# Resilient Turns:

## *Epistrophe, Incrementum, Metonymy*

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**Abstract:** In this essay, we demonstrate how rhetorical analyses of style can maintain their focus on linguistic patterns while simultaneously attending to material ones. Focusing on the trope of metonymy and the figures of *incrementum* and *epistrophe*, we show how these devices represent different modes of material-semiotic addressivity, resiliently turning and reconfiguring the rhetorical ecologies they capacitate. Using three case studies—a corpus of news articles about water quality amid extensive wind turbine development in Chatham-Kent, Ontario; traditional and "rogue" pain scales; and scientific literature about CRISPR—we explore the stylistic affordances of *epistrophe*, *incrementum*, and metonymy, showing how these "turnings" allow resilient material-semiotic articulations. We conclude by suggesting how our framework may be applied and extended to other topics and how this understanding of tropes and figures may align with other research trajectories in RSTM.

**Keywords:** style; rhetoric of science; tropes; figures; rhetorical ecology

## Introduction

Scholarship on tropes and figures in ARSTM tends to fall (loosely) into two camps. In the first camp, we might identify foundational work by Jeanne Fahnestock, Ken Baake, Elizabeth Shea, Randy Harris, and many others, all of whom have called attention to the fundamental work tropes and figures perform in scientific

discourse. These figures do persuasive work, of course, but these scholars have shown that they do much more than that by offering inventional resources for scientific thought (or, in Harris' view, *all* thought) or by epitomizing arguments (Fahnestock). In their view, tropes and figures are ubiquitous as patterns and forms, and we can recognize them at work in almost any linguistic domain.

In the second group, we might place scholars invested in new materialist interpretations, who focus on tropes as a productive way to develop notions of ecological relationality that bear theoretical similarities to Nathan Stormer and Bridie McGreavey's work on resilience. These scholars note that the term "trope" derives from the Greek τροπή, meaning "turn" or "change," an etymology shared by scientific terms that index material, ecological relations such as "heliotrope" (Muckelbauer, 2016), "tropic," and "trophic" (Druschke, 2019; Keeling & Prairie, 2018). Among them, John Muckelbauer argues for a post-human rhetorical theory centered around the concept of trope as an affective mode of material relationality and change (Muckelbauer, 2016, p. 40). Building on Muckelbauer's work, Thomas Rickert suggests that a theory of tropological "turning" helps trace how organisms rhetorically *turn to* and *turn with* other organisms (Walsh *et al.*, 2017, p. 453). In a similar vein, Diane Keeling and Jennifer Prairie (2018) use the concept of tropological "turning" to identify a kind of rhetorical engagement that, like resilience, places critical emphasis on rhetorical addressivity, affectivity, and responsivity. They argue that "different modes of response…are indicative of different tropes," and so "the ways organisms interact with each other and their environments are tropic" (Keeling & Prairie, 2018, p. 47). These scholars shift our understanding beyond words alone to consider tropes as rhetorical modes of engagement and transformation.

This outline may suggest two irreconcilable approaches to understanding tropes and figures. However, the camps we just set up are not so neatly divided. Indeed, one can see this more traditional scholarship on tropes and figures as tracing language's resilient stylistic capacities for rearticulating natural and technological phenomena in ways that suasively attune audiences, arguments, and inventions. Charles Bazerman, for instance, showed how verbal and material floral metaphors were used to market early electric light fixtures in ways that resiliently turned two otherwise distinct discourses—the new discourse of electric innovation and the traditional discourse of feminine domesticity—

towards a more attuned articulation (1999, pp. 313-326). Similarly, in *Rhetorical Figures in Science,* Fahnestock (2002) identifies figures as resilient visual-material devices that range from Faraday's "elector-magnetic rotation apparatus," a visual (and material) *antimetabole* (p. 147), to the visual antithesis in Darwin's depictions of dogs' opposite postures in *The Expression of Emotions in Man and Animals* (p. 67). Moreover, in his recent work on cognitive rhetoric, Harris posits a different kind of material resiliency, suggesting that rhetorical figures are cognitive patterns that can be repurposed across situations but that nonetheless constitute durable "grooves of the mind" (2013, p. 4). Figurative structures persist because they attune both neuro-anatomic materiality and linguistic rhetorical arrangements.

Meanwhile, those espousing materialist approaches do not intend to set aside linguistic creativity but to identify the discursive transformations that occur as material assemblages evolve and intra-act. If, as Keeling and Prairie put it, different tropes are indicative of different modes of affective engagement and change, then rhetorical analyses versed in tropes and figures can help specify different material-semiotic transformations. For instance, Scott Graham (2015) argues that metaphor, metonymy, and synecdoche, respectively, characterize increasingly tight material-semiotic couplings between medical technologies and the images they produce. For instance, he notes that early x-ray technology was described metaphorically, as a type of lantern, in a way that did not yet couple the x-ray with its characteristic image. Later, however, technologies such as CT scans were represented metonymically as agents able to "take pictures," which represents a tighter coupling between the technology and its image (Graham, 2015, p. 134).

