Information Systems Beyond the Sociotechnical through Speculative Entangled Design: Extended Abstract – CTDG-SI 2026

Marcelo Soares Loutfi[1], **Sean Wolfgand Matsui Siqueira (Advisor)**[1]

[1]Programa de Pós-Graduação em Informática (PPGI)
Universidade Federal do Estado do Rio de Janeiro (UNIRIO)
Rio de Janeiro, RJ – Brasil

marcelo.loutfi@edu.unirio.br, sean@uniriotec.br

Abstract. *Current methodologies and theories of information systems (IS) design and development are largely grounded in anthropocentric and instrumental assumptions. This study introduces Speculative Entangled Design (SpED), a theoretical and methodological approach grounded in Actor-Network Theory, Speculative Realism, Agential Realism, and Postphenomenology. SpED conceptualizes design as a performative and relational practice through which sociotechnical worlds are enacted. This innovative approach is operationalized through the Sociotechnical Entanglement Framework (SEF) and a set of speculative design tools. Drawing on a participatory workshop conducted in 2024 and a diffractive analytical strategy, the study demonstrates how speculative practices can make non-human actors, infrastructural constraints, and algorithmic mediations visible and actionable. The findings highlight the potential of SpED to support post-anthropocentric, ethically situated, and future-oriented IS design.*

1. Introduction

Information Systems (IS) design is increasingly shaped by artificial intelligence, automation, and data-intensive infrastructures. Despite these advances, dominant approaches remain grounded in instrumental and reductionist paradigms, treating technology as a neutral tool and design as an optimization-oriented activity [Malik and Malik 2021]. Recent studies advocate more responsible and future-oriented approaches [Mikalef et al. 2022, Tuunanen et al. 2024], yet they often remain within solutionist paradigms that do not question underlying ontological assumptions [Hemon-Hildgen and Rowe 2022].

We introduce Speculative Entangled Design (SpED) [Loutfi et al. 2026], a theoretical and methodological approach grounded in entanglement theories, which supports post-anthropocentric and non-dualistic design practices. This study contributes by advancing a post-anthropocentric perspective on IS design and proposing SpED and Sociotechnical Entanglement Framework (SEF) as a theoretical-methodological alternative.

2. Speculative Entangled Design (SpED)

SpED is grounded in entanglement theories [Loutfi et al. 2025, Loutfi et al. 2026] that challenge dualisms such as human/non-human and subject/object. It draws on Actor-Network Theory, Speculative Realism, Agential Realism, and Postphenomenology to support a relational understanding of sociotechnical systems. From this perspective:

1. **Non-human actors must be made visible:** Non-human actants actively participate in sociotechnical processes.
2. **Human agency is not autonomous, but mediated:** Human action is shaped through interactions with technologies.
3. **Reality as relational and irreducible to totality:** Sociotechnical reality is relational and only partially accessible.
4. **Speculating in the face of uncertainty:** Speculation explores both visible and hidden aspects under inherent uncertainty.
5. **In defense of a cosmopolitics of hybrids:** Sociotechnical systems involve heterogeneous and interdependent entities.
6. **Ethics and responsibility emerge from sociotechnical relations:** Ethical considerations arise within sociotechnical entanglements.

2.1. Sociotechnical Entanglement Framework (SEF)

The SEF operationalizes SpED by structuring design into three movements:

1. analysis of the present sociotechnical configuration;
2. speculation of future implications;
3. design of intervention-oriented solutions.

2.2. Tools supporting the SEF

A set of tools was developed to support the SEF, comprising: (i) Sociotechnical Board, used to surface the actants involved in the sociotechnical ecosystem under analysis and to establish relationships among them; (ii) Sociotechnical Implications Wheel, a tool for examining the long-term consequences of proposals or future scenarios within a sociotechnical ecosystem; (iii) Possibilities Wheel, a tool for making speculative futures more concrete by focusing on a specific future moment and examining how the sociotechnical scenario may unfold, organizing emerging implications into categories based on their perceived likelihood; (iv) Technological Mediation Cards, designed to foster speculative and reflective exploration of how technologies shape and reconfigure relationships between humans and the world; (v) Supporting Notebooks, a set of structured instruments that support the use of speculative design tools by organizing the systematic documentation of participants' activities.

3. Methodology

The approach was applied in a participatory workshop conducted in 2024, structured around the SEF. Participants mapped sociotechnical ecosystems, explored future scenarios, and designed technological solutions. Data were collected from artifacts, notebooks, and participant feedback, and analyzed using a diffractive approach grounded in Agential Realism.

4. Results

The results indicate that SpED enables a shift from technicist and reductionist perspectives toward relational understandings of sociotechnical systems. This study advances a novel contribution to IS by articulating Speculative Design with entanglement theories, offering a post-anthropocentric lens for technology design. Methodologically, it

introduces diffractive analysis to interpret sociotechnical phenomena, while practically supporting its application through a structured set of design tools. It also contributes pedagogically by providing didactic materials and documented experiences in IS education.

Participants recognized non-human actors as active elements and understood technology as mediating perception and action rather than acting as a neutral tool. The findings also reveal the emergence of distributed responsibility, involving users, platforms, and institutional actors, moving beyond individualistic and purely technical framings. However, tensions remained, as anthropocentric perspectives persisted and participants showed discomfort with uncertainty and incompleteness. Overall, SpED fostered more reflexive and ethically situated forms of sensemaking while exposing the challenges of moving beyond technicist paradigms.

5. Conclusion

This study advances a performative and relational view of IS design, in which knowledge, technology, and action emerge from sociotechnical intra-actions. The SEF and its tools support moving beyond functionality and efficiency, fostering engagement with ethical and long-term implications. This study is limited by its application in a specific workshop context. Future research should explore SpED across diverse settings to assess its robustness and applicability.

Reference to the Original Publication

This extended abstract summarizes the following work currently under review: Loutfi, M. S.; Tibau, M.; Siqueira, S. W. M. *Information Systems Beyond the Sociotechnical through Speculative Entangled Design*. Submitted to an international journal.

References

Hemon-Hildgen, A. and Rowe, F. (2022). Conceptualising and defining devops: a review for understanding, not a framework for practitioners. *European Journal of Information Systems*, 31(5):568–574.

Loutfi, M. S., de Rezende Ribeiro, T. M., da Fonseca Ramos, F., and Siqueira, S. W. M. (2025). Teorias do emaranhado e design especulativo na computação: Mapeamento sistemático de literatura e implicações para a interação humano-computador. In *IHC 2025*, pages 1323–1349. SBC.

Loutfi, M. S., de Souza Deluca Ferreira, T., and Matsui Siqueira, S. W. (2026). Mapping entanglement theories in information systems: A bibliometric study and implications for sociotechnical design and hci. *International Journal of Human–Computer Interaction*, pages 1–37.

Malik, M. and Malik, M. M. (2021). Critical technical awakenings. *Journal of Social Computing*, 2(4):365–384.

Mikalef, P., Conboy, K., Lundström, J. E., and Popovič, A. (2022). Thinking responsibly about responsible ai and 'the dark side'of ai. *European Journal of Information Systems*, 31(3):257–268.

Tuunanen, T., Winter, R., and Brocke, J. v. (2024). Dealing with complexity in design science research: A methodology using design echelons. *MIS quarterly*, 48(2):427–458.