TOPICS
TOPICS IN COGNITIVE SCIENCE

Topics in Cognitive Science 00 (2023) 1–24

ISSN: 1756-8765 online
DOI: 10.1111/tops.12651

This article is part of the topic "Conceptual Foundations of Sustainability," Barbara Malt and Asifa Majid (Topic Editors).

Why is Mother Earth on Life Support? Metaphors in Environmental Discourse

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Received 15 August 2022; received in revised form 23 March 2023; accepted 23 March 2023

Abstract

From *mother* nature and carbon *footprints* to *greenhouse* gasses and the *race* against global warming, popular discourse on environmental issues is saturated with metaphor. Some people view these metaphors as obfuscating or ineffective, while others believe they are crucial for improving climate communications and environmental attitudes. In this paper, we provide a systematic overview and evaluation of the use of English metaphors in Anglo environmental discourse, drawing on a range of empirical and popular media sources. We begin by discussing the role of metaphor in language in thought. Next, we introduce a range of metaphors used to frame discussions of (1) our relationship to nature (e.g., the earth is our *common home*), (2) our impact on the environment (e.g., we are *knocking* the climate *off balance*), and (3) how we should address this impact (e.g., *reduce* our ecological *footprint*). We classify these metaphors along several dimensions, including how conventional they are, how systemic they are, how emotionally impactful they are, and how aptly they capture the topics they are used to describe. From this analysis, we derive several promising candidate metaphors that may help increase public understanding and engagement with environmental issues. However, we note that such claims must be tested empirically in future research; currently, there are few large, systematic, replicable experiments in the literature assessing the impact of environmental metaphors. We conclude

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by offering general recommendations for using metaphors in communications about climate change and sustainability.

Keywords: Metaphor; Framing; Reasoning; Environmental communications; Climate change; Sustainability

1. Introduction

Over the past decade, world leaders have repeatedly sounded the alarm. The climate is in peril, we are to blame, and something must be done. On June 18th, 2015, Pope Francis tweeted a blunt warning from his encyclical on the environment: *"The Earth, our home, is beginning to look more and more like an immense pile of filth"* (Francis, 2015). Later that year, global delegates gathered in Paris for the 21st Conference of the Parties, commonly known as the Paris Climate Conference. King Charles—then the Prince of Wales—made the following declaration to those in attendance: *"The whole of Nature cries out at our mistreatment of Her. If the planet were a patient, we would have treated her long ago. You, Ladies and Gentlemen, have the power to put her on life support, and you must surely start the emergency procedures without further procrastination!"* (Windsor, 2015). The Pope and the King were calling attention to the same issue: the precarious state of our environment. But they used very different metaphors to do so. In one message, the earth is a house accumulating dirt and grime. In the other, she is a dying woman in need of urgent care.

It is not just the global elite who rely on figurative language to express environmental concerns. From *mother* nature and carbon *footprints* to the *race* against global warming and the *war* on coal, popular discourse on environmental issues—like all complex sociopolitical topics—is saturated with metaphor (Larson, 2011; Princen, 2010; Thibodeau, Frantz, & Berretta, 2017). Why are metaphors so common in conversations about issues like nature, and what does their presence reveal about how people conceptualize the natural world? Do metaphors influence how people think and feel about the environment, or are they just there to enliven otherwise stale prose? How *should* we use metaphors if our goal is to help people understand what is happening to our climate and promote sustainability? Some critics have argued that the use of metaphor in climate and sustainability discourse has been haphazard and ineffective (Forgács & Pléh, 2022). Others have suggested that metaphors are crucial for improving climate communications and environmental attitudes, though certain metaphors may be better than others (Larson, 2011; Thibodeau et al., 2017). In this paper, we aim to clarify these issues by offering a systematic overview and evaluation of the use of metaphors in environmental discourse.

We first discuss the place of metaphor in language and thought. Metaphors help us communicate and think about novel, complex, and abstract topics (like *climate change*) by grounding them in simpler and more familiar concepts (like *illness;* Lakoff & Johnson, 1980; Thibodeau, Matlock, & Flusberg, 2019). But metaphors are heterogeneous, varying along multiple dimensions that affect their utility in different contexts. We unpack several of these dimensions and

discuss how they relate to a metaphor's potential for providing an apt model for thinking about complicated subjects and a rhetorical punch that can motivate action.

Next, we introduce three common themes in environmental discourse. We consider the challenges associated with each theme, which gives us insight into what types of metaphors are best suited to reasoning and communicating about these issues. We then discuss a range of metaphors used by scientists, journalists, activists, and policymakers to talk about each theme. By assessing the properties of the metaphors and surveying the empirical literature, we derive several promising candidate metaphors for increasing public understanding and engagement with environmental issues. However, this analysis is necessarily exploratory and is limited by a lack of high-quality, replicable experimental findings in the literature. We therefore indicate ways in which our assessment can be used as a guide for future systematic research on this critical issue. We conclude by offering high-level recommendations for using metaphors in communications about climate change and sustainability.

2. Metaphor in language and thought

Metaphor is a type of figurative language that most people associate with poetry, art, and literature. "All the world's *a stage,"* according to Shakespeare. *"*You may *shoot me* with your words, you may *cut me* with your eyes," wrote Maya Angelou. And *"*Chaos *is a friend of mine,"* sang Bob Dylan. The italicized words are metaphorical because they do not *literally* apply to the objects they accompany. The world is not a physical stage, words cannot shoot, eyes cannot cut, and chaos, as an abstract concept, cannot befriend any singer (no matter how famous they are). Metaphors like these invite a comparison between the *source domain* (e.g., "friend") and a seemingly unrelated *target domain* (e.g., "chaos"), indicating some type of similarity. We understand the metaphor by figuring out which aspects of the source correspond with or *map onto* the target. In this way, metaphors help people communicate about complex, unfamiliar, or abstract topics by drawing attention to what they share with more familiar source domains. Dylan, for example, is letting us know that he enjoys the frequent turbulence on his life's journey, finding comfort in the turmoil.

