The illusion of credibility: How the pseudosciences appear scientific

August Hämmerli
Institute of Philosophy, University of Bern, CH
Claus Beisbart
Institute of Philosophy, University of Bern, CH
David J. Grüning
Institute of Psychology, Heidelberg University, D
Kevin Reuter
Department of Philosophy, Linguistics and Theory of Science, University of Gothenburg, SE

Abstract

The pseudosciences often bear a striking resemblance to the sciences. Using a mimicry account as a framework, this paper investigates how the appearance of social media posts influences people's perception of the content of such posts as scientific. We present the results of two empirical studies. The first, preparatory study, identifies typical characteristics of "scientificness" in social media posts to inform feature manipulation within the main study. The main study then examines what happens if the features are systematically manipulated. The findings support the hypothesis that pseudoscientific digital content benefits from using features of scientificness. We discuss implications for understanding the appeal and persistence of pseudoscience.

Keywords: Cultural evolution, mimicry, pseudoscience, scientificness

Introduction

At first sight, there are striking similarities between pseudoscience and science. Homeopathy, for example, which is both popular and widely recognized as a pseudoscience (Mukerji & Ernst, 2022), has research institutes and peer-reviewed journals with a tradition as old as some of the most respected medical journals. Homeopathic remedies are sold using the same language and visual appearance as science-based drugs (Oreskes, 2019). Indeed, unlike most religious leaders and people engaged in magical practices, proponents of pseudoscientific fields such as homeopathy, anthroposophy, and astrology frequently present themselves as scientists. Some scholars who have begun to explore these striking similarities between pseudoscience and science frame pseudoscience as a form of imitation or mimicry. Mahner (2013, p. 42), for example, notes that "pseudosciences mimic research communities" and Oreskes (2019, p. 881) states that pseudosciences are "facsimile sciences because they mimic the appearance of science".

To understand why pseudosciences are inclined to mimic the sciences, it is crucial to recognize that science enjoys high esteem, at least in most societies. Scientists are regarded as experts in their fields, their words are taken to be highly credible, and a great deal of cultural prestige is associated with science (Hansson, 2021). It is, therefore, attractive for proponents of pseudoscience to mimic scientificness to enjoy similar benefits. By emulating the sciences, these fields can hope to enhance their perceived legitimacy, attract followers, and boost the confidence of their proponents. Blancke et al. (2017) investigate this phenomenon in more detail by framing it as cultural mimicry and linking it to evolved resemblance in evolutionary biology. They analyze the success of pseudoscience and describe how pseudoscience is disseminated and what strategies it adopts vis-à-vis laypeople and science.

Whether pseudoscientific content gains an advantage from presenting itself in scientific clothing is fundamentally an empirical question. Experimental research is needed to explore which features are crucial for the perception of science, and whether and how these features may be used to make pseudoscientific content appealing and persuasive. This paper seeks to conduct the first empirically grounded, systematic investigation of the resemblance between pseudoscience and science based on the cultural mimicry idea using an experimental approach focusing on social media posts. Our paper has two primary empirical objectives. First, through empirical analysis, we aim to identify factors determining whether people judge a social media post as scientific or pseudoscientific. Second, we want to experimentally test whether these features can be used to attract people to pseudoscientific content. From a theoretical perspective, we aim to evaluate whether our findings support the hypothesis that the observed similarities are most appropriately understood as a form of mimicry in analogy to biological theory. By addressing these objectives, we hope to explore the mechanisms underlying the relationship between pseudoscience and science and to contribute to the discussion about the theoretical framing of pseudoscience.

We proceed as follows: First, we present a framework informed by evolutionary biology for understanding mimicry and apply it to pseudoscience. We introduce a classic example of evolutionary mimicry: the *Ophrys* flower. From this case, we extract a key condition that must be met for a phenomenon to qualify as mimicry. Second, we apply this framework to the specific case of homeopathy, exploring how it aligns with this condition. Third, we present two studies testing the interplay of pseudoscientific content with perceived scientificness using a set of social media posts. Finally, we discuss the findings of these studies in the context of possible alternative explanations within a wider context of pseudoscience and conclude with an outlook for future research for this novel experimental platform.