In what follows, we demonstrate how rhetorical analyses of style can maintain their focus on linguistic patterns while simultaneously attending to material ones. Focusing on the trope of metonymy and the figures of *incrementum* and *epistrophe*, we show how these devices represent different modes of material-semiotic addressivity, resiliently turning and reconfiguring the rhetorical ecologies they capacitate. Detailing the stylistic affordances of *incrementum*, *epistrophe*, and metonymy, we show how these "turnings" enable resilient material-semiotic articulations. To study rhetoric in this way is to explore how materiality is marked and animated by stylistic transformations, evolutions which rhetorical analysis is well-prepared to investigate. Stylistic devices can attune, turn, and change the ambient rhetorical environment, often in ways that

allow rhetors to become more engaged in discourses that might otherwise exclude them, their motivations, and their arguments.

## *Epistrophe*

Schemes of repetition allow for adaptation and stability, for the new to arise out of the old or traditional, and for mobile rhetorical assemblages that can respond flexibly to changing situations. In her work on style, Jeanne Fahnestock (2011) positions figures of repetition, including *epistrophe*, among figures of argument—that is, figures for which "the very form of a statement, its grammatical arrangement, was considered to carry meaning itself" (p. 223). In particular, the figure of *epistrophe*, or repeated end units in successive clauses or sentences, follows the trend of other figures using parallelism that "equalizes or coordinates content, and this equalizing can have persuasive consequences as listeners and readers 'consume' statements formed into smaller units" (Fahnestock, 2011, p. 224). In what follows we demonstrate how to understand *epistrophe* as a resilient rhetorical force, coordinating and ordering what might otherwise seem like disparate, disconnected events within a community.

We use a case study of controversies surrounding water quality amid extensive wind turbine development in Chatham-Kent, Ontario, a traditionally agricultural community that has recently become home to hundreds of wind turbines. Farmers initially signed up to place turbines on their farmland, attracted by the promise of money in exchange for use of just a small portion of their land. Soon, though, rural folks started noticing changes in their well water. As more turbines were introduced, their water got cloudy, full of dark particles that, in some cases, made their water undrinkable and unusable. Concerned residents founded Water Wells First (WWF), an organization seeking to advocate for those who say their water has been damaged by the wind turbines. According to WWF, the vibrations from pile driving turbine bases deep into the ground disrupt the Kettle Point black shale bedrock beneath and, they say, may destroy the underground aquifer upon which rural citizens depend for their water. To determine how discourse about this event functions, this analysis draws on a corpus of news articles about this issue between 2016 and 2019. Here, we present instances of how *epistrophe* occurred across this archive to support the claim that wind turbines had caused the water quality problems.

Schemes of repetition occur regularly in newspaper accounts in which WWF representatives and local community members speak about the water quality problems they face. Within a given article, they often appear when speakers wish to emphasize a point about the effects of wind turbine development on their wells. Here are just a few examples from news articles that are textbook instances of schemes of repetition, such as this quote from a homeowner who says her well was damaged: "Mais c'est bizarre: mon puits **est perdu**, le puits voisin **est perdu**, le puits sur l'autre concession **est perdu**. Tout **est perdu** depuis qu'ils ont commencé avec North Wind" ("But it's odd: my well **is lost**, the neighboring well **is lost**, the well on the other concession **is lost**. All **is lost** since they started with North Wind") (qtd. in Pham & Lefevre, 2017). In this passage, the speaker employs *epistrophe* (repetition of the last words in a clause) across three connected clauses and then repeats the clause "est perdu" at the beginning of the next sentence. These sentences link three different events, syntactically and logically under the final repetition, "tout est perdu" ("all is lost"). This links disparate events under a shared grammatical structure and, by implication, a causal one as well. In other words, the grammatical structure of the sentence reinforces its logical structure. It is worth noting that the first sentence in the quote also employs *epanaphora*, repetition of a beginning clause, since each one begins with "le puits" ("the well"). Through these two schemes of repetition, *epistrophe* and *epanaphora*, what might be seen as three disconnected events—three wells going bad—is turned, rhetorically, into a single phenomenon. This rhetorical connection is important because rural community members could not establish a scientific connection between these events in a way that was persuasive to the municipal government.

We see a similar structure in this example from a letter to the editor published in *Farmer's Forum*: "The first five turbines built in Dover **affected water wells**; the next 35 **affected more water wells**. The next in Chatham township **affected water wells**. If you keep doing the same thing can you expect different results?" (Hensel, 2018). Here, the speaker relies once again on three clauses or sentences linked epistrophically, focusing on different sets of wind turbines that "affected water wells." Here again, disparate events become linked logically by the grammatical structure, and the final sentence reinforces that argument (in this case with a rhetorical question). Fahnestock explains that parallelism (especially when combined with strategic repetition) often supports inductive arguments (2011, p. 227). Both examples discussed thus

far rely on the repetition of an event—the poisoning of wells—that occurs in physical space as well as inductive reasoning wherein these repeated events lead to a conclusion or generalization. These examples coincide with the initial stage of WWF's advocacy, which involved raising awareness of the affected wells and seeking answers about how they had become contaminated.