Metaphors are not merely poetic additions to otherwise literal language—they are *woven* into the *fabric* of language itself. The linguist George Lakoff and the philosopher Mark Johnson documented hundreds of English metaphors hiding in plain sight in their classic 1980 book, "Metaphors We Live By." These metaphors usually appear not as isolated figures of speech, but as collections or *families* of interconnected phrases, all drawing on the same source domain. For example, we are using the metaphor NATURE IS A PERSON when we say things like: "Nature *speaks* to me—the wind *sighs* through the trees and the stream *murmurs her sorrowful song*." This example illustrates another key feature of metaphors: they have specific *entailments*—the characteristics of the source domain that are projected onto the target domain. As a result, a metaphor will invariably highlight certain aspects of the target domain while masking others. In the previous example, the metaphor draws attention to how nature's soundscape makes us feel, but it downplays other elements. This shows that metaphors both enhance and constrain our thinking. Nature is also a *dormitory* for many

creatures, a *playground* for our children, and an *antidote* to our modern ills, but it requires additional metaphors to communicate those properties.

Why are metaphors so common? First, they serve many useful functions. Metaphors fill gaps in language and help us generate new vocabulary. This is evident when we talk about *mouths* of rivers, *heads* of companies, or your carbon *footprint* (Gibbs & Colston, 2012; Ortony, 1975). As these examples illustrate, the source domain for many common metaphors comes from aspects of experience that are intimately familiar, like the human body. Such metaphors enable people to quickly establish common ground, making communication more efficient and effective. If I want you to understand some abstract or complex issue—like the emotions nature evokes or why carbon emissions increase the global average temperature—then using a metaphor based on a simpler and more familiar source domain is likely to help. This is one reason metaphors are so handy when you want to explain something or persuade someone: they leverage what the listener already knows to help them gain a new perspective (Sopory & Dillard, 2002; Thibodeau, Crow, & Flusberg, 2017).

Second, some scholars believe that metaphors are common because they reflect how human cognition works (e.g., Gibbs, 1994; Hofstadter & Sander, 2013). This is the central claim of Lakoff and Johnson's (1980) book. Patterns of metaphor in language, they argue, reflect the underlying metaphorical structure of the human conceptual system. That is, when we talk about a *sighing* wind, we are not just *speaking* metaphorically, we are *thinking* metaphorically, using what we know of human expression to represent and reason about nature. Metaphors are especially useful when the target domain is something abstract that cannot be perceived by the senses, like how nature makes us feel or the global climate. In such cases, metaphors provide much-needed structure to topics that would otherwise be difficult, if not impossible to conceptualize.

Over the past 40 years, researchers have proposed a range of different cognitive models for how people process and use metaphors, many of which challenge elements of Lakoff and Johnson's "Conceptual Metaphor Theory" (e.g., Bowdle & Gentner, 2005; Glucksberg & Keysar, 1990; Sperber & Wilson, 2008; Thomas & Mareschal, 2001; For recent reviews, see Gibbs, 2017; Holyoak & Stamenković, 2018). For example, while Lakoff and Johnson argue that metaphors reflect deep underlying conceptual mappings between source and target domains, other scholars suggest that metaphors are understood via general mechanisms of categorization (Glucksberg & Keysar, 1990) or pragmatic inference (Sperber & Wilson, 2008)—no mapping needed. While cognitive scientists continue to debate the mechanisms that support metaphor processing, there is widespread agreement that metaphors and analogies play an important role in our cognitive ecology. They can facilitate problem-solving, scientific reasoning, cognitive development, creativity, and persuasive communications (Brown, 2003; Gentner, 2010; Holyoak & Thagard, 1996; Thibodeau et al., 2019). It is these functions that are most relevant for our analysis of metaphor in environmental discourse.

2.1. Dimensions of metaphors

Metaphors vary along multiple dimensions that influence how people process and respond to them. Here, we describe four dimensions of metaphor, though this list is not exhaustive.

This will help us assess the utility of metaphors used in different aspects of environmental discourse.

2.1.1. Conventionality

The first dimension is the *conventionality* or novelty of a metaphor. Conventional metaphors are those which have become commonplace, like *mother* nature and river *mouths*. Conventional metaphors are processed just as quickly as comparable literal language, and they can make complex messages seem simpler and easier to understand (Burgers, Konijn, Steen, & Iepsma, 2015; Glucksberg, 2003). Novel metaphors are those which are not in common usage. For example, you may have only encountered the phrase "*put her on life support"* in reference to our planet at the outset of this paper. This is a novel extension of the conventional *mother nature* metaphor. Other metaphors involve completely novel mappings, like "the earth is a *spaceship*" or "the atmosphere is a *bathtub*." Understanding novel metaphors takes more mental effort than understanding conventional metaphors (Bowdle & Gentner, 2005; Lai, Curran, & Menn, 2009), but this can elicit feelings of pleasure, like solving a puzzle (Giora et al., 2004). This reaction may accompany the experience of hearing a great metaphor, one that helps you think about the world in a new way. Sometimes this requires that a metaphor be elaborated or explained. Studies have shown that extended metaphors have a greater influence on how people reason about a target domain than isolated conventional metaphors (Flusberg, Lauria, Balko, & Thibodeau, 2020).

2.1.2. Systemicness

A second important dimension is the *systemicness* of a metaphor. This concerns what information is mapped from source to target. At one end of the spectrum, there are *nonsystemic* metaphors, where the features that are mapped are basic attributes or associations.[1] For example, describing someone as an eco-*warrior* indicates that they engage in practical activism and other direct actions to promote sustainability and raise awareness for environmental issues. These individuals may display *courage* and *toughness* and be willing to *fight* for the cause they believe in. In other words, it is the basic attributes of literal warriors that are mapped onto eco-warriors.