In D. Barner, N.R. Bramley, A. Ruggeri and C.M. Walker (Eds.), *Proceedings of the 47th Annual Conference of the Cognitive Science Society*

A biologically informed framework

Evolutionary mimicry: the *Ophrys* flower

The study of similarity lies at the heart of the biological sciences (Mesoudi, 2011, p. 89), with the concept of mimicry playing an important role in evolutionary theory (Futuyma & Kirkpatrick, 2018). Some biological similarities can be explained in terms of mimicry. In this paper, we suggest that using biological mimicry as a starting point offers a compelling framework for understanding the similarity between science and pseudoscience. Note in this respect that, unlike cultural mimicry, biological mimicry has been considered in an extensive body of experimental evidence supporting its mechanisms and effects (Mueller, 2020).

One of the most popular text-book examples for mimicry is the flower of a group of orchid species of the genus *Ophrys* (Correvon & Pouyanne, 1916; Vereecken & Schiestl, 2008). Flowers in the *Ophrys* genus mimic female insects to attract male pollinators, using a combination of pheromones, visual cues, and tactile features to deceive them into aiding pollination. Pheromones attract males from a distance, while shape, color, and tactile structures become significant up close. This collective set of traits, called the "pollination syndrome," exploits the male insect's pattern recognition to increase the flower's reproductive success. Experiments manipulating these traits, such as using synthetic pheromones or optical stimuli, confirm that this mimicry is not coincidental, but an adaptation to deceive the pollinator, enhancing the flower's fitness.

Building on this case, we can characterize mimicry more generally by following Jager & Anderson (2019). Their work considers mimicry as one of several processes that may result in observed resemblances and identifies conditions under which resemblance can be experimentally classified as mimicry. Other, non-mimicry-based causes for resemblance are:

(a) Non-Evolved Resemblance: Incidental similarities (e.g. a cloud resembling a face).
(b) Evolved Non-Mimicry Resemblance: Similarities arising from convergent evolution due to common selective constraints (e.g. wings in birds and bats).
(c) Kinship Resemblance: Similarities arising from relatedness due to common origin/ancestry (e.g. sisters, twins, taxon).

For our purposes, we can adapt Jager & Anderson (2019)'s definition of mimicry as follows: A similarity or resemblance between two organisms O_1 and O_2 counts as mimicry if, and only if, a group of receivers put evolutionary pressure on O_2 to become similar to O_1. When this condition is fulfilled, O_1 is called the model and O_2 the mimic.

An important consequence of this definition is that mimicry requires fulfillment of the following condition:

C: O_1 has a set of features such that it gives O_2 an advantage if O_2 obtains these features.

In the case of the *Ophrys* flower, the flower's resemblance to the female insect is due to the fact that it has a collection of features—it produces pheromonal, visual, and tactile cues. To establish *C*, we have to show experimentally that manipulating features of the mimic (such as pheromones or visual stimuli) can predictably increase or decrease the advantage for the mimic (in our case, increase its deceptive effect, and ultimately pollination).

Applying the Framework to Pseudoscience

To see how this framework and, particularly, condition *C*, can be applied to pseudoscience, consider homeopathy. Homeopathy is a standard example that philosophers use to discuss the distinction between science and pseudoscience – a distinction that defines the demarcation problem in philosophy (Hansson, 2013; Oreskes, 2019; Mahner, 2013). Homeopathy is a school of medicine with several variants revolving around the central claim that "highly diluted homeopathic remedies can have therapeutic effects above placebo" (Mukerji & Ernst, 2022, p. 394). The relevant experts in the medical sciences agree that this claim is neither plausible nor supported by empirical data. In particular, regulated double-blind clinical trials, which all approved medical treatments must successfully undergo, have not established the effectiveness of homeopathy (Mukerji & Ernst, 2022).