Facing an uphill battle, rhetorically, WWF members and their allies continued to argue epistrophically, turning the discourse affectively as well as logically. Increasingly, rural community members became distrustful as the municipal and corporate officials placed the burden of proof on WWF to show that water well quality was affected by wind turbines and not simply a random set of occurrences due to the ages of the wells or poor maintenance. The following two quotations use a similar tripartite structure to the examples above, only here the *epistrophe* emphasizes an ambivalent sense that something harmful is happening and no one knows why:

- "I think we have to take some very strong action here because we don't know **what is going on**. At best, all we know is that something seems t**o be going on**, and the people in Chatham-Kent with water wells need to know **what is going on**" (Corcoran, 2017 August).

- "People **are worried** about their health and they **are worried** about their property valuation and people **are worried** about water. We have to protect the water security of Chatham-Kent" (Corcoran, 2017 September)

In each of these cases, the repeated terms, "what is going on" or "are worried," invoke an unknowable crisis and, possibly, a conspiracy. The first sentence features *epistrophe*, while the second features a different scheme of repetition, *mesodiplosis*, or repetition of words in the middle of a sentence. Unlike the previous example, which suggests a causal relationship, these evoke a shared affective sense that something is amiss. These appeals coincide with WWF's increasing emphasis, rhetorically, on the potential health problems associated with consuming the "dirty" or "contaminated" water from affected wells.

The examples included here are not particularly notable as rhetorical performances in the traditional sense. The people interviewed in these articles offer up examples from their personal

experience of how the wind turbines have affected water supply for them, their families, their pets, their livestock, and even their appliances. Yet their language is steeped in rhetorical figures and schemes. (With more space, we could go on to identify frequent use of rhetorical questions, adages drawn from the experiences of rural life, and other devices common to oral speech reflected in newspaper interviews.)

   Phrases linked by *epistrophe* allowed speakers to connect events, grammatically and logically, that might otherwise be considered random or disconnected. Repetition, more broadly, offers a resilient way to turn ambiguity in their favor, forging a resilient response to concerns that, to date, have not been resolved.

## *Incrementum*

In her foundational book, *Rhetorical Figures in Science*, Fahnestock (2002) explains that an *incrementum* "expresses an ordered series, a series that goes somewhere," one that typically ascends "from the bottom to the top of an accepted hierarchy" (p. 92). *Incrementum*, she argues, can work in multiple ways: by implying that the items in the series "belong in the same category" (p. 95), "spanning the conceptual gap" between disparate items, "rhetorically lengthening" the space between items (p. 97), and "reduc[ing] the separation between groups" (p. 113). Fahnestock notes that *incrementum* is frequently used in biomedicine to, for instance, triage patients in the hospital (p. 95) and understand disabilities on a spectrum (p. 113).

   Accordingly, it makes sense that healthcare providers and researchers turn to pain scales to order, evaluate, and treat pain, a resilient embodied rhetorical phenomenon. Pain scales are visual-verbal tools that primarily employ the figure of *incrementum* to "detect changes in pain with pain treatment or procedures known to produce pain" (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011, p. 2399). To analyze these scales is to delve into the "biomedical backstage," where the "material-discursive performance" of pain is *turned* into "manageable bits and bytes" (Teston, 2017, p. 171). Pain scales, then, do not merely represent pain. As we argue, even the commonly used Wong-Baker FACES Pain Scale, which was developed for children, opens patients and healthcare providers to arguments about what pain can be and might become. In this section, we examine how *incrementum* helps us understand the FACES Pain Scale and a number of alternative "rogue" pain scales.

As we will show, these rogue pain scales renegotiate the typical pain scale formation, present incomplete or overlapping series, or eschew series entirely, thereby turning the form of the traditional pain scale. As such, these alternative scales suggest that standard pain scales are not merely linear measurements: they turn patients and their healthcare providers toward new possibilities for understanding the felt experience of pain.