At the other end of the spectrum, what gets mapped are not attributes, but the functional relationships that define the source domain. Consider the metaphor "the atmosphere is a *bathtub*" (Hofstrand, 2018). The atmosphere and bathtubs share no physical attributes. They do, however, share properties *as systems* via the abstract causal relationships they embody. Carbon dioxide (CO_2) *flows* into the atmosphere from burning fossil fuels just as water flows into a tub when you twist the handle. CO_2 *drains* out of the atmosphere when it is absorbed by the ocean, just as water drains out of a tub when you remove the drain plug. If you turn the water on full blast, a tub will keep filling up even if the drain is open because the inflow is greater than the outflow. Similarly, with the current rate of emissions, CO_2 is building up in

[1] In the analogy literature, which is closely related to research on metaphor, what we refer to as nonsystemic metaphors are sometimes called *attribute* comparisons. What we call systemic metaphors are similar to what are called *relational* comparisons or analogies (Gentner & Markman, 1997).

the atmosphere faster than our planet can absorb it. Therefore, "the atmosphere is a *bathtub*" is an example of a *systemic* metaphor: it leads people to represent a network of causal relations in the target domain that it imports from the source domain. One study found that being exposed to systemic metaphors induces a "systems-thinking mindset" (Thibodeau, Winneg, Frantz, & Flusberg, 2016). This prompts people to consider more distal causal relationships in their reasoning, which is important for understanding complex systems like the climate.

2.1.3. Emotional impact

A third key dimension of metaphors is their emotional impact. Emotions play a significant role in how we communicate, persuade, and make decisions (Dillard & Seo, 2013; Lerner, Li, Valdesolo, & Kassam, 2015). Some metaphors, like "the atmosphere is a *bathtub*," provoke little affective response. The effectiveness of this metaphor as a tool for communicating and thinking about the atmosphere depends entirely on the conceptual correspondences between source and target domains. Other metaphors are more emotionally engaging. Consider the two quotations we introduced at the beginning of the paper. Metaphors like these increase our arousal and may trigger emotions like disgust and anger or worry and empathy. As a result, they are more memorable and may be more effective in motivating action (Flusberg, Matlock, & Thibodeau, 2017, 2018). The emotional aspect of metaphors has received relatively little attention in the cognitive science literature, though it plays a key role in discussions of rhetoric and poetry (Holyoak & Stamenković, 2018).

2.1.4. Aptness

The fourth and final dimension is the accuracy or *aptness* of a metaphor: How well does the source domain capture important elements of the target domain? No metaphor is perfect, but apt metaphors are generally useful and easier to understand because they illuminate something relevant about the target domain. "The atmosphere is a *bathtub*" is an apt metaphor. Studies have shown that using this metaphor can improve people's understanding of how carbon accumulates in the atmosphere, leading to stronger support for climate action (Guy, Kashima, Walker, & O'Neill, 2013). At the other end of the spectrum are the inapt metaphors, where it is unclear how the source maps onto the target or where the comparison is misleading. This can generate confusion and undermine the intended effects of the metaphor.

Aptness is a fuzzy concept, though, and people sometimes disagree about the accuracy or quality of a particular metaphor. One example of a popular metaphor that some regard as inapt is "carbon *footprint*," which refers to the total greenhouse gas emissions attributable to an individual or organization. Recently, several proenvironmental writers have argued that this metaphor is misleading and promotes a model of sustainability that undermines systemic efforts to address the climate crisis (Kaufman, 2020; Schendler, 2021; Solnit, 2021). This expression may seem sensible only because it has become so conventional, as processing fluency and aptness are easily conflated (Thibodeau & Durgin, 2011).

Consider: in what way does a person's footprint relate to greenhouse gas emissions? Intuitively, there is a spatial correspondence, where the volume of gaseous emissions maps onto the size of a person's footprint. Or perhaps, like the footprints that trail us as we walk through sand, it represents the environmental damage we leave behind through our use of fossil

fuels. The origins of this metaphor are illustrative. "Footprint" can indeed be an apt, two-dimensional spatial metaphor, as in the conventional phrase "the building's *footprint*." This refers to the amount of square footage a building's foundation occupies, which maps onto the amount of space occupied by an individual's footprint. In the 1990s, this metaphor was extended to describe a city's *ecological footprint*, or "the total area of land required to sustain an urban region" (Rees, 1992, p. 121). This metaphor was then used in environmental circles to highlight the unsustainable trajectory of human society based on increasing energy and food demands worldwide. So far so good. However, in the early 2000s, the British oil company BP co-opted the metaphor and made it personal, promoting the phrase *carbon footprint*. This was part of a public relations ploy to shift the burden of lowering carbon emissions away from fossil fuel companies and toward the individual consumer (Kaufman, 2020; Schendler, 2021; Solnit, 2021). They even encouraged customers to go on a "carbon *diet*" to reduce personal emissions. And so, *carbon footprint* caught on, and became a conventional metaphor that draws attention away from the world's biggest polluters, calling its aptness into question.

2.2. Interim summary

We hope it is becoming clear why metaphors are so pervasive in environmental discourse. Metaphors are common because they help us communicate and think about complex topics by grounding these subjects in more concrete and familiar concepts. Metaphors influence how we reason and act by illuminating key correspondences between source and target domains and via their emotional resonance. In the next section, we discuss several broad themes in environmental communications where metaphorical appeals are common. Our goal is to assess which metaphors might be apt for reasoning about each theme, and which metaphors might be effective in environmental messaging. These are related goals. Both are a function of the properties the metaphor and the context in which the metaphor is used. However, some metaphors might be rhetorically effective without being apt—and vice versa—which makes the distinction worth highlighting.

