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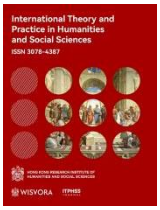

Embodied Aesthetics in Immersive VR Animation: An Operational Design Framework

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Abstract

Immersive virtual reality (VR) is commonly evaluated through presence, fidelity, usability, and task performance. These approaches do not fully explain how technical transformation, abstract audiovisual form, and bodily activity jointly become materials of aesthetic design. This short article proposes the Embodied Aesthetic Framework (EAF) for designing and analysing immersive VR animation. Developed through an integrative synthesis of phenomenology, enactivism, postphenomenology, animation aesthetics, presence research, and embodied interaction design, the EAF distinguishes three interdependent constructs: Technological Mediation, Aesthetic Abstraction, and Embodied Cognition. Reflective Awareness is treated as a contingent outcome rather than an automatic effect. The article defines observable features for each construct, formulates four relational propositions, and presents a compact application protocol. The framework shifts attention from maximising immersion to composing a legible relation among system transformation, audiovisual organisation, and bodily sense-making. It is intended as a mid-range explanatory and generative framework, not a psychometric scale or a claim of universal effects.

1. Introduction

Immersive VR research has established valuable concepts of presence, plausibility, and embodiment (Cummings & Bailenson, 2016; Kilteni et al., 2012; Slater, 2009). These concepts explain whether a virtual environment is experienced as a place and whether a virtual body or action is accepted as one's own. They are less precise about a different design problem: how an immersive artwork composes a felt relation among an apparatus, an abstract audiovisual field, and an acting body.

Immersive animation is not conventional animation transferred to a headset. Head and hand movement may alter what appears; breath may become light or spatial change; latency may be rendered as a visible trace. The animated image is therefore produced through a circuit among sensing, computation, rendering, and action. A smoothing function changes the quality of a

gesture, while a buffer changes the experience of time. Technical decisions are also formal and experiential decisions (Bolter & Gromala, 2003; Hansen, 2004; Manovich, 2013).

Recent design studies show that immersive experiences are shaped through creative tools, physical props, empathetic spaces, and different forms of visual stimulus rather than display technology alone (Chai et al., 2023; Fouad et al., 2023; Lee et al., 2021; Yang et al., 2024). A connecting vocabulary is still needed for relating technical transformation to audiovisual form and bodily interpretation.

This article asks: How can embodied aesthetics be operationalised for immersive VR animation without reducing experience to presence or treating reflection as guaranteed? The answer is the Embodied Aesthetic Framework (EAF), comprising Technological Mediation (TM), Aesthetic Abstraction (AA), and Embodied Cognition (EC), with Reflective Awareness (RA) as a possible outcome. No human-participant data are reported. The contribution is conceptual: definitions, observables, relational propositions, and a concise design protocol.

2. Conceptual Basis

Phenomenology understands perception as an active bodily relation with a world rather than passive reception (Merleau-Ponty, 1962). Enactivism and sensorimotor theory similarly position cognition in recurrent action–perception relations (Noë, 2004; Varela et al., 1991). These perspectives explain why bodily activity matters, but do not specify how code, mapping, rhythm, or abstract form should be documented as design variables.

Postphenomenology provides a second foundation. Technologies amplify, reduce, delay, and translate; they help constitute what can be perceived and how action is possible (Ihde, 1990; Verbeek, 2005). Mediation is therefore not noise between a participant and an experience. It is part of the experience. Extended-mind accounts further challenge the treatment of tools as external additions to cognition (Clark, 2008; Clark & Chalmers, 1998).

Aesthetic theory supplies the formal dimension. Perceptual forces are organised through rhythm, contrast, intensity, movement, and spatial relation (Arnheim, 1974). Dewey (1934) describes aesthetic experience as an integration of doing and undergoing, while Böhme (2017) locates aesthetic effect in atmospheres exceeding discrete objects. In immersive animation, abstraction can translate an invisible process, intensify a sensation, or produce distance between action and representation.

Presence remains relevant, but it is not the sole criterion. A highly present environment may be aesthetically conventional; visible delay or distortion may be meaningful precisely because it interrupts seamless control. The relevant unit of analysis is therefore a mediated aesthetic relation: a bounded episode in which a technical operation transforms bodily or environmental input into perceptible form, and that form can reorganise attention, action, affect, or interpretation.

3. The Embodied Aesthetic Framework

Construct	Operational definition	Typical observables	Evidential limit
Technological Mediation	Transformation that selects, maps, delays, amplifies, reduces, or returns information	Input, mapping, latency, smoothing, threshold, gain, failure state	Operation does not establish meaning or effectiveness
Aesthetic Abstraction	Compositional transformation that organises perceptible relations while suspending or	Colour, rhythm, geometry, sound, density, synchrony,	Abstract form has no universal emotional

Construct	Operational definition	Typical observables	Evidential limit
	reconfiguring literal reference	persistence, contrast	meaning
Embodied Cognition	Situated meaning-making through sensorimotor activity, bodily feeling, affect, and interpretation	Posture, movement, tempo, stillness, exploration, action–response correspondence	Affordance does not establish an internal state
Reflective Awareness	Possible attention to one's body, action, or relation with mediation	Traceable self-directed account or convergent situated observation	Reflection is not an automatic property of an interface

3.1 Technological Mediation

TM concerns the experiential consequence of a technical transformation, not merely a component list. A respiratory sensor matters analytically because a changing signal is stabilised and mapped to scale, colour, or sound. Relevant variables include sampling, smoothing, mapping range, delay, spatial registration, and legibility. TM may remain in the background, become recognisably responsive, or be foregrounded as an aesthetic theme. None of these modes is inherently superior.