   Although anesthesia was first used in the mid-1800s, measuring pain did not become an American fascination until the end of World War II (Ball & Westhorpe, 2011, p. 529). The first visual analogue pain scale was developed in 1966, and it served as the inspiration for Dr. Donna Wong and Connie M. Baker's Wong-Baker FACES Pain scale, which they developed in the 1980s. They published the first version in 1988 and a revision in 1995 (Baker, 2016). Wong and Baker contend that the scale was "drawn by children in pain who wanted to convey their suffering as quickly and meaningfully as possible" (p. 297). However, a meta-analysis suggests that it is now used with both adults and children (Tomlinson, von Baeyer, Stinson, & Sung, 2010, p. e1173). On the instruction sheet (see fig. 1), healthcare providers are told to select the term "hurt" or "pain"— "whichever seems right for a particular child"—and say

> These faces show how much something can hurt. This face [point to face on far left] shows no pain. The faces show more and more pain [point to each from left to right] up to this one [point to face on far right] - it shows very much pain. Point to the face that shows how much you hurt [right now].
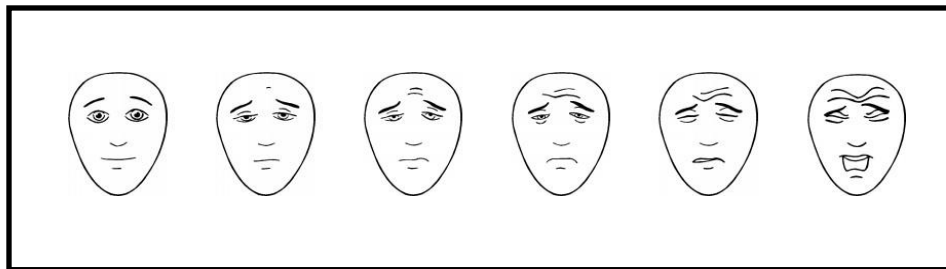


Figure 1. Faces Pain Scale – Revised (FPS-R) ©2001, International Association for the Study of Pain. Available from www.iasp-pain.org/FPSR

   This scale shows a series of faces, starting with a seemingly neutral expression and climaxing with a final, agonized expression in which the person's mouth is open as if they are screaming. The

final face's forehead is wrinkled and their eyes are squeezed shut due to overwhelming misery. The description of the faces transitioning from showing no pain to "show[ing] more and more pain" is a traditional *incrementum* following an Anglo-European left-right processing pattern. Small features on the faces shift as the pain increases: the eyes move from open to squeezed shut, the forehead transitions from unwrinkled to wrinkled, and the mouth moves from a seemingly neutral half-smile to a scream. The scale persuades us to view pain as a bounded experience that increases at equal increments. It makes pain seem controllable and scalable, since there is a clear beginning and end to the pain experience. Notably, studies suggest that the most valuable aspect of the faces scale is seeing how scores change over time (Tomlinson *et al.*, 2010, p. e1187). In all, in this scale, a person's pain is rendered visible and quantifiable based on increasingly tormented facial expressions.

Intriguingly, rogue pain scales trope on this scale to show how the embodied experience of pain is vastly different. For patients with chronic pain, the problems with this scale and its directions for use are obvious. The scale does not account for how people experience multiple types of pain in different places, how people experience pain differently, nor how people have learned to internalize pain. Thus, patients with both chronic and acute pain conditions have taken to creating their own pain scales. These scales, which are circulated on social media sites in the form of memes and graphics, show how traditional linear, unambiguous pain scales invalidate their nonlinear, ambiguous experiences of living with pain. These alternative scales more clearly express the resilience of pain in its multiplicity—its varying types, locations, triggers, and contexts. Notably, many of these "rogue" pain scales renegotiate the typical pain scale formation, present incomplete or overlapping series, or eschew series entirely, thereby shifting the form of the pain scale to better reflect the individual and somewhat ineffable experience of experiencing pain. Alternative pain scales generally do not have a clear author nor origin. Accordingly, we chose to focus on two series that are most clearly troping on the Wong-Baker FACES Pain Scale: the so-called "Improved Pain Scale" and the "Fibro Bunny" series, both of which examine the qualitative changes in felt pain.

The so-called "Improved Pain Scale" highlights the inadequacy of the FACES and other common pain scales (see fig. 2). While the scale still functions incrementally, with the numeric scale imposing and regulating an *incrementum*, each increment is a vastly different unit of measure. The "Improved Pain Scale" begins at 1 and ends at

10, but it is presented in two vertical columns, which makes the items appear less closely connected. The phrasing of the first item, "It might be an itch," suggests that it is unclear if a person is experiencing pain, and if so, what kind of pain. This is different from the FACES scale, which begins with "no pain" and does not specify any particular pain sensations (such as itching or burning, or as this scale later describes, bee stings). Questions about the existence and type of pain persist through item 5. From there, the distance between each item increases exponentially—from "Bees!" to "I can't move it hurts so bad" to "Mauled by a bear or ninjas." The scale ends with "unconscious," implying that a person is no longer capable of rating their pain. In this scale, both the quantitative measures and qualitative types of pain are increasing. Because the images do not show the same kind of overall iconic progression, they better represent the unpredictable yet persistent experience of living with pain.



