Attuned Design Practice: towards Open Rehearsals for Embodied Knowledge and Computational Design.

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Abstract

This article introduces Attuned Design Practice (ADP), a design vocabulary and conceptual framework for producing embodied knowledge at the intersection of artistic and scientific inquiry, to inform the development of computational models that generate body-based interpretations and articulations. The convergence of Robotics, AI, HRI, and HCI in Industry 5.0 demand bold experimentation in artistic-scientific inquiry to interpret embodied knowledge beyond quantifiable data. In ADP, we propose the concept of 'attunement' to examine how alternative design vocabularies for embodied knowledge can be produced in reciprocity with the development of computational models that direct and facilitate expression and attunement over optimization or efficiency. Attunement is seen as a tuning fork to incrementally investigate the phenomena, relationships and patterns that inherently exist in tensions in-between tangible-intangible, or palpable-impalpable forms of materiality in human-computer connections, partnerships, and shared experiences. We propose Open Rehearsals, wherein alternative experiential understandings unfold in three areas of expertise: (1) preparing of tools and instruments, (2) performative practice, and (3) composition and choreography and notation methods. Our aim is to reinvent design innovation by cultivating integrative, reflective, and adaptive modes of collaborative design-making, from embodied discovery to embodied transformation.

Introduction

The enhancement of computational model interpretability through body-based understanding has been navigated for decades in technology communities, yet emergent AI-developments establish a further integration of knowledge domains at a rapid speed. Robotics, AI, Human-Robot Interaction, or Human-Computer Interaction drift towards each other for industry 5.0 (Passalacqua et.al., 2024). Due to these developments, bold experimentation in artistic-scientific inquiry (LaViers, 2025) is required to further comprehend the meaning of embodied knowledge in computational domains. Although quantifiable data generates a strong foundation and understanding for modeling body-based data, a tremendous gap of knowledge is still missing, to interpret and articulate affective nuances of human bodily expression. We propose the concept of Attuned Design Practice (ADP), a methodological framework for producing embodied knowledge at the intersection of artistic and scientific inquiry, to inform the development of computational models that generate body-based interpretations and articulations. Instead of trying to close the knowledge gap, for instance by further enhancing data-driven approaches or computational modelling, we suggest looking for an alternative viewpoint that starts from an integrated orientation. In ADP, we foreground 'attunement' as both a design vocabulary and methodological framework to complement and connect algorithmic logic with body-based research in human-computer relationships, and vice versa. We aim to develop an alternative design vocabulary for embodied knowledge, embedded in the phenomena, relationships and patterns that inherently exist in tensions in-between tangible-intangible, or palpable-impalpable forms of materiality. We see Attuned Design Practice as a 'tuning fork' for cultivating collaborative design-making that operates at the intersection of artistic and scientific inquiry. We aim to reinvent design innovation by emphasizing 'attunement', thereby emphasizing bodily expression, and aesthetic values, preferences and sensitivities over optimization or efficiency. We explore 'attunement' by engaging in performative activity, such as music and dance, whilst working in the digital-physical fabric of artefact-experience relationality, attuning to emerging and generated dialogues in embodied practice. Our aim is to reinvent design innovation, thereby cultivating integrative, reflective, and adaptive modes of collaborative design-making, from embodied discovery to embodied attunement.

Embodied Ways of Knowing

Body-based experiences have always been part of our cultural, religious, and healing traditions (Babikian, et.al., 2013) yet have developed largely outside of academia. Therefore, we want to investigate knowledge domains both in and outside of academia and investigate how a design praxis unfolds through an integration of artistic and scientific inquiry. 'Attunement' involves the embodied felt sensing experiences that resonate in psychological, emotional, and somatic states of consciousness, which facilitate kinesthetic empathy (Kossak, 2021). In Attuned Design Practice, embodied knowledge is part of a living, experiential repository that navigates the complexities in tangible-intangible, and palpable-impalpable materiality through modes of calibration. Embodied knowledge is produced in reciprocity

with the development of computational models, as interactive choreographies or compositions that direct and facilitate expression and attunement over optimization or efficiency. In Attuned Design Practice, we see the body as a site for investigation, which is in a continuous state of 'becoming' (Barad, 2007; Braidotti, 2013) through real-time co-constitutive exchanges and constant negotiations that resonate with significant articulations, interpretations and understandings of the integrative qualities in human-computer relationships.

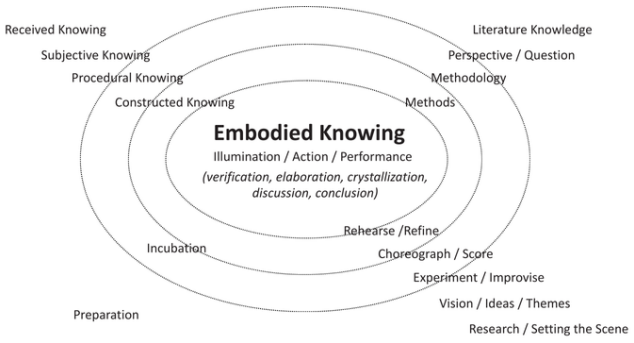

Fig. 1. Embodied Ways of Knowing (Barbour, 2011).

