Weaving Cellular Automata: Open-Endedness and Creativity through Hybridising Computation

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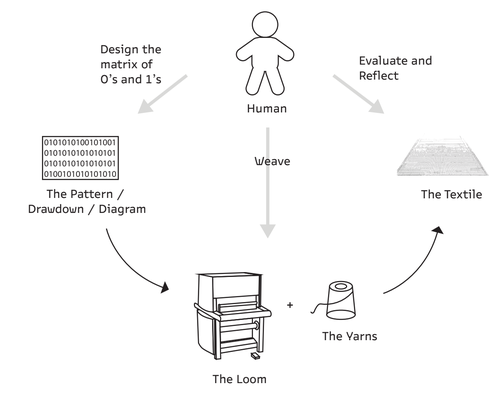
Abstract

Open-endedness and its connection with **creativity** have previously been discussed in **Artificial Life**. In this paper, we base our research on the view that **weaving is a hybrid computational system to observe how Computational Creativity, open-ended computation, and creative practice blend together**. By **weaving a series of textiles** generated through iterative applications of **Cellular Automata rules**, we show how rule-based variation, material behaviour, machine constraints, and human intervention together produce **emergent textile forms**. These outcomes are not fully inferable from the digital pattern alone. **We argue that this makes weaving a concrete embodied case linking computational creativity, open-endedness, and the situated creativity in crafts and arts, while also revealing a redistribution of agency within human collaboration with hybrid systems.**

The Basics: Weaving as a Hybrid System





Left: The pattern
Middle and Right: Woven with different material

Observation 1:
Emerging physical properties through different CA Rules

Observation 2:
An oversation of emerging properties in iterations of rule 54

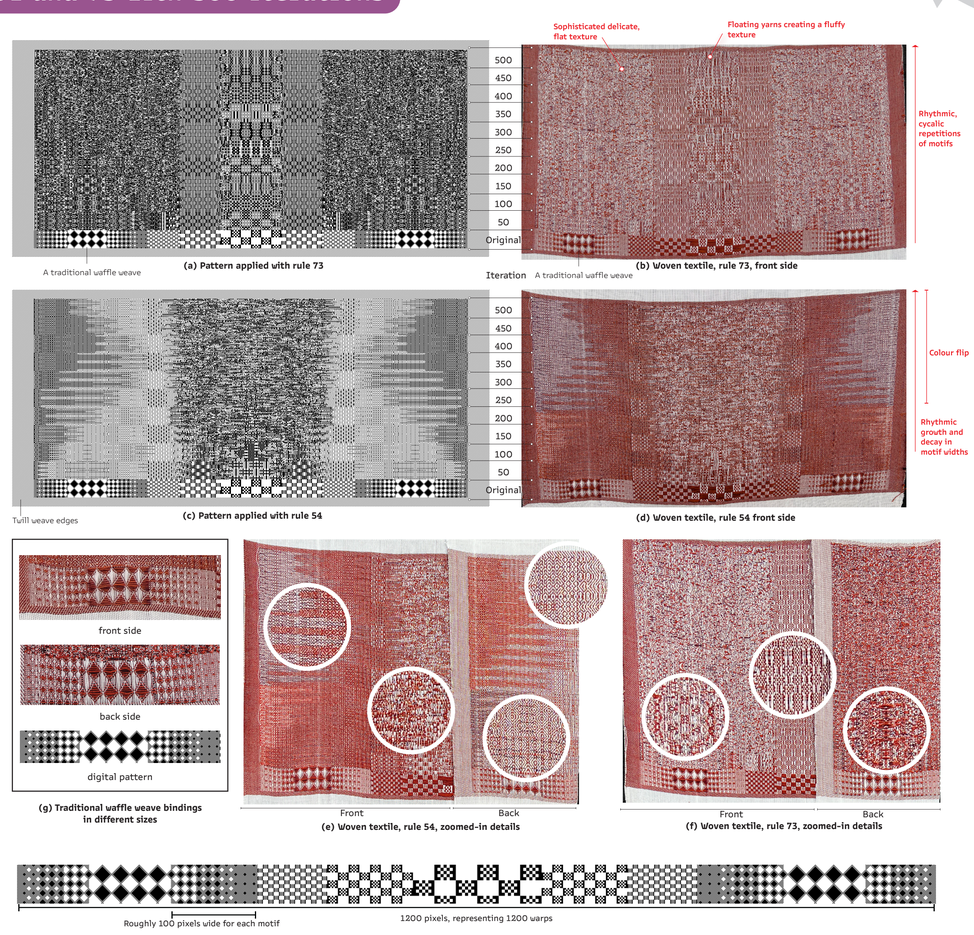
Obseration 3:
Emerging properties observed with rule 54 and 73