Figure 2. "Improved Pain Scale." Unknown Author. Available from https://www.reddit.com/r/nursing/comments/6y4iia/an_improved_pain_scale/

The "Fibro Bunny" pain scale, in contrast, shows how individuals can further turn the original pain scale toward one that addresses embodied pain experiences. This scale tropes on the Wong-Baker Pain Scale to better represent the experience of living with fibromyalgia, an ambiguous chronic illness thought to be caused by overactive nerves. There is not yet a meaningful diagnostic test for this condition and its symptoms range from widespread musculoskeletal pain to cognitive difficulties. Accordingly, the so-called "Fibro Bunny" eschews a linear scale. Instead, to demonstrate the limits of *incrementum*, it uses a chart format to document the different types of pain—ranging from no discomfort to agony—that fibromyalgia patients experience. The creator(s) use colors and short captions to visually and verbally explain the intricacies of fibromyalgia.

The chart begins with "What is pain? I feel great!" and a seemingly happy bunny surrounded by sparkly bursts, implying positivity and energy. If read left to right or top to bottom, the bunnies depict varying types of pain and illness related to fibromyalgia. However, one symptom does not necessarily cause another. For example, the third bunny's caption, "I'm feeling some pain in my head. NOT COOL MAN!," is followed by another bunny, captioned, "Why am I so exhausted?" Although, plausibly, head pain could contribute to exhaustion, it usually does not cause it. Some units on the scale, however, are positioned in a more linear fashion. For example, the "Why am I so exhausted?" bunny comes before the "I feel like I could sleep for five days!!!" bunny. As a result, the scale ends with a bunny that has fire in its eyes, posed with an upturned, tight fist, saying "Did someone just set my body on fire? Sh*t just got real! HELP!" For fibromyalgia patients who transition between these different levels of pain on a daily basis, this bunny may represent a climax in their pain, but more likely, a buildup of exhaustion and frustration about experiencing pain that eventually boils over.

With these pain scales, patients turn the original scale toward a version that humorously validates patients' embodied experiences. Pain itself is resilient and has, to adopt Stormer and McGreavy's terms, "capacitated" others in the rhetorical ecology of pain management to trope on traditional pain scales as a means of understanding, representing, and clarifying their felt sense of pain. Instead of rejecting the pain scales entirely, users further develop them to better meet the needs of their evolving environments,

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allowing patients to rearticulate their felt experiences of pain. Accordingly, rogue pain scales are not simply linguistic critiques of pain descriptors; they are, instead, indicative of the ways that rhetorical ecologies are always open to troping.
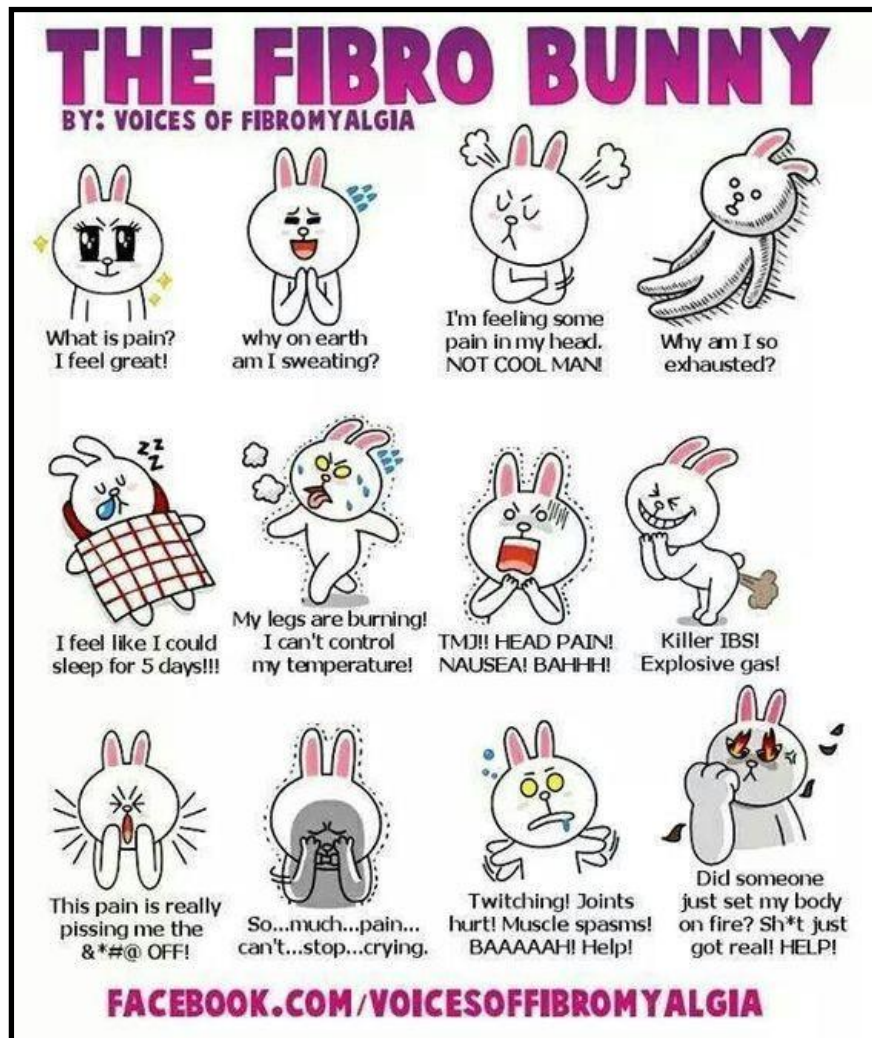


Figure 3. "The Fibro Bunny." Unknown Author. Available from https://pin.it/pa6z7asic57lzu.