Figure 1, (Barbour, 2011; Belenky, 1986) shows an integrative framework on producing Embodied Knowing, which is based on the (a) developmental path to knowledge construction, moving from *'received to constructed knowing'*, (b) the continuum of scientific methodology, moving from '*theory to practice'*, and a (c) performative path of inquiry, from *'staging to rehearsing'*. The integration of the separate paths flows together at the center, where embodied knowledge is situated as a stage for knowing through action, performance, or illumination. In Attuned Design Practice, we are inspired by this model and want to further investigate how to embed computational modelling to produce an alternative epistemology to produce embodied knowledge based at the intersection of scientific and artistic inquiry.

Towards Attunement in Open Rehearsals

We propose Open Rehearsals to invite interdisciplinary teams to engage in experiential 'knowing together' (Nimkulrath et.al., 2020). Open Rehearsals highlight three areas of expertise, that deal with the following questions:

Preparing tools and instruments

1. How can tools and instruments act in *multiple roles at once* (for instance being observer, being the observed as well as the observation)?
2. How do tools and instruments act whilst facilitating *multiple representations at once* (such as being a notation, an instruction, or a performative seed)?
3. How do tools and instruments exist in *multiple orientations or perspectives in identity* (such as being both a part and a whole at once)?

Performative activity

4. How can a deep empathetic resonance and reciprocal affect *be activated and ground* the performer's heightened state of awareness towards the sensory nervous system of the self and the other(s)?
5. How can rhythmic and choreographic interpretations *scaffold and unfold* expressive articulation that form signatures of aesthetic mutuality?
6. How can body-to-body and body-instrument dynamics *morph and iterate* assemblages of intersubjective and intrapersonal attunement, using props, demonstrators and open designs & prototypes?

Composition, choreography and notation

7. How can the experience of embodied attunement be *scribed, marked, transmitted, captured or codified* through real-time computational compositions and data embodied representations?
8. How can the experience of embodied attunement be *performed, mapped and composed*, when bodies are in a constant state of becoming, through real-time co-constitutive exchanges and constant negotiations?

Conclusion

This article has proposed Attuned Design Practice (ADP) a concept that foregrounds 'attunement' as a tuning fork for Embodied Knowledge in human-computer connections, partnerships, and shared experiences. We have proposed Open Rehearsals at the intersection of artistic and scientific inquiry, which highlights three areas of expertise: (1) preparing of tools and instruments, (2) performative practice, and (3) composition and choreography and notation methods. Future research involves semi-structured interviews with performance practitioners, such as disabled and non-disabled dance artists, expressive dance artists, and dance movement therapists, to further enhance our understandings for the concept of Attuned Design Practice.

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References

Published Book

Barad, K. 2007. Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning, Durham, Duke University Press.

Barbour, K. N. 2011. Dancing across the page: Narrative and Embodied Ways of Knowing. Intellect Books.

Belenky, M. F., Clinchy, B. M., Goldberger, N. R., Tarule, J. M. 1986. Women's ways of knowing. New York, NY: Basic Books.

Braidotti, R. 2013. Metamorphoses: Towards a materialist theory of becoming. John Wiley & Sons.

Kossak, M.S., 2008. Attunement: Embodied transcendent experience explored through sound and rhythmic improvisation. Union Institute and University.

Published Journal or Magazine Article

Babikian et al., T. 2013. Music as medicine: A review and historical perspective. *Alternative and Complementary Therapies*, vol. 19, no. 5: 251– 254. doi: 10.1089/act.2013.19510.

Carvajal, A.E. 2020. Exploring the Use of Arts-Based Research in Social Science Academic Research: A Literature Review. *Visual and Embodied Methodologies Network Working Paper*: King's College London.

Laviers, A. 2025. Annual Review of Control, Robotics, and Autonomous Systems Robots and Dance: A [63] Promising Young Alchemy. *Annual Review of Control Robotics Autonomous Systems*, vol. 8: 12. doi: 10.1146/annurev-control-060923.

Nimkulrat, N., Groth, C., Tomico, O., Valle-Noronha, J. 2020. Knowing together – experiential knowledge and collaboration, *CoDesign*, 16:4, 267-273, doi: 10.1080/15710882.2020.1823995

Passalacqua, M., Pellerin, R. Magnani, F., DoyonPoulin, P., Del-Aguila, L., Boasen, J., Léger, P-M. 2025. Human-centredAI in industry 5.0: a systematic review, *International Journal of Production Research*, 63:7, 2638-2669, doi: 10.1080/00207543.2024.2406021