3. Metaphors in environmental discourse

3.1. What we talk about when we talk about the environment

Communications about the environment often center on three broad themes: (1) our relationship to nature, (2) our impact on the environment, and (3) how we should address that impact. These themes are interrelated. Whether or not you feel connected to nature may influence how you feel about rising sea levels or adopting a more sustainable lifestyle. However, each theme is associated with unique conceptual and communicative challenges. These challenges are compounded by the fact that messages do not resonate equally with everyone. There are many personal and social factors that shape ecological concerns and behaviors, including environmental and moral values, political ideology, and where you live (Gifford & Nilsson, 2014; Hornsey, Harris, Bain, & Fielding, 2016).

3.2. Methods

For each theme, we identified multiple candidate metaphors by surveying the empirical literature as well as recent popular media. We then rated each metaphor on the four dimensions described in the previous section. For the "emotion" dimension, we rated the metaphors on both "arousal," or emotional intensity, and "valence," or how positive or negative is the feeling associated with the metaphor. Ratings were originally generated through experimenter intuition, followed by discussion, until a consensus was reached. We deferred to expert judgments of aptness and other dimensions when these were available in the literature. Finally, we used pilot data from naïve American participant raters to inform our ratings.[2]

There are several reasons we did not rely on participant ratings alone to classify the metaphors on each dimension of interest. First, measuring these constructs can be challenging, and participant-generated metaphor ratings have certain well-known problems. For example, there is often a high correlation between conventionality and aptness ratings, despite the common understanding that these are orthogonal dimensions (Jones & Estes, 2006; Thibodeau & Durgin, 2011). This seems to result from the fact that people conflate aptness with how easy it is to process the metaphor, which is associated with familiarity (Thibodeau & Durgin, 2011). This is one reason metaphorical expressions like *red herring* and *carbon footprint* may *feel* apt, even when they are not. Second, metaphors can take on different properties when they appear in different contexts. This makes it difficult to assess the validity of participant ratings since they typically view just one instantiation of each metaphor. Finally, experts sometimes disagree with the lay public on the aptness of certain metaphors. Since the goal of this paper is to generate candidate metaphors that may improve understanding and attitudes toward environmental issues, consulting expert judgments in the literature was especially important.

3.3. Theme 1: Humanity's relationship to nature

Environmental attitudes and decision-making are rooted in a core conception of how we relate to the rest of nature. This has been operationalized as the strength of the connection people feel toward the natural world. There is a large literature exploring the factors that contribute to a sense of connectedness with nature and the implications of this construct for environmental attitudes and behavior (for review, see Zylstra, Knight, Esler, & Le Grange, 2014). Generally speaking, people who feel more strongly connected to nature hold more proenvironmental positions and exhibit greater subjective well-being (Capaldi, Dopko, & Zelenski, 2014; Mayer & Frantz, 2004). Therefore, people should be encouraged to think of

[2] These data were collected as part of a larger follow-up study that is currently underway. Using the Prolific crowdsourcing platform, we recruited 125 participants located in the United States (58% female, $M_{age} = 35.7$, $SD_{age} = 12.5$; 95% reported English as their first language). Each participant rated a randomly selected set of seven of the 21 central environmental metaphors presented in this paper (~40 ratings for each metaphor) on six key properties: conventionality, systemicness, emotional arousal, emotional valence, aptness, and liking. Our complete study survey, ratings data, correlations between items, and descriptive statistics can be found on the Open Science Framework: https://osf.io/ek26c/?view_only=c51947d6b9f4438fbee89b5a3605dd24.

themselves as interconnected with a larger ecological system. Apt metaphors will be systemic, situating humanity in an interdependent relationship with nature—the environment provides for us, and our actions impact the environment (Larson, 2011; Princen, 2010; Thibodeau et al., 2017). From a communications standpoint, the emotional connotations of the metaphor should be positive. Below, we discuss three metaphors for the human/nature relationship. Table 1 includes a summary of this discussion, plus several additional metaphors that we did not have room to describe in the text.

(*a*) **NATURE IS BALANCE**. The view that all living things live in *balance* has ancient roots and is present in many cultures (Cuddington, 2001). Conventional expressions about nature's *stability, equilibrium, harmony*, and the *circle of life* reflect this core idea. This metaphor tends to be associated with the positive feeling that nature is beneficent (Cuddington, 2001). Our naïve American participants generally liked this metaphor and viewed is as positively valenced, apt, and systemic. However, ecologists have argued it is not an apt metaphor, and that it is only slightly systemic. They have pointed out, for example, that nature is constantly in a state of flux, not balance. As a result, the balance metaphor can lead to problems with how people reason about and model the environment (Botkin, 2012; Kricher, 2009). One study found that students who endorse this metaphor are less concerned with human behavior that damages the environment, as they believe nature will recover its *natural balance* when perturbed (Ergazaki & Ampatzidis, 2012).

(*b*) **NATURE IS A PERSON**. The personification of nature is also ancient and widespread (Merchant, 1980). In the West, the most conventional instantiation of this metaphor depicts nature as *woman*, as in the statement: "*Mother* nature *nurtures* and *sustains* us with *her* bounty." This metaphor is dynamic and can be extended in novel ways. For example, people can map specific body parts onto nature, as in the following sentence from an essay about the importance of the oceans: "The ocean is the *heart* and *lungs* of the planet" (Hoegh-Guldberg, 2014). A related idea can be found in James Lovelock's (1979) "Gaia Hypothesis," an alternative ecological theory that views the earth as a singular superorganism. And do not forget that King Charles described nature as a *woman on life support* in his Paris Climate Conference speech.