## Metonymy

Thus far our analyses of stylistic turnings highlight ways rhetors can leverage language's material arrangement to resiliently turn and transform rhetorical engagement. In the next section, we approach material-semiotic resilience from the other direction, showing how a material transformation is equally appreciable as a linguistic and conceptual turning of one thing into another.

We do this by focusing on metonymy, a trope that has not received much attention in rhetorical analyses of science. Yet in his classic essay "Four master tropes" (1941), Kenneth Burke argued that science is decidedly metonymic because of its predilection for *turning* phenomenal effects into material causes (as when, in a poetic sense, we metonymically refer to love as "the heart" or, in a scientific vein, reduce love to the action of neurochemistry). As a discipline, Burke asserted, science's ideology goes beyond merely ascertaining correlation to advance reductive, causal, metonymic substitutions. Perhaps this is why Burke's description of science's metonymic disciplinarity has generally gone unremarked; the reduction of phenomenal effect to material cause is so central to scientific ideology that we often accept it without realizing it is a rhetorical, metonymic *turning* of one thing to another. Burke's attention was directed toward the kind of "basic science" that is principally concerned with studying material causes, and it's quite possible his observation still holds true in that regard. Yet much of the recent work in science studies suggests science is as much a project of technological fabrication as it is a practice of knowledge construction. While scientists are still motivated by the causal ideology Burke identified, they are likewise invested in fabricating technologies that allow them to instrumentalize causes. In this section, we explore technoscientific rhetoricity using Burke's method of tracing science's metonymic transformations.

As a case study, we trace important turns in the metonymic development of one of biology's most heralded technological advances, CRISPR/Cas9 genetic engineering (hereon referred to as CRISPR). We argue CRISPR technoscience was advanced by metonymic turnings in which scientists gradually reimagined CRISPR agents as technological instruments (as when we metonymically refer to journalists, the agents of journalism, by their paradigmatic instrument, calling them "the press"). Metonymies are tropes in which the close association of two entities (like agent and instrument) allow one to be substituted for the other. This same metonymic logic of close association made CRISPR's invention possible, as every indication of CRISPR's own power could be troped as a potential instrument. Thus, what advanced and invented CRISPR technoscience is a kind of metonymic *resilience* in which CRISPR's agency could be *turned* into an instrument.

Making this case requires a brief précis on what CRISPR is, for though it is best known as genetic engineering technology, that is

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not its only form, nor its primary one. In the first instance, CRISPR is actually a naturally occurring bacterial immune system capable of rewriting bacterial genes in response to viral infections. Identifying CRISPR as a natural genetic agent was a radical discovery for microbiologists. For whereas classical genetics generally holds that a species' genome determines its traits, CRISPR offers evidence that organismal traits (in this case the CRISPR system) can determine genomes. As a number of bacteriologists suggest, this makes CRISPR an agent of Lamarckian evolution by acquired characteristics, as opposed to neo-Darwinian evolution by genetic mutation and natural selection. It took a number of years for bacteriologists to understand that CRISPR was agentially causing evolutionary change by rewriting genes, but as this became apparent, evidence of CRISPR's agency was resiliently, metonymically troped as evidence it could be turned into an instrument.

Take, for example, one of the pivotal early studies of CRISPR led by Rodolphe Barrangou (2007) in which the potential to metonymically turn CRISPR from agent to instrument was an underlying motivation. Though the study's avowed purpose was simply to understand CRISPR's biochemical actions, the scientists also made clear they believed CRISPR's agency might be instrumentalizable. In this regard, it is important to note that Barrangou's research team was largely employed by Danisco, a food conglomerate that developed bacterial cultures for the dairy industry. Danisco's cultured bacteria were frequently killed by the same viral infections that harm wild bacteria. The researchers believed that understanding CRISPR's evolutionary agency—its ability to evolve bacteria with viral immunities—might bring them closer to developing CRISPR-based technology that could provide similar antiviral immunities (Barrangou *et al.*, 2007, p. 1709-1710). As Burke (1969) might say, these scientists were doing more than merely describing nature in "scenic" terms (p. 41); their research was motivated by a metonymic inclination to turn CRISPR from a natural evolutionary agent into a genetic engineering instrument. The scientists themselves acknowledged this in their conclusion. They first pointed out that their research tended to confirm that CRISPR is an agent of genetic evolutionary change, writing that because CRISPR alters bacterial genomes in response to hostile viruses, "it likely plays a significant role in [bacterial] evolution…" (Barrangou *et al.*, 2007, p. 1711). Then they immediately suggested that this evolutionary agent could be instrumentalized. They wrote that because CRISPR evolves bacteria in response to viruses, it

"may accordingly be exploited as a virus defense mechanism and also potentially used to reduce the dissemination of mobile genetic elements [other deleterious genetic infections]…" (Barrangou *et al.*, 2007, p. 1711-1712). It is precisely because of CRISPR's evolutionary agency that it "may accordingly be exploited" and "potentially used" as an instrument. Such inventional rhetoric demonstrates a metonymic troping in which an openness to CRISPR's agency helps scientists to begin resiliently thinking about it as a tool.