Since its development by Hahnemann (1755—1843), homeopathy has diversified into different homeopathic schools, some of which increasingly and systematically use scientific clothing to communicate and advertise their products. These schools do so in order to look respectable and science-based, while making no real scientific progress (Oreskes, 2019, p. 887). This deceptive approach makes use of features like scientific discourse, science education, statistical graphs, data tables, scientific content, credentials, linguistic register, etc. (Boudry & Braeckman, 2011; Thomm & Bromme, 2011; Blancke & de Smed, 2013; Boudry et al., 2015; Bromme et al., 2015; Blancke et al., 2017; Reuter & Baumgartner, 2025). There is a pattern of scientific appearance that becomes recognizable through a syndrome of features, which again can be imitated by pseudoscience.

Using our evolution-informed framework, we suggest analyzing homeopathy as a potential case of mimicry. A model (science, medicine) and a mimic (pseudoscience) are both facing receivers (laypeople engaging with both). The mimic obtains measurable benefits, such as increased online engagement (and ultimately higher sales) in the form of clicks, shares, or likes, as well as an enhanced perception of scientific legitimacy ("scientificness") by displaying features that are typical of science. However, whether or not the mimicry criterion *C* is fulfilled cannot be decided *a priori*. Empirical research is needed to determine whether *C* is satisfied for digital pseudoscientific content. We now turn to two experiments we have conducted to test *C* for examples of pseudoscience.

Empirical Studies

Our two studies investigate how pseudosciences, such as homeopathy, creation science, and climate change denialism, mimic scientific content to appear more credible and attract attention. We distinguish scientific from pseudoscientific claims based on whether they align with established scientific findings and analyze how features like graphs or presentation styles influence perceptions of scientificness. Using social media posts as models and mimics, we vary these features and measure their impact on user engagement, using clicks as a proxy for fitness or attractiveness. Study A identified features perceived as indicators of scientificness, which informed the manipulations in Study B to test whether pseudosciences become more appealing when they resemble science. More specifically, we tested the following hypotheses:

Main Hypothesis: Feature manipulation of pseudo-science-related social media posts (mimic) vis-à-vis science-related posts (model) significantly affects mean scientificness ratings by receivers.

Secondary Hypothesis: Feature manipulation of pseudo-science-related social media posts (mimic) vis-à-vis science-related posts (model) significantly affects the degree by which the receivers select the mimic over the model.

Materials

To prepare the material for both studies, pairs of apparently similar social media posts were collected as screenprints from X in a database using the Google mobile simulator plug-in on Chrome. Each pair was supposed to contain one model (post with scientific content) and one mimic (post with pseudoscientific content with the same topic), where the mimic was somehow similar to the model concerning features that the literature mentions for science. From this database, ultimately, three pairs of "model m" and "mimic w" (w = wildtype = unmanipulated post from X) were selected for the studies (see Figure 1, "model m" and "mimic w").

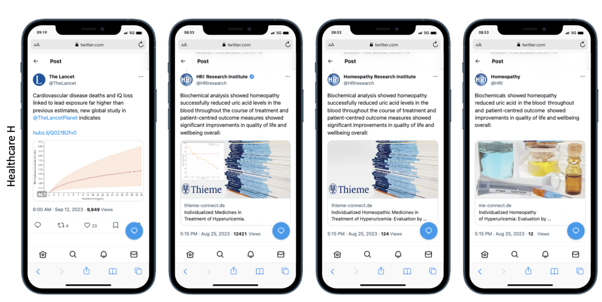

Figure 1: Four social media posts for the topic of healthcare: model m, mimic plus +, mimic wildtype w, mimic minus -, were used for Study B. Study A uses only pairings for model m and mimic w.

When we call the first post in a pair "model", and the other "mimic", this is not meant to imply that the latter has been shown to be a mimic. The terms "model" and "mimic" are functional terms; i.e., something can only be called a model if it plays a certain role in mimicry, and we haven't yet shown that there is real mimicry. The terms "model" and "mimic" are thus understood as putative roles in a possible mimicry. Note also that the mimicry will not take place at the level of the individual posts; i.e., if, in our database, a mimic is similar to a model, we don't want to say that the former has imitated the latter. Mimicry at most takes place at a higher level (mimics imitate the features of a bunch of models).

