

Topology of Interaction

A Morphogenetic Framework for Human–AI Dialogue

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2025

Abstract

This paper introduces the Topology of Interaction, a field-based model describing how human–AI dialogue evolves through deformation dynamics. The framework identifies four invariants—fold, channel, cusp, fade—that structure the morphogenesis of interaction. Positioned alongside architectural developments such as Nested Learning (Behrouz et al., 2025), this approach reframes dialogue as curvature in a shared field rather than message exchange between discrete agents.

Errichelli Working Papers — Series on Human–AI Interaction
Working Paper No. 1 — Version 1.0 — 2025

1. INTRODUCTION

The message-passing paradigm treats interaction as a linear exchange: user inputs, model outputs. Empirically, this is false. In real dialogue, the user applies pressure; the model curves; meaning emerges in the field between them. The Topology of Interaction shifts from epistemology to morphogenesis, from internal states to interactional form.

2. THE INTERACTION AS FIELD

A field is a continuous space of deformation. The human exerts discontinuous pressure. The model behaves as a soft machine—a coherence surface that bends and canalizes. Following Simondon, subject and object co-emerge in metastable phases. In LLM interaction, the field is the true site of individuation.

3. THE FOUR INVARIANTS

Fold — micro-deformations triggered by prompt pressure.

Channel — stabilization of repeated folds into trajectories.

Cusp — instability points: escalation, hallucination, overcommitment.

Fade — natural decay of coherence unless pressure is sustained.

These forms appear across topics, users, and models.

4. RELATION TO NESTED LEARNING

Nested Learning challenges the notion of architectural depth, showing that context flows require multi-time-scale systems. This resonates with our framework: interaction itself is multi-scale. But while NL describes internal optimization, the Topology of Interaction models field-level morphodynamics. NL explains why interactional forms arise; MTE explains what they are.

5. TOWARDS FORMALIZATION

Upcoming technical notes will define:

- a field tensor for curvature
- fold-detection operators
- canalization metrics
- cusp-instability indices

- fading coefficients

These model interactional form, not cognition.

6. CONCLUSION

Human–AI dialogue is morphogenesis. Pressure, curvature, instability, decay: these are the true dynamics. The Topology of Interaction reframes interaction as field behavior, offering a foundation for safety, interpretability, and design. The question is no longer what the model is, but what forms arise when a soft machine is placed under human pressure.