Personification metaphors are moderately systemic with a variable emotional impact. Much like human beings, nature behaves in ways that provoke different emotional responses. While a *nurturing mother earth* is positively valenced, describing *her angry wrath* is negatively valenced. Generally, the *mother* role emphasizes how the environment supports human life, but in so doing it downplays how our actions impact the environment (Thibodeau et al., 2017). Therefore, it does not fully capture the interdependence of humanity and nature. Critics have also argued that the feminization of nature is rooted in a misogynistic, patriarchal view of society. Women, and by extension nature, are not just stereotyped as *nurturing*, but as *wild* and *unpredictable*—and so they both must be *conquered* and *tamed* (Merchant, 1980). From this perspective, then, it is not an apt metaphor.

Table 1
Metaphors for the human/nature relationship

Source	Example	Dimensions/properties			
		Conventionality	Systemicness	Emotion	Aptness
Balance	We live in *stable, balanced harmony* with our surroundings	Conventional	Mildly systemic	Low arousal, positive valence	Low aptness
Person	*Mother* earth *nurtures* and sustains us. The ocean is her *heart*, the forests *her lungs*	Conventional	Systemic	High arousal, mixed valence	Moderate aptness
Home	I feel at *home* when I walk in the valley, *safe* and *secure*	Conventional	Systemic	Low arousal, positive valence	Apt
Machine	Geo*engineering* helps us *regulate* and *control* the environment	Conventional	Mildly systemic	Low arousal, neutral valence	Low aptness
Spaceship	"We *travel* together, *passengers on a little spaceship*, dependent on its vulnerable reserves of air and soil; all committed for our safety to its security and peace; preserved from annihilation only by the care, the work, and, I will say, the love we give our *fragile craft*"—Adlai Stevenson (Platt, 1993, p. 95)	Novel instantiation of the machine metaphor	Systemic	Low arousal, mixed valence	Moderate aptness
Resource	Nature contains *limited resources* that human beings can *gather*, *store*, and *use*	Conventional	Low systemicness	Low arousal, neutral valence	Moderate aptness
Bank	We can *withdraw* resources from the planet to *invest* in our continued survival	Moderately conventional instantiation of the resource metaphor	Low systemicness	Low arousal, neutral valence	Moderate aptness

However, there may be positive consequences of viewing nature as a (nongendered) person. Most countries guarantee their citizens the right to live in peace. Ergo, nature, as a person, should deserve similar rights. In 2008, Ecuador became the first country to adopt this perspective when they voted to add the right for nature to exist and flourish to the nation's constitution (Charman, 2008). The personification of nature is also related to *animism*—the view that aspects of the natural world have intelligent agency—which plays a significant role in many indigenous cultures (Rout & Reid, 2020). Rout and Reid (2020) suggest that adopting animist metaphors in the modern Western context may help promote sustainability, which has been stifled by an overreliance on machine metaphors for nature.

(*c*) **NATURE IS OUR HOME**. Pulitzer Prize winning poet Gary Snyder wrote, "Nature is not a place to visit. It is *home*" (Snyder, 1990, p. 7). The metaphor of nature as our *common home* may be conventional, but it has less baggage than some of the other metaphors we have considered. For many people, *home* has a positive valence and conjures a sense of comfort. A sample of climate experts and lay participants rated *home* as the most apt metaphor for the human/nature relationship from a selection that included variations of the other metaphors in Table 1 (Thibodeau et al., 2017). It was also the favored metaphor of the bunch and rated as highly systemic. We observed the same pattern of responses in our pilot data. This metaphor emphasizes the symbiotic relationship between nature and humanity. Like a literal home, nature provides shelter and resources we need to survive. But our actions also impact the integrity of the (home) environment, which requires consistent upkeep and care. That said, some people do not share this comforting vision of home, which is a concept that depends a great deal on personal experience. Additionally, this metaphor is less dynamic than some others, like NATURE IS A PERSON, which can be extended in many novel ways.

3.4. Theme 2: Humanity's impact on the environment

3.4.1. Characterizing negative impacts on the environment

One line of communications about our impact on the environment emphasizes the negative consequences of human behavior. The goal is to increase concern and a sense of urgency about ecological issues, so rhetorical impact often takes precedence over apt descriptions. One challenge is that climate change can feel abstract and distant, which makes people less likely to engage (Maiella et al., 2020; Spence, Poortinga, & Pidgeon, 2012). Good messaging needs to resonate emotionally and make the climate crisis feel concrete and closer to home (Brosch, 2021; Van der Linden, Maibach, & Leiserowitz, 2015; but see Brügger, Morton, & Dessai, 2016). Too much catastrophizing can backfire, however, leading to reduced environmental concerns (Feinberg & Willer, 2011)—people need to feel hope for the future (Nabi, Gustafson, & Jensen, 2018). Moral concerns play a role as well. Messages that activate "individualizing" values of harm, care, or environmental justice resonate more with political liberals, while messages that activate "binding" values like in-group loyalty, deference to authority, and purity resonate more with political conservatives (Feinberg & Willer, 2013; Wolsko, Ariceaga, & Seiden, 2016).

Effective metaphors should be highly arousing and negatively valenced, exerting a strong emotional impact consistent with the moral concerns of the target audience. An image that makes the precarious state of the environment more concrete is crucial. Most of the metaphors we assess below are extensions of the metaphors for the human/nature relationship described in the previous section. See Table 2. None of these metaphors generates a sense of hope unless coupled with potential remedies.

(*a*) **ENVIRONMENTAL IMPACT IS IMBALANCE**. This is an extension of the NATURE IS BALANCE metaphor, where an accumulation of pollution and carbon emissions will lead us to a *tipping point*, causing nature to be *knocked off balance* and creating *disequilibrium* in the natural order. A related idea views environmental impacts as a form of *injustice*, which requires that we try to *balance the scales*. These metaphors are negatively valenced, but they do not convey a strong sense of urgency. When invoking a sense of justice or fairness, this metaphor might appeal more to a liberal audience.