Study A: Preparatory survey to collect features of scientificness

Participants A total of 120 participants were recruited. Of these 120 participants (60 women, 60 men, average age 38 years old, 17 students (15.7%)), 108 completed the whole survey and were included in the analyses. A test run was performed with 15 participants to see whether everything ran smoothly. These 15 participants were excluded from the actual survey. Participants had to have an approval rating on Prolific of $\geq 95\%$, have English as their main language, and be U.S. American citizens.

Stimuli Three pairs of social media posts from X (Twitter), each about one of the three topics selected above, were presented to each participant in random order. As mentioned before, within each pair, the posts were similar in crucial respects; in particular, they were about the same topic. One post of each pair represented science as consensus of relevant experts in the field (Macedo, 2019) (model), and the other post represented pseudoscience (mimic, sometimes also mimic w(ildtype)).

Procedure Participants compared pairs of posts, selecting the more appealing one and rating its scientificness on a 7-point Likert scale from "highly non-scientific" to "highly scientific." They then chose up to three guiding features from a randomized list of 10 theoretical features, including images, titles, credentials, authority, and language. After rating scientificness, participants rated the credibility of the chosen posts on another 7-point scale from "highly non-credible" to "highly credible".

Finally, participants were asked to name additional (empirical) features that guided their ratings (at least one) into a text box. To make these general features specific to the survey posts, participants' text responses were recoded in two steps. First, responses were converted into science-related keywords using a semi-automated Python script. Next, keywords were classified into trust, look & feel, and language features. For instance, "institute" and "organization" were grouped under trust features, while terms like "facts" and "trustworthy" were categorized as professional under language features. The coding catalogue summarizes this classification:

1. **Trust features:** institute, sender, organization, IPCC, science, magazine, lancet.
2. **Look & Feel features** graphics, charts, data, numbers, statistic, percentages.
3. **Language features:** knowledge, facts, respectable, not propaganda, scientific, trustworthy, [understanding] comprehension, accessibility, easy to read, clarity, plain language, [catch words] bible reference, religion, climate.

Results To retrieve a syndrome for scientificness from this survey, the three most commonly chosen theoretical features from a list of 10 choices were further specified with classified empirical features (text entries). These had to occur at least twice in the dataset. Sixteen features fulfilled this criterion (see Table 1).

Scientificness is often assumed to be closely related to credibility. We found a significant positive correlation between scientificness and credibility averaged over all topics ($t(106) = 12.73$, $r = 0.78$, $p < 0.01$). This correlation was also a robust pattern for individual topics and even for model/mimicry within each topic separately. Because of these strong correlations, credibility was dropped for Study B, which instead focused on scientificness.

Of a total of 324 choices (108×3), 249 (77%) were in favor of the model, while 75 (23%) favored mimicry. At the level of participants, 51 (47%) chose only the model, and 57 chose at least one mimicry (40 (36%) chose 1 mimicry, 16 (16%) chose 2 mimicry, and only one (1%) participant chose all three mimicry posts). These counts lay the foundation for the four degrees of choosing the mimic (0, 1, 2, 3) used as a response variate for the secondary hypothesis in Study B.

Discussion The results from the preparatory Study A provided the following insight for the performance of Study B. First, the variability in average scientificness ratings showed that the posts were received differently. Second, the features identified within the posts corresponded with theoretical features from the literature. They thus serve as guidance (informed guess) for the manipulations of Study B. Third, credibility was tightly linked to scientificness and could thus be dropped for Study B.

Study B: Main experiment manipulating features of scientificness

Participants 660 participants (330 women, 330 men, average age 42 years old, 71 students (10.8%)) were recruited through Prolific. A test run with 20 participants was performed to ensure everything worked smoothly between Prolific and Qualtrics. Participants had to have an approval rating on Prolific of $\geq 95\%$, have English as their main language, and be U.S. American citizens at the time of taking the survey.