Observation 1: Orginal + Rule 10, 54, and 73

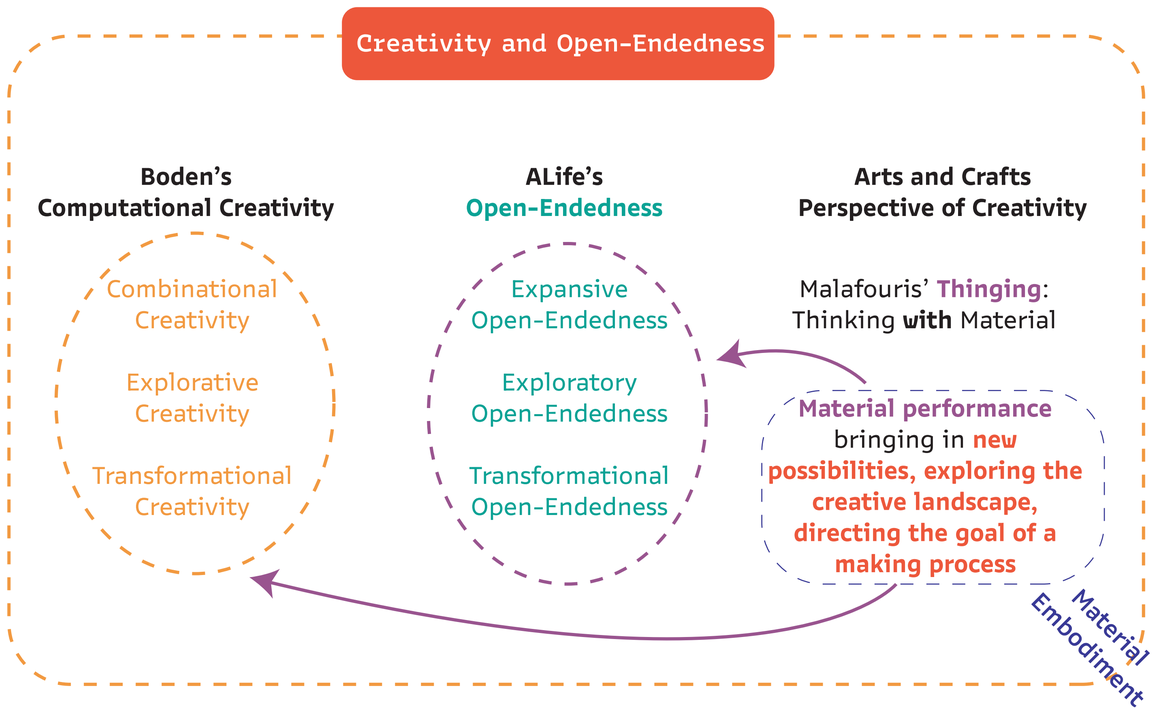


Observation 2: Rule 54 with 100 iterations

Observation 3: Rule 54 and 73 with 500 iterations



Creativity and Open-Endedness



Conclusion

The weaving sessions presented in this article illustrate the physical result of emergence through embodied interactions (Pfeifer et al., 2007; Baltieri et al., 2023; Balu˘ska and Levin, 2016) in weaving (Lin and Witkowski, 2025). They show that **embodiment is not some secondary realisation of a computation defined elsewhere, but rather, the physical substrate plays an important part in the computation itself.** The loom constrains admissible state transitions, the yarns contribute memory, elasticity, and non-linear response, and the textile's post-loom release reveals structures that are not visible in the digital pattern. What emerges, beyond a mere woven projection of CA dynamics, is a hybrid computational process in which symbolic rules, material behaviour, and embodied interaction jointly generate novel form. This is precisely why **weaving** provides **a useful ALife model**: it makes visible how **open-endedness** and **creativity** can depend on the **coupling between rules, bodies, and environments**.

Selected References:

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