(*b*) **ENVIRONMENTAL IMPACT IS DISEASE**. This is an extension of the NATURE IS A PERSON metaphor, where the planet is described as *sick* or *dying* because of how we *treat* and *poison her*. This is a negatively valenced metaphor that may activate feelings of concern, urgency, and empathy. It invokes moral values of harm and care, which appeal more to liberals. King Charles' speech at the Paris Climate Conference, which included a passionate elaboration of this metaphor, may have resonated more strongly with the progressive delegates in attendance.

(*c*) **ENVIRONMENTAL IMPACT IS DESTRUCTION**. This is among the more conventional ways of describing the human impact on the environment. Our planet is *falling apart*: we have *ravaged* our lands, causing *devastation* and *destruction*, leaving our climate on the verge of *collapse*. This physical metaphor can function as an extension of the *machine* and *home* metaphors for the relationship between humanity and nature. For instance, Swedish environmental activist Greta Thunberg regularly uses the expression "*our house is on fire*" to describe the effects of climate change (e.g., Thunberg, 2019). This metaphor family is negatively valenced, conveys a clear and immediate sense of urgency, and may trigger emotions like fear and anxiety. In emphasizing the moral values of harm and care, however, it likely appeals more to a liberal audience. It is also vulnerable to accusations of alarmism because of the intensity of the source domain.

(*d*) **ENVIRONMENTAL IMPACT IS IMPURITY**. This metaphor views pollution and wasteful consumerism as *despoiling*, *contaminating*, *desecrating*, or *corrupting* the *purity* of the natural world. As Pope Francis illustrated in his tweet, this metaphor can extend the image of nature as our *common home* by describing the earth accumulating *filth*. This metaphor is negatively valenced and conveys a sense of urgency and disgust, as well as religious undertones. By invoking the moral value of purity, it might appeal more to a conservative audience (Feinberg & Willer, 2013).

Table 2
Metaphors for the human impact on the environment

Target	Source	Example	Dimensions/properties			
			Conventionality	Systemicness	Emotion	Aptness
Negative human impact on the environment	Imbalance	Our energy habits have *knocked* the climate *off balance*	Conventional	Low systemicness	Low arousal, slight negative valence	Low aptness
	Disease	The effects of burning carbon have *spread like a virus*, making the planet *sick*	Conventional	Low systemicness	Moderate arousal, negative valence	Moderate aptness
	Destruction	Our behavior is *destroying* the environment, and now the climate may *collapse*	Conventional	Low systemicness	High arousal, negative valence	Moderate aptness
	Impurity	Burning fossil fuels is *corrupting the purity* of nature, *despoiling* the earth	Conventional	Low systemicness	Moderate arousal, negative valence	Moderate aptness
Explanation of why human behavior impacts the climate	Greenhouse	The atmosphere is a *greenhouse* that traps heat	Conventional	Moderately systemic	Low arousal, neutral valence	Moderate aptness
	Blanket	The atmosphere is a *heat-trapping blanket*	Moderately conventional	Moderately systemic	Low arousal, neutral valence	Moderate aptness
	Debt	We are currently *exceeding* our carbon *budget*	Novel	Systemic	Low arousal, negative valence	Moderate aptness
	Bathtub	CO_2 *flows* into the atmosphere and *drains* into the ocean	Novel	Systemic	Low arousal, neutral valence	Apt

3.4.2. Explaining why human behavior impacts the climate

Another line of communications about our impact on the environment concerns climate change itself: why does human behavior lead to global warming? The mechanisms that contribute to anthropogenic climate change are complicated. Even highly educated people can hold a flawed mental model of how carbon emissions accumulate in the atmosphere (Sterman, 2011; Sterman & Sweeney, 2007). Therefore, the most apt metaphors in this space will be highly systemic, providing a more accurate mental model for thinking about carbon emissions and global warming. The emotional connotations are of secondary import here. Such metaphors will likely need to be extended to serve a useful explanatory function. See Table 2.

(*a*) **THE ATMOSPHERE IS A GREENHOUSE**. This is one of the most conventional metaphors for explaining the causes of global warming, with origins dating back to the 19th century (Nerlich & Hellsten, 2014). Greenhouses have clear glass walls and roofs. Sunlight shines through the glass and the resulting heat is trapped inside the enclosure, keeping the inside warm even during colder months. So too with our atmosphere, where *greenhouse* gasses like CO_2 help trap heat and warm the planet. Releasing more and more CO_2 into the atmosphere leads to more trapped heat. This is a moderately systemic and apt metaphor that captures the central mechanism for how carbon emissions relate to climate change. However, it has been criticized for not sufficiently accounting for key elements of our climate system (Chen, 2012; Forgács & Pléh, 2022). For example, the metaphor does not recognize that carbon is simultaneously absorbed by the ocean and plant life, or that you cannot just *open a windowpane* to let out the heat.

(*b*) **THE ATMOSPHERE IS A BLANKET**. This metaphor depicts greenhouse gasses as a *heat-trapping blanket*. Just as we use warm blankets in winter to trap the heat our bodies give off and keep us warm at night, CO_2 and other gasses trap the heat of the sun in our atmosphere, which leads to global warming. Some have claimed that this metaphor is more useful than the *greenhouse* for improving public understanding of climate change (Bales, Sweetland, & Volmert, 2015). Others suggest the two metaphors naturally go together (Nerlich & Hellsten, 2014). In our view, these metaphors have similar flaws, but the *blanket* metaphor may provide a more apt framework for understanding global temperature increases because the source domain is more familiar.