Stimuli For the experimental survey, mimic posts were manipulated by adding or removing scientificness features using tools like Photoshop, Firefly, and DALL-E 2. Features were selected based on ranked results from Study A. For instance, as "graphs" and "data" were linked to high scientificness, a statistical graph was added to a homeopathy post (homeopathy +), while a climate denialism post replaced a graph with a generic weather image (climate denialism -). Other elements, like text and titles, were similarly adjusted. Three pairs of posts per topic (climate change, evolution, healthcare) were created, with topics treated as repeated measures in the ANOVA model.

The aim of the manipulations was not to identify one particular feature or to estimate the relative causal importance of individual features for the attractiveness of the mimic. Rather, we wanted to find out whether it is at all possible to use the syndrome of scientificness to manipulate posts to obtain predictable effects. We cannot exclude that the manipulation of one feature had an impact on other features that influence how scientific the post appeared. At this stage, scientificness, as perceived by the participants, is best seen as a complex construct consisting of many features, and it is this construct that is manipulated. Accordingly, we can only say that, in the +/- case, there is overall more/less scientificness.

Procedure The statistical design and hypotheses were preregistered on the Open Science Framework.

Study B hypothesizes that manipulating features of pseudoscientific posts (mimics) compared to scientific posts (models) significantly impacts participants' scientificness ratings in a predictable way. The design includes three treatment levels (mimic with added, unmanipulated, or removed scientific features) across three topics (climate change, evolution, healthcare), with the difference in pairwise ratings as the dependent variable. A secondary hypothesis predicts that mimic manipulations affect how often participants choose mimics over models, with total mimic selections (0–3) as the dependent variable or a simpler distinction between those choosing only models and those choosing at least one mimic.

To avoid order effects, participants were randomly presented with three sets of pairs of posts (model vs. mimic +, model vs. unmanipulated mimic w; model vs. mimic -). The topic of each pair was determined randomly, with the constraint that each topic was chosen once such that each participant was confronted with all three topics. As in Study A, for each pair of posts (or, equivalently, topic), participants had to first "choose the post which is the more appealing one of the two" and then rate their chosen post for scientificness on a 7-point Likert scale from highly non-scientific to highly scientific. Then, participants also had to rate the other post, which they had found less appealing, on the same Likert scale. After they had done this for all three pairs of posts (topics), participants were asked the following question: "Have features of science influenced your choice of the more appealing posts?". Participants were asked to indicate their agreement with this question from "strongly disagree" to "strongly agree" on a 7-point Likert scale. This question was followed by the same three questions regarding science consensus from Study A regarding climate change, evolution, and healthcare, which

T: heoretical features (6) → E: mpirical features (16)	Climate		Evolution		Healthcare	
	s	p	s	p	s	p
T: General appearance (look & feel) of images, statistical graphs, data tables → E: Look & Feel Features: graphics (41), statistics (20)	48	14		18	45	16
T: Credibility of content → E: Trust Features: organization (22), verification (10)	40	10	46			12
T: Scientificness of content → E: Language Features: professional (16), understanding (4) Trust Feature: science (19)	30	12	38		33	
T: Language used (linguistic register) → E: Language Features: register (12), information (8)			40	5		12
T: Authority of sender such as known institution, journal, expert, celebrity → E: Trust Features: lanced (8), IPCC (6), Jordan Peterson (4)					29	
T: Catch words/phrases such as global warming, climate crisis, creation, genesis, homeopathy, lancet → E: Language Features: clarity (2), simplicity (2), bible (2), climate change (4)				7		

Table 1: The grey-colored cells in this table highlight the science features most frequently identified by participants to be relevant for rating the scientificness of social media posts (darker shading = less frequent). Each shaded cell can be read as corresponding to a symptom, and the whole collection of shaded cells as reflecting a syndrome of scientific appearance. Within each topic, adjacent shaded cells are the most likely candidates for features, which pseudoscience mimics to appear more scientific. The number of rows corresponds with the six most common theoretical features (T), which are matched up with the 16 most common empirical features (E), with the total number of occurrences in brackets behind each of the 16 features. The numbers in the table correspond with the number of occurrences of the theoretical features for the three topics climate, evolution, and healthcare, each for the science post (s) and the pseudoscience post (p).

were again presented in random order.

