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LETTER

Evolutionary biology as a frontier for research on misinformation

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Abstract
The field of misinformation studies has experienced a boom of scholarship in recent years. Buoyed by the emergence of information operations surrounding the 2016 election and the rise of so-called "fake news," researchers hailing from fields ranging from philosophy to computer science have taken up the challenge of detecting, analyzing, and theorizing false and misleading information online. In an attempt to understand the spread of misinformation online, researchers have adapted concepts from different disciplines. Concepts from epidemiology, for example, have opened doors to thinking about spread, contagion, and resistance. The life sciences offer concepts and theories to further extend what we know about how misinformation adapts; by viewing information as an organism within a complex ecosystem, we can better understand why some narratives succeed and others fail. Collaborations between misinformation researchers and life scientists to develop responsible adaptations of fitness models can bolster misinformation research.

Keywords: misinformation; fitness; complex systems; information ecosystems; evolutionary biology

The field of misinformation studies has experienced a boom of scholarship in recent years. Buoyed by the emergence of information operations surrounding the 2016 election and the rise of so-called "fake news," researchers hailing from fields ranging from philosophy to computer science have taken up the challenge of detecting, analyzing, and theorizing false and misleading information online.

In an attempt to understand the spread of misinformation online, researchers have adapted concepts from different disciplines. Concepts from epidemiology, for example, have opened doors to thinking about spread, contagion, and resistance. Constitutive metaphors of pollution and contamination have also been productive ways to think about shared responsibility and systemic conditions. More broadly, the notion of an "information ecosystem" have been used to draw attention to the broader systems of information generation, uptake, circulation, and arbitration (Introne et al., 2024).

Researchers have even begun thinking about information as analogous to (non-viral) organisms as they seek to develop more appropriate models for misinformation adoption and propagation. For example, Berlinger et al. (2013) examined self-organizing collectives, whereby individual action contributes to larger, global behavior—a sort of "natural collective intelligence." Researchers have also found that information jumps in linear and non-linear ways from one group of Giant honeybees to another through *shimmering* (Kastberger et al., 2012); and have explored the threshold needed for informed whirligigs to trigger a Flash Expansion, used to avoid predators (Romey & Lamb, 2015). The collective behaviors of social insects also offer insights into communication networks, including information flow and propagation (Guo et al., 2022).

In short, the life sciences have been an important source of concepts and theories for misinformation research. They have informed researchers in other disciplines to better understand misinformation's

spread, vulnerabilities to misinformation, and more systemic perspectives on why misinformation can be influential.

However, while the borrowing from life sciences has been extensive, much of the work draws from concepts more akin to outdated linear or two-step modes (Bennett & Manheim, 2006) of communication, whereby a sender (virus, pathogen, etc.) transmits to a receiver to create some effect. But modern information systems are interdependent—they must consider such variables as the source, receiver, platform, original and remixed message form, among others, sometimes all at once. And while the idea of information ecosystems has gained traction, less has been done to drive further theorization of information as an *organism within that ecosystem.* Conceptualizing messages or pieces of information as organisms allows us to understand the specific adaptations that permit a piece of information to thrive or spread. Additionally, it also helps us understand the conditions to which it has adapted. In short, we can understand misinformation's fitness.

This perspective is essential if we are to take into account the speed and ease with which information can change shape and reach multiple audiences. If the biological conception of ecosystems has provided a framework for nuanced understandings of interlaced information systems, then thinking of information as organisms can bring into focus the optimizations that serve to make any content proliferate and endure.

Rather than think about *immunity* to misinformation, or think about misinformation as a virus or pollutant, we propose thinking about misinformation as analogous to a classification of organisms that are adaptive to a given information ecosystem. This perspective both extends the ecological turn in misinformation studies and makes available additional tools and theories that help us understand misinformation as a dynamic practice that is deeply embedded in our communicative and interpretive technologies and practices. In other words, it introduces the concept of "fitness" as a guiding principle for misinformation successes or failures. Definitions of fitness vary, but, "In the crudest terms, fitness involves the ability of organisms—or, more rarely, populations or species—to survive and reproduce in the environment in which they find themselves" (Orr, 2009).

Seen from a fitness perspective, the study of misinformation teaches us about why bad information succeeds, where the causal mechanisms involve the fit between communication and environment.

A focal point of modern misinformation research has been to examine the binary of true and false, or real and "fake." We argue that facticity is not the only attribute to consider when examining a popular narrative—and that it may not even be a consideration in its uptake. By taking a systems approach that emphasizes fitness, we can explore other characteristics that allow information to fit its environment, from complex structural and social factors to more individual drivers. Recognizing diversity in misinformation, much like the diversity of species in an ecosystem, is crucial. Different types of misinformation prey on different vulnerabilities and spread through different channels. Understanding how misinformation fills specific niches within the information ecosystem, like exploiting anxieties or appealing to authority figures, can help us develop targeted interventions. By taking these factors into account, misinformation research can better attune to the ways that content adapts and thrives within complex online environments.

Our recommendation: misinformation researchers and life scientists should collaborate on responsible adaptations of fitness concepts and models to augment misinformation research. This union creates opportunities to model misinformation as part of a complex environment to augment approaches that use a low-dimensional space of contacts (epidemiology) or a broad characterization of socio-technical systems (information ecosystems).

By theorizing and modeling fitness in the complex sociotechnical systems that comprise online interaction, we can raise additional questions that surface some of the most pressing issues in understanding the proliferation of misinformation. This approach can also be used to study where misinformation fails to thrive, which can lead to novel approaches for building resilience to its impact.

Misinformation will continue to impact society, particularly as new technologies like generative artificial intelligence gain widespread public adoption and further expand our information ecosystem. The conditions in which misinformation spreads and is adopted are complex and dynamic; thus, our

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research approaches must also be adaptable. We urge researchers to consider interdisciplinary approaches to understanding misinformation based on the concepts of biological fitness to continue what has been a productive turn toward using biological concepts to drive innovative perspectives and interventions in misinformation studies.

Competing interest. The authors declare none.

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