Such resilience marked a number of other CRISPR-related scientific advances. One of these was reported by Makarova, Grishin, Shabalina, Wolf, & Koonin (2006), who were the first to explicitly suggest CRISPR might cause Lamarckian evolution. They postulated this theory in their conclusion, writing, "Interestingly, as a mechanism of inheritance of acquired traits, CASS seems to come closest to a true Lamarckian mode of evolution among all known systems of heredity" (Makarova *et al.*, 2006, p. 16). Then, just like Barrangou *et al.*, they quickly followed this description of evolutionary agency with the suggestion that such agency could be instrumentalized. They write that CRISPR's ability to rewrite genetic code could be "exploited to silence any gene in organisms that encode [the CRISPR system]" (Makarova *et al.*, 2006, p. 17). Again, it is because CRISPR naturally acts on genetic texts that these scientists can resiliently reimagine it as a potential genetic engineering technology. In a sentence following that suggestion, Makarova *et al.* went so far as to propose that constructing such technology might even be "simple," given that the capacity for acting on genetic texts already exists within natural CRISPR systems (p. 17). Describing the transformation from agent to instrument as "simple" leverages the same logic of close association that undergirds the agent-instrument metonymic pairing. Since agency and instrumentality are, metonymically, so closely associated,[1] the movement from one metonymic state to the other

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[1] Though Burke generally equates "agency" with instrumentality, we use it here to describe the causal capacities of agents. Interestingly, the multiple meanings of the words "agency" may be the result of the same metonymic logic that closely associates agent and instrument. The *Oxford English Dictionary* notes that the word "agency" can be used to refer to either the capacity for action, the instrument of an actor, or the actor itself ("agency, n."). Undergirding what seems like lexical ambiguity might be a very reasonable metonymic tendency to closely associate and substitute agents, their causal capacities, and instruments.

could be, conceptually, quite "simple." That CRISPR is a natural evolutionary agent is no obstruction to it also being inventionally turned into an engineering instrument. By being open to CRISPR's agency, these scientists were able to resiliently conceive its instrumentality.

By 2012, predictions of CRISPR's metonymic utility proved true. A group of researchers led by Doudna and Charpentier identified the molecular modifications required to let biochemists turn CRISPR from evolutionary agent into genetic technology. Their discovery, as they put it, was that "[the CRISPR system's cutting enzyme] can be programmed … to target and cleave any [genetic] sequence of interest" (Jinek *et al.*, 2012, p. 820). Significantly, the use of the word "can" makes Cas9's metonymic transition from natural actor to "programmed" instrument a substitutional possibility compatible with the wild CRISPR's agency. Agency is not seen in opposition to instrumentality. Instead, a metonymic logic undergirds the potential for turning one material state into the other.

Doudna and Charpentier understood that their work prepared future researchers to better metonymize CRISPR's agency as an instrument. They made this observation two years after they published their initial findings, in a 2014 essay in *Science*: "Following [our] 2012 publication of Jinek *et al.*, three [subsequent] studies … demonstrated that CRISPR-Cas9 *represents an efficient tool* to edit the genomes of cells" (Doudna & Charpentier, p. 1258096-4; our emphasis). Doudna and Charpentier had laid the foundation for CRISPR systems to "represent" something new. Representation can, of course, occur via any number of tropes, but a representational substitution that leverages the close association between agent and instrument is metonymic.

Doudna and Charpentier were correct that CRISPR's metonymic instrumentality became a motivation for subsequent study. What had once been a fascinating example of a natural evolutionary agent was increasingly metonymized as a biotechnical tool. Indeed, CRISPR's metonymization became so established that even natural bacterial CRISPRs were increasingly thought of as technologies. So, for example, when a group of M.I.T. researchers published groundbreaking work on using CRISPR tools to genetically engineer mice, the first sentence of their report begins with a metonymy in which the natural agent is depicted as inherently

technological. They write that "The … bacterial CRISPR/Cas system is a novel genome- engineering technology…" (Yang *et al.* 2013, p. 1370). That the authors acknowledge CRISPR is a natural bacterial system in no way impedes their ability to say that natural system "is" a "technology." This metonymic logic had been so well established in preceding technoscientific inventions that it was now common sense.