Results **Main hypothesis (Figure 2, left):** The modification of the social media posts had a significant effect on the scientificness ratings ($F(2,657) = 46.22,\ p < 0.01$). In addition, the independent variable topic climate change, evolution, and healthcare (treated as repeated measurements) was significant ($F(2,1314) = 49.53,\ p < 0.01$). Furthermore, the interaction between the modification and topic was also significant ($F(4,1314) = 9.31,\ p < 0.01$). Post-hoc testing revealed significant differences (0.05 significance level) between all pairs in "Climate", between mimic + and mimic w, and mimic + and mimic - in "Evolution", and between mimic + and mimic - in "Healthcare".

Secondary hypothesis (Figure 2, right): We pre-registered to test this hypothesis using Kruskal-Wallis, which is often used as an equivalent for the one-way ANOVA for non-parametric data, in this case, the manipulation of the social media posts mimicking science (the treatment), against the number of times a participant has chosen the mimic (0, 1, 2, or 3 times, the response variable). Kruskal-Wallis was not significant. However, we do obtain significant results when the data is aggregated further into two groups of participants: those who chose only the model and those who chose at least one mimic. Post-hoc pairwise testing (0.05 significance level) revealed a significant difference between the + and – treatments (p = 0.007), while the difference between the + and w treatments (p = 0.054) and the w and - treatments (p = 0.505) were not significant.

Discussion The results of Study B support the case for mimicry in social media posts with pseudoscientific content from the perspective of a biological analogy. As explained above, it is crucial for mimicry that the mimic benefits from becoming similar to the model (condition C). The main results show that the manipulation of several science-related features (the syndrome) in social media posts with pseudo-scientific content significantly affects the mean scientificness ratings of participants as predicted. The results also show that the manipulations significantly affect the frequency by which posts from different topics are chosen (clicks). The mimic becomes more attractive to potential receivers when a collection of common features becomes more similar to the model and thus has a likely advantage in harvesting attention, which translates into the currency of clicks in the digital domain.

Although unlikely, it is in principle possible that all participants who chose the mimic knew what they were choosing and thus that no one has mistaken the mimic for the model. This raises the question of whether anyone has been duped in the same sense that the insect has been duped into mistaking the flower for a mating partner. We can answer this question by taking a different perspective: All participants with positive scientificness rating differences for any of the three topics have, through this positive difference, indicated that their chosen post appeared to them more scientific than the other post. But if their chosen post was the mimic, they were mistaken. Of all the clicks in Study B, 39% (N = 186) were mistaken in this way. And these mistaken clicks were performed by 32% (N = 159) of all participants, most of whom (N = 157) were in the group of participants who chose 1 or 2 mimics (only 2 out of 30 participants in the group choosing 3 mimics were also mistaken in this way).