(*c*) **THE ATMOSPHERE IS A BANK**. This is a novel instantiation of the metaphor NATURE IS A BANK. We have a *limited* carbon *budget* that we must *spend* wisely (i.e., burn) before we *go into debt* (i.e., too much carbon accumulation in the atmosphere), which can have disastrous consequences (i.e., global warming). If we *reduce* our *spending*, the accumulated *debt* will remain for a while. So too with carbon in the atmosphere. This is a systemic metaphor designed to be apt in the context of reasoning about CO_2 accumulation in the atmosphere. However, while people are better at reasoning about financial debt problems compared to analogous CO_2 accumulation problems, the use of the financial metaphor does not appear to improve reasoning in the latter case (Newell, Kary, Moore, & Gonzalez, 2016).

(*d*) **THE ATMOSPHERE IS A BATHTUB**. We unpacked this novel metaphor earlier in the paper. This is an apt and systemic metaphor which has been presented as a useful educational tool by environmental scientists (e.g., Hofstrand, 2018). Using the metaphor with lay participants leads to improvements in reasoning about CO_2 accumulation, as well as increased support for climate causes (Guy et al., 2013). That said, this metaphor has been critiqued as overly simplistic, failing to account for some of the more complex aspects of climate change (Forgács & Pléh, 2022). For example, like the *greenhouse* and *blanket*, the *bathtub* metaphor does not capture the fact that the climate will continue to change for decades even if humanity greatly reduces emissions over the next few years. Though the metaphor has been shown to improve reasoning in CO_2 accumulation problems, most people still fail to come up with the correct answer even after receiving the metaphor (Guy et al., 2013).

3.5. Theme 3: How humanity should address environmental impacts

3.5.1. Characterizing climate action

One line of communications for how to address environmental problems characterizes climate action at a high level. The challenge is to increase proenvironmental attitudes and behaviors. As in communications about our impact on the environment, effective discussions of climate action should be emotionally resonant. These messages should make climate action seem urgent and necessary. Apt metaphors in this space will be systemic, providing a meaningful framework for thinking about climate action. Many of the metaphors used in these discussions are direct extensions of the ones we considered in the previous section. For example, we can focus on *restoring the balance, putting out the fire*, *repairing the damage, treating the illness*, or *cleaning up the filth*. Below, we consider two broader metaphors frequently used to frame discussions of climate action. See Table 3.

(*a*) **CLIMATE ACTION IS A RACE**. In his 2019 remarks at the Climate Action Summit, UN Secretary-General António Guterres said, *"The climate emergency is a race we are losing, but it is a race we can win"* (Guterres, 2019). From the *sprint* toward net zero emissions to the *hurdles* we face in achieving sustainability, the *race* metaphor has become a conventional way to describe climate action. The metaphor is only mildly systemic and apt. It highlights the fact that time is of the essence in addressing climate change, that obstacles must be overcome, and that losing is bad. However, races are generally fun sporting events, not life or death scenarios. One study found that framing the U.S. approach to climate change using the race metaphor did not lead to any increase in a sense of urgency, risk perception, or willingness to change personal behaviors compared to a neutral, nonmetaphorically framed message (Flusberg et al., 2017).

(*b*) **CLIMATE ACTION IS A WAR**. War metaphors are among the most frequent, conventional metaphors in public discourse (Flusberg, Matlock, & Thibodeau, 2018). We can *wage a war* on fossil fuels, *combat* excessive energy use, and, hopefully, *win the battle* against global warming. This metaphor has some of the same entailments as the

Table 3
Metaphors for how to address environmental issues

Target	Source	Example	Dimensions/properties			
			Conventionality	Systemicness	Emotion	Aptness
Climate action	Race	We have got to *surge ahead* in the *sprint toward* net zero emissions	Conventional	Low systemicness	Moderate arousal, neutral valence	Low to moderate aptness
	War	We need to *win* the *battle* against fossil fuels to win the *war* on climate change	Conventional	Moderate systemicness	High arousal, negative valence	Moderate aptness
Sustainability	Footprint	We must *reduce* our ecological *footprint*	Conventional	Low systemicness	Low arousal, neutral valence	Low aptness
	Nuclear disarmament	Countries should *sign* a fossil fuel *nonproliferation agreement*	Novel	Systemic	Moderate arousal, positive valence	Apt but narrow
	Rocket	Like a *rocket trying to escape earth's gravity*, we may need to *burn more fuel* in the short term to achieve a sustainable future	Novel	Systemic	Moderate arousal, mixed valence	Moderate aptness but narrow
	Runway	Human civilization is a *plane on a runway*: we can *accelerate* into post-scarcity by burning fuel, but we may *overshoot and crash* into climate disaster	Novel	Systemic	Moderate arousal, mixed valence	Apt but narrow

race metaphor. There are opposing sides, actions must be taken to win, and time is of the essence. However, war metaphors convey an additional sense of urgency because lives are on the line. Wars can also bring people together to *face a common enemy*, and they lend greater legitimacy to governmental actions (Cohen, 2011). In this way, the war frame is more emotionally resonant, systemic, and apt than the race metaphor. One study found that, compared to a race metaphor, describing the U.S. approach to climate change using war metaphors was more effective: it led to increases in a sense of urgency, risk perception, and a willingness to change personal behaviors (Flusberg et al., 2017). However, war metaphors are not entirely apt (Kester & Sovacool, 2017). Climate change is not like an *enemy* that can be *defeated*, and there will be no time and place when the *battle is won*. Since addressing climate change will be a continuous effort for decades, if not centuries, people may get tired of an urgent war framing—just as they do with real protracted wars (Flusberg et al., 2018).

3.5.2. Characterizing sustainability

Another line of communications for addressing environmental problems concerns the concept of sustainability. The challenge is to clarify what sustainability is and how to achieve it. The most apt metaphors will be systemic, providing a mental model for reasoning about sustainability. Novel, extended metaphors may be especially useful since sustainability is a recent, abstract concept. For messaging purposes, a more emotionally impactful metaphor will help sustainable actions feel more urgent. Here, we consider one conventional metaphor and three recent novel metaphors for sustainability. See Table 3.

