Designed Frictions and Layer Inversion in AI-Augmented Metaverse Classrooms

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Summary

Metaverse Interoperability, Friction, and Care Ethics: As metaverse technologies and artificial intelligence become woven into teaching and learning, design educators face a rapidly shifting landscape in which virtual environments may increasingly act as the primary sites of creative practice. This concept note outlines an original framework for understanding how care, craft, and community can be sustained as the virtual and physical worlds converge. Reference at: Khara, A. (2025) *Designed Frictions and Layer Inversion in AI-Augmented Metaverse Classrooms*. Available at: **https://www.fairness.design/metaverse**. Version 1.0 pre-print ready.

Abstract

This page introduces an original concept in metaverse theory: the potential inversion of layers between the physical and virtual worlds. As metaverse technologies become increasingly seamless and interoperable, the virtual world is no longer simply an overlay on the physical but risks becoming the dominant grounding layer of meaning. This shift could erode the material frictions, imperfections, and embodied resistances through which care, attentiveness, and craft are ordinarily learned. To address this, the research proposes that virtual environments should be intentionally designed with "constructed frictions" that echo the ethical and tactile demands of the physical world. By embedding repair, maintenance, vulnerability, and interdependence into digital systems, we can ensure that AI-augmented virtual worlds cultivate the same care-ful attitudes that make learning humane, grounded, and relational.

1. Layer Inversion: When the Virtual Becomes the Grounding World

Today, the digital realm is generally treated as an overlay on the physical world, i.e., a supplementary layer that augments material experience. However, with the acceleration of immersive, persistent, and interoperable virtual environments, we are moving toward a future in which the virtual becomes the grounding layer of meaning, and the physical becomes the occasional overlay. This potential layer inversion fundamentally changes how learners experience presence, agency, identity, and responsibility. When the digital becomes the primary lived environment, its rules, metaphors, and physics begin to define how people understand the world and one another.

2. The Loss of Friction in Virtual Environments

Physical craft depends on material friction. This entails resistance, texture, gravity, wear, decay, unpredictability. These frictions teach attentiveness, patience, responsibility, and relational sensitivity. They also cultivate a sense of stewardship toward materials, tools, and environments. The virtual world, by default, has no natural friction. Digital objects persist without aging, systems run without resistance, and simulations remain optimised for smoothness. Without friction, learners risk losing the very conditions through which care becomes learnable. Exploring, but extending beyond, Tim Ingold's (Ingold, T. (2013). Making: Anthropology, Archaeology, Art and Architecture. Routledge) work on material engagement, this framework argues that friction is not merely physical resistance but a moral and pedagogical condition that underpins care.

3. Designed Frictions: Reintroducing Conditions for Care

If the virtual becomes the primary layer of lived experience, then educators and system designers must intentionally embed frictions into AI-augmented environments to preserve the relational qualities of craft-based learning. Examples include: digital garments that age, tear, fade, and distort, encouraging a repair culture in virtual fashion studios; tools that require calibration, uncertainty, or negotiation, echoing the tactility of physical craft; AI collaborators that model attentiveness and moderation rather than instant optimisation; and learning environments that contain constraints, resistance, or imperfections to prevent frictionless, thoughtless interaction. These frictions are not obstacles: they are ethical infrastructures that sustain dignity, reflection, and care.

4. Care as a Pedagogical Responsibility in the Metaverse

Care is not simply an interpersonal virtue but a material and environmental practice. It arises when learners must attend to the needs, limits, and tendencies of something beyond themselves. In the physical studio, those "others" include materials, tools, spaces, and peers. In AI-augmented metaverse classrooms, these relational opportunities must be designed into the environment. Without such design, virtual learning risks becoming smooth, efficient, but ethically hollow.

5. A Framework for AI-Augmented Design Education

This emerging framework proposes that metaverse classrooms should: (i) Preserve friction as the condition through which craft, judgement, and care are cultivated; (ii) Treat AI as a collaborator, supporting attentiveness, reflection, and shared presence rather than replacing the teacher. (iii) Prioritise dignity and relational ethics, ensuring that digital rules reinforce care rather than override it. (iv) Blend craft and code to allow simulated environments to inherit the care-inducing qualities of physical making. (v) Design for continuity so that virtual objects and spaces develop histories, attachments, and repairable lives.

Conclusion

As interoperability deepens and physical and digital spaces merge, the question is not whether we should slow or prevent this convergence. Instead, the responsibility lies in designing virtual environments whose rules, frictions, and affordances sustain the human capacities that matter most. Care, dignity, and craft are not relics of the material world. They are practices that can and must be cultivated in the metaverse. As such, doing so requires deliberate, ethical, and friction-aware design.

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