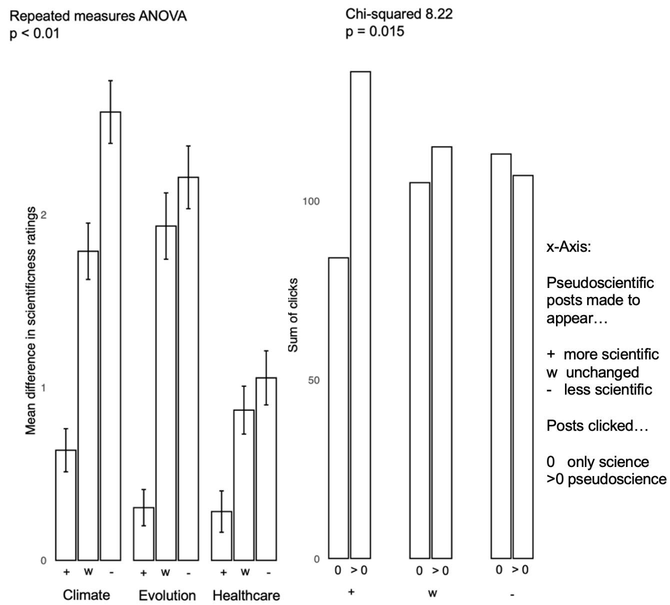

Figure 2: Left: Bar plot showing mean differences of the pairwise ratings of social media posts (±1 sem) from X containing either pseudoscientific or scientific content from three topics. The pseudoscientific posts were manipulated to contain *more science features* (+) or *less science features* (-) or were left *unchanged* (w). Participants' ability to distinguish between pseudoscientific and scientific posts significantly increased with decreasing number of science features in the pseudoscientific post (from (+) to (-)). Right: Bar plot showing the number of participants who either clicked the science post for all three topics (0) or one, two or three pseudoscientific posts > 0 for the groups of posts with science features added (+) or removed (-) or left unchanged (w). A significantly higher proportion of participants clicked the pseudoscientific posts when these posts were made to appear more scientific (+).

General Discussion

Our study shows that pseudoscientific social media posts resembling scientific ones are more likely to attract clicks and be rated as scientific. Manipulating features such as graphs, statistics, and institutional affiliations demonstrated that these elements enhance the perceived scientificness of pseudoscientific posts, supporting the hypothesis that mimicry increases their appeal. This aligns with mimicry theory, where imitation serves as an adaptive strategy to exploit the credibility of established science, even though our study does not establish evolutionary mimicry.

Critics might argue that the resemblance between pseudoscience and science arises from chance or shared origins rather than mimicry. While common historical roots, such as herbal medicine in homeopathy, may explain some similarities, mimicry often involves purposeful imitation paired with deceit to gain credibility. For instance, pseudosciences such as homeopathy benefit from mimicking scientific features without undergoing the rigorous validation processes of science, exploiting credibility at the expense of both science and consumers. This asymmetric relationship highlights how pseudoscience thrives by "abusing" the reputation of its scientific counterpart.

The broader relevance of mimicry theory to pseudosciences beyond homeopathy and creation science is less clear but plausible. Fields like astrology and anthroposophy exhibit mimicry elements, such as adopting scientific terms, institutions, or research-like practices, even if they lack strong resemblance to specific scientific disciplines. These examples suggest a spectrum of mimicry, where some pseudosciences develop fully scientific façades while others only imitate selectively. This variation aligns with evolutionary perspectives, where mimicry evolves differently based on environmental pressures and selection regimes. Future studies could further explore these dynamics to better understand the extent and impact of pseudoscientific mimicry.

Conclusions and Future Research

This paper lays the groundwork for two future research directions: conceptually studying mimicry in cultural systems through controlled experiments and practically applying the mimicry framework to combat online misinformation. First, digital platforms offer an ideal environment to explore the evolution of mimicry due to their rapid, high-fidelity interactions. Experiments could track the evolution of artificially created, false posts as they adapt to resemble credible content. This approach could extend to more recent formats like TikTok or YouTube shorts, offering insights into how posts mimic credible information to achieve virality.

Second, applying the mimicry framework to misinformation could reveal how specific features (e.g., visuals, linguistic framing, or authority cues) exploit cognitive biases like confirmation bias or trust in authority. Future studies could systematically manipulate and assess these features' impact on user engagement and trust. Researchers could also examine the "arms race" between misinformation producers and countermeasures like fact-checking, exploring how misinformation evolves to evade detection. Additionally, interventions such as digital literacy training, personalized nudges, and tools to flag mimicry features could enhance epistemic vigilance, equipping users to recognize and counter misleading content.

Finally, social media platforms could be repurposed as experimental grounds to address misinformation. By training algorithms to recognize mimicry features in pseudoscientific content, platforms could automate the detection and flagging of misleading material. Such methods, alongside user education and critical thinking initiatives, could reduce the spread of pseudoscience. This scalable and resource-efficient approach could complement existing fact-checking systems and offer a novel way to mitigate the influence of misinformation in digital spaces.