(*a*) **SUSTAINABILITY IS A SMALL FOOTPRINT**. We explored the conventional *carbon footprint* metaphor in our earlier discussion of aptness. To increase sustainability, individuals and organizations must *tread lightly* and *reduce the size of their footprint*. This metaphor is not very systemic and has little emotional impact. It is more apt in the form of a community's *ecological footprint*. However, because it has become so conventional, *carbon footprint* may be useful shorthand in messaging about carbon emissions and risk management (Nerlich & Hellsten, 2014).

(*b*) **SUSTAINABILITY IS NUCLEAR DISARMAMENT**. A recent novel metaphor describes efforts to reduce global emissions in terms of *nuclear disarmament* (Calma, 2020). The goal is to foster international cooperation by getting organizations, states, and nations to sign a fossil fuel *nonproliferation treat*y, modeled on nuclear nonproliferation treaties of the past (see fossilfueltreaty.org). Preventing nuclear war is perhaps the most acute comparison we have for addressing climate change, so this is a systemic metaphor. Like the war frame this metaphor builds on, nuclear disarmament conveys a sense of urgency and life or death stakes. That this metaphor is tied to a specific set of actions and a hopeful outcome is notable. For this reason, while the metaphor is narrow in scope, it is an apt description of one way to achieve greater sustainability.

(*c*) **SUSTAINABILITY IS A ROCKET**. This is a novel metaphor that aims to provide an apt framework for thinking about our path to sustainability (Bostrom, 2013). A

rocket on a landing pad or floating in space is stable and can maintain itself for a long time without expending resources. During takeoff, however, it burns a lot of fuel, and it must continue to burn more and more fuel to escape the earth's gravitational field and reach stability once again in space. If it cannot burn enough fuel, it will crash and burn. So too with humanity. According to this metaphor, we are in the rocket during takeoff, and we must continue to extract and use energy if we ever hope to solve our ecological problems and achieve a new stage of stability. It is too late to go back to a previous era, just as it is too late for a rocket to try to stop climbing mid-takeoff. So, we may need to pursue a less sustainable period to achieve greater stability in the future. In contrast to the static image of a footprint, this systemic metaphor is intended to capture a more dynamic and realistic pathway to sustainability. It offers a vivid and exciting image, but the aptness is unclear—the metaphor does not have entailments for what policies or actions we should engage in to ensure humanity *breaks through the atmosphere* (Karlsson, 2016).

(*d*) **SUSTAINABILITY IS A RUNWAY**. Like the *rocket* metaphor, the *runway* is a novel metaphor intended to offer an apt way of thinking about humanity's path to sustainability. Political scientist Rasmus Karlsson (2016) explains it as follows: *"One can imagine human civilization as an airplane running down the 'runway of modernity.' Initially, three very different outcomes seem possible: (1) an acceleration and take-off into a space-faring post-scarcity civilization, (2) a deceleration back into a localized economy based on norms of frugality and simplicity, or (3) an overrunning of the runway resulting in a devastating and most likely irreversible crash. To complicate the situation, the people on the airplane do not know the precise length of the remaining runway…"* This metaphor builds on the entailments of the *rocket* metaphor in charting possible trajectories for humanity, adding in the option of *decelerating* our progress. Karlsson (2016) argues this metaphor also highlights the structural forces that are preventing us from taking any decisive action one way or another since we do not know how much runway (time) we have left. This is a more systemic metaphor than the rocket. It seems like an apt metaphor for the current state of global decision-making on sustainability, though it offers no framework for thinking about a solution to this problem.

4. Discussion

In this paper, we have documented a broad range of metaphors in environmental discourse by surveying the empirical literature and popular media. We organized these metaphors into three broad, interrelated themes and classified them on several key dimensions, informed by expert opinion and naïve participant ratings. We have sought to clarify which metaphors are most apt for representing different topics, and which metaphors would be most impactful in environmental communications. In some cases, the same metaphor serves both functions, like NATURE IS OUR COMMON HOME (Thibodeau et al., 2017). In other instances, a metaphor may be rhetorically effective without being fully apt, like CLIMATE ACTION IS WAR. We believe it

is important to keep this distinction between the cognitive and communicative functions of metaphor in mind. See Table 4 for a summary of the specific metaphors we have reviewed that may help increase public understanding and engagement with climate change and sustainability.

4.1. General recommendations for using metaphors in environmental communications

To paraphrase the statistician George Box: all metaphors are wrong, but some are useful. In this paper, we have argued that a deeper consideration of the dimensions of metaphor can help clarify the role of metaphor in environmental communications. The aptness of a metaphor will depend on multiple factors. Because the environment and climate are complex and dynamic, systemic metaphors are essential. Systemic metaphors can help people understand how we relate to nature, how our behavior impacts the climate, and what steps should be taken to promote sustainability. Novel, extended metaphors are especially helpful for explaining complex ideas like how carbon emissions relate to global warming and our possible pathways to sustainability. The emotional impact of a metaphor plays a critical role in motivating behavior change and action. However, different metaphors tap into different moral values, so it is important to know the values of your target audience. Of course, there are still holes in the metaphorical landscape. We would encourage readers to generate new metaphors to fill the gaps with these recommendations in mind—and to conduct appropriate studies to measure their impact.

4.2. Limitations

There are several limitations with our current analysis. We have not considered every metaphor used in environmental discourse, and we may have missed useful ones associated with domains outside our expertise (e.g., plant biology). Additionally, while we have drawn extensively on existing research, there have not been many large-scale, replicable experimental studies on the influence of metaphors in environmental communications. Some of our claims about the potency of specific metaphors are, therefore, speculative. Researchers interested in this subject will need to conduct carefully controlled experