

Modelling Complex Systems to Analyse Social Media for Belief Revision

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Abstract: Belief revision is an important branch of cognitive science and has been studied extensively, mainly focused on face-to-face interactions. However, social media introduces new platforms for global human interaction. These platforms amplify ongoing problems on a larger scale, including misinformation, disinformation, influence campaigns, echo chambers, and polarisation. Early detection and a deeper understanding of how these processes unfold are crucial. A central aspect of this is understanding how people revise their opinions, as this action shapes the spread and persistence of these problems.

Foundational psychological models offer deep theoretical insights on belief revision. However, they are primarily descriptive and offer limited utility for persuasion at the level of individual interactions. Work in computational social science has also sought to analyse persuasion through machine learning and, more recently, large language models. However, these approaches often function as black boxes, offering limited interpretability on final outcomes. In this work, we sought to understand and model belief revision through a complex system on a many-to-many scale.

The cognitive dissonance theory (Festinger, 1957) posits that individuals are motivated to reduce the discomfort caused by conflicting cognitions, often leading to belief reorganization. Using data collected from MAGPIE, an isolated social media platform (Alister et al., 2025), we construct the complex system, including cognitive networks (Dalege and van der Does, 2022), and affiliation networks (Vandenhoe et al., 2025). The data covers a wide range of controversial topics and reflected the two-polar political system in the U.S. Therefore, we also aim to explore group identity and its effect on belief revision.

The proposed method consists of multiple components, including both beliefs/ideologies and social networks. By modelling and encoding the results from MAGPIE with the complex system, we can analyse and observe the belief revision in a controlled environment. Through this process, we develop the foundation for understanding belief revision on real-world social media platforms.

Keywords: *Belief revision, cognitive network, affiliation network, complex system, data simulation, modelling*

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