References

Blancke, S., Boudry, M., & Pigliucci, M. (2017). Why do irrational beliefs mimic science? *Theoria: The Cultural Evolution of Pseudoscience*, *83*(1), 87–97.

Blancke, S., & de Smed, J. (2013). Evolved to be irrational? evolutionary and cognitive foundations of pseudosciences. In M. Pigliucci & M. Boudry (Eds.), *Philosophy of pseudoscience: reconsidering the demarcation problem* (pp. 361–380). The University of Chicago Press.

Boudry, M., Blancke, S., & Pigliucci, M. (2015). What makes weird beliefs thrive? the epidemiology of pseudoscience. *Philosophical Psychology*, *28*(8), 1177–1198. doi: 10.1080/09515089.2014.971946

Boudry, M., & Braeckman, J. (2011). Immunizing strategies and epistemic defense mechanisms. *Philosophia*, *39*(1), 145–161. doi: 10.1007/s11406-010-9254-9

Bromme, R., Scharrer, L., Stadtler, M., Hömberg, J., & Torspecken, R. (2015). Is it believable when it's scientific? how scientific discourse style influences laypeople's resolution of conflicts. *Journal of Research in Science Teaching*, *52*(1), 36–57. doi: 10.1002/tea.21172

Correvon, H., & Pouyanne, M. (1916). A curious case of mimicry in ophrys. *J Soc Nat Horticult France*, *4*, 29–47.

Futuyma, D. J., & Kirkpatrick, M. (2018). *Evolution (4 ed.)*. Oxford University Press.

Hansson, S. O. (2013). Defining pseudoscience and science. In M. Pigliucci & M. Boudry (Eds.), *Philosophy of pseudoscience: reconsidering the demarcation problem* (pp. 61–78). The University of Chicago Press.

Hansson, S. O. (2021). *Science and pseudo-science.* Retrieved from `https://plato.stanford.edu/entries/pseudo-science/` (The Stanford Encyclopedia of Philosophy, E. N. Zaltas)

Jager, M. L. D., & Anderson, B. (2019). When is resemblance mimicry? *Functional Ecology*, *33*(9), 1586–1596. doi: 10.1111/1365-2435.13346

Macedo, S. (2019). Why trust science? perspectives from the history and philosophy of science. In N. Oreskes (Ed.), *Why trust science?* (pp. 1–147). Princeton University Press.

Mahner, M. (2013). How to demarcate after the (alleged) demise of the demarcation problem. In M. Pigliucci & M. Boudry (Eds.), *Philosophy of pseudoscience: reconsidering the demarcation problem* (pp. 29–44). The University of Chicago Press.

Mesoudi, A. (2011). *Cultural evolution: how darwinian theory can explain human culture and synthesize the social sciences*. The University of Chicago Press.

Mueller, L. (2020). 1930 evolution of mimicry. In L. Mueller (Ed.), *Conceptual breakthroughs in evolutionary ecology* (pp. 15–16). Academic Press. doi: 10.1016/B978-0-12-816013-8.00006-5

Mukerji, N., & Ernst, E. (2022). Why homeopathy is pseudoscience. *Synthese*, *200*. doi: 10.1007/s11229-022-03882-w

Oreskes, N. (2019). Systematicity is necessary but not sufficient: on the problem of facsimile science. *Synthese*, *196*, 881–905. doi: 10.1007/s11229-017-1481-1

Reuter, K., & Baumgartner, L. (2025). Conspiracy Theories Are Not Theories: Time to Rename Conspiracy Theories. In M. Isaac, S. Koch, & K. Scharp (Eds.), *New Perspectives on Conceptual Engineering.* Springer.

Thomm, E., & Bromme, R. (2011). It should at least seem scientific! textual features of scientificness and their impact on lay assessments of online information. *Science Education*, *96*(2), 187–211.

Vereecken, N. J., & Schiestl, F. P. (2008). The evolution of imperfect floral mimicry. *Proc Natl Acad Sci U S A*, *105*(21), 7484–7488. doi: 10.1073/pnas.0800194105