD in Cold War America. Culture, Medicine and Psychiatry, [online], v. 43, n. 4, p. 597–621, 2019. ISSN 0165-005X.

ZIELINSKI, Siegfried. Deep time of the media: toward an archaeology of hearing and seeing by technical means. Translated by Gloria Custance. Cambridge, MA: MIT Press, 2006.

ZUBOFF, Shoshana. The age of surveillance capitalism: the fight for a human future at the new frontier of power. New York: PublicAffairs, 2019.