3.2 Aesthetic Abstraction

AA is not synonymous with visual simplicity. A complex particle field can be abstract when rhythm, luminosity, density, and change carry the relation rather than a depicted object. Abstraction can intensify qualities, translate hidden processes, defamiliarise habitual action, or create representational distance. It should be evidenced through colour scripts, sound maps, animation curves, comparative renders, and parameter changes rather than the label “abstract.”

3.3 Embodied Cognition

EC identifies how an encounter solicits or reorganises bodily activity. Observable features include invited movement, effort, pacing, synchronisation, interruption, and exploratory gesture. Embodied interaction research makes bodily sensibility an explicit design material (Höök, 2018; Svanæs, 2013). The evidential distinction is crucial: an environment can be designed to invite slower breathing, but cannot be said to cause calm without appropriate participant or physiological evidence.

3.4 Reflective Awareness

RA is not a fourth construct equivalent to TM, AA, and EC. It is a possible experiential outcome. A mirror, delay, biometric mapping, or abstract avatar does not automatically produce self-knowledge. Reflection depends on perceptibility, pacing, comfort, interpretive openness, and context. Artefact analysis can demonstrate a difference between action and return; a claim about experienced reflection requires a traceable encounter source.

4. Relational Propositions

P1—Appropriate legibility. Mediation becomes aesthetically operative when its transformation is perceptible at a level appropriate to the intended experience. An opaque mapping may not be attributed to action; an overly mechanical mapping may remove interpretive openness.

P2—Patterned embodied attention. Abstraction organises bodily attention through rhythm, contrast, audiovisual synchrony, and transformation. It does not carry a universal meaning; interpretation depends on compositional and cultural context.

P3—Reciprocal adjustment. Embodied meaning emerges through an evolving circuit rather than a simple stimulus-response. A participant acts in response to an environment that changes in

response to action (Dourish, 2001; Suchman, 2007).

P4—Recognisable difference. Reflective awareness is more plausible when a relation contains a tolerable difference between action and return. Delay, scaling, persistence, or abstraction may make habitual action noticeable, but excessive difference can weaken agency, intelligibility, or comfort.

These propositions generate bounded design claims. A movement buffer, for example, can return semi-transparent traces after a delay. TM identifies buffering and timing; AA identifies opacity and persistence; EC identifies the invitation to anticipate or wait. A defensible proposition is that perceptible latency can become aesthetic material when the returned movement remains recognisable. It is not defensible to declare a universal optimal delay without comparative evidence.

5. Compact EAF Protocol

The framework can be applied in five steps. First, bound the relation in one sentence: "When the participant does X, the system transforms it through Y, producing form Z." Second, specify mediation by documenting inputs, mappings, thresholds, delays, and failures without anthropomorphic language. Third, analyse abstraction by identifying the formal variables that make the transformation perceptible. Fourth, articulate the bodily invitation, keeping artefact affordance separate from encounter evidence. Fifth, audit the claim by recording its source, alternative explanation, missing evidence, and strongest defensible verb.

This protocol distinguishes what an artefact demonstrably does from what it may enable. "Maps voice amplitude to luminance" is operational; "understands emotion" is not. "Creates visible separation between present and returned movement" is descriptive; "produces self-awareness" requires additional evidence. The distinction protects artistic interpretation while preventing technical or psychological overclaim.

6. Discussion and Conclusion

The EAF reframes immersive design in three ways. First, it treats the apparatus as aesthetic composition: mapping, buffering, smoothing, and tracking thresholds determine how form behaves. Second, it treats abstraction as an operation that translates or reorganises relations rather than as a visual genre. Third, it makes evidential restraint part of design knowledge. Immersive immediacy can encourage strong language—empathy, transformation, awareness—but immediacy is not evidence of durable or general effects.

The framework is deliberately mid-range. It does not replace presence, embodiment, accessibility, clinical assessment, or usability evaluation. Its categories may overlap in practice; a delay is both mediation and temporal form. The distinction is analytical rather than ontological. Future work should test whether designers can use the constructs consistently across devices, cultures, bodies, and aesthetic traditions, and whether comparative cases refine the proposed boundary conditions.

In conclusion, immersive VR animation requires a vocabulary that crosses software, form, and bodily experience. TM identifies how systems transform relations; AA explains how perceptible form organises attention; EC describes situated bodily sense-making; and RA remains contingent. The EAF's contribution is a disciplined way to ask what an immersive artwork does, how it does it, and what the available evidence permits a researcher to say.

Declarations

No new human-participant data are reported. This conceptual article develops material originating in the first author's doctoral research at City University Malaysia. Funding: [confirm]. Conflict of interest: [confirm]. Author contributions: Jiao Xiangting—conceptualisation, methodology, writing; Ahmad Rashidi bin Hasan—supervision, validation, review. [Both authors to confirm.]

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