   This prominence of metonymic invention does not rule out the possibility that CRISPR might also be articulated through other tropes and figures. Previous research notes the prevalence of "editing" and "textual" metaphors surrounding CRISPR technologies, as the technology allows researchers to rewrite and revise genetic "texts" (O'Keefe, Perrault, Halpern, Ikemoto, & Yarborough, 2015, p. 7). Others rightly point to metaphors that describe CRISPR as a genetic "scalpel" (Nelson, Yu, & Ceccarelli, 2015, p. 60). All these may be operative in CRISPR discourses, yet attending to a technoscience's metonymic invention can be just as important for assessing its motivations and capacities. What we see in this study is that a specific metonymic turning, instrument for agent, can describe how this technoscience conceives its own capacities for change.

## Conclusion: Tropes/Figures as a Resilient Path for Researchers in RSTM

We will conclude by briefly suggesting how our framework may be applied and extended to other topics and how this understanding of tropes and figures may align with other research trajectories in RSTM.

   Cognitive approaches to tropes and figures stress the interiority of schemes and tropes as mental patterns. In a 2018 article, Harris and his co-authors remind us that rhetorical figures are "cognitively moulded linguistic devices that serve functional, mnemonic, and aesthetic purposes" (p. 155). As Harris, Di Marco, Ruan, and O'Reilly (2018) develop tools that can code figures, they can help us understand how figures overlap within and across texts, genres, and authors (p. 164). We might suggest, however, that cognitive approaches could profitably engage models of the "embodied" or even "ecological" brain. For instance, a child practicing a new word (as one author's son did recently, practicing the word "dinosaurio" every night before bed) is not only engaging in repetition

cognitively but also physically (in this case, trying repeatedly to articulate the Spanish "r" sound with his lips and tongue). Such repetitions can engage embodied actions or even material ones (for instance, while playing with a dinosaur toy).

In fact, children's development is an excellent example of the broader tendency for figures to emerge through material engagements. Within rhetorical studies, little research examines how human children develop tropic and figural expression. As in other species, children develop rhetorical abilities through figures such as hyperbole, repetition, and metonymy. (Consider how much an infant cries—and soon learns to do so hyperbolically and repetitively—"turning" crying into a metonym for food or any number of needs). Children's play involves various material-semiotic representations: "Both pretend play and language involve symbolic representation. In language, sound represents objects, actions, attributes, and situations. In play, children use objects and actions, as well as language, to stand for other things" (Christie & Roskos, 2006, p. 8). Children's imaginative play often involves metaphorically "turning" one object into another—a wooden block becomes a telephone; a stick becomes a sword. For children, a firefighter hat metonymically turns one into a firefighter. Early literacy researchers argue that these actions lay the groundwork for literacy (Christie & Roskos, 2006). Yet, little overlap exists between RSTM focused inquiries and scholarship in linguistics, speech and hearing sciences, or other fields that could inform these investigations. We might note Harris' work (2013) as a key exception, as well as (on the other end of the developmental spectrum) his piece in this issue.

Extending this research on the development of tropes and figures, scholars in RSTM might profitably engage research on animal and plant rhetorics. Kennedy (1992) speculates about a range of figures and tropes through which animals communicate (either with each other or with other species). He gives the example of animal communication via metonymy: "though none of my dogs has ever brought me his leash to suggest going on a walk, when I take the leash in hand, they become excited and know exactly what it signifies" (Kennedy, p. 19-20). He also describes the "inclination to hyperbole" among many animals, such as the exaggerated posturing or growling animals use in mating rituals or in establishing hierarchies (Kennedy, p. 19). The goal of this approach would not involve simply cataloging the various tropes and schemes present in animal communication, but, inspired by rhetoric's

current material turn, to attend to the ecologies within which tropes can allow for resilient "turning" between/among/across species. Exploring such acts as instances of tropological or figurative rhetoric would entail investigating "qualities of relations between entities, not just among humans, that enable different modes of rhetoric to emerge, flourish, and dissipate" (Stormer & McGreavy, 2017, p. 3). To take one specific example, hermit crabs' chemosensory systems attune them via scent to predation sites for other species (such as snails), where they can find a good source of food (carrion) or empty shells to inhabit. Research suggests that crabs can identify scents specific to both carrion availability and shell availability, suggesting a metonymic relationship where the scent in question orients or turns the hermit crab to a specific resource (Laidre & Greggor, 2015, p. 970). In this instance, the hermit crab exhibits something of the same metonymic sensibility that Burke identified in scientists: an ability to substitute an odoriferous effect for its material cause. Scholars trained in RSTM are poised to pursue such explorations by engaging critically with scientific literature and collaborating with ecologists and zoologists on problems of mutual interest.

We have argued throughout this essay that tropes and figures offer rhetorical resources that lend specificity to investigations of resilient material-semiotic relations among and across different ecologies. The rich catalog of rhetorical figures offers many avenues for future investigation. This can include not just the list of those things that are most technically defined as tropes but any figurative device that turns language beyond its most literal or straightforward use. In this way, rhetoric's long commitment to moving language beyond the literal can also be seen as a broader effort to study and invent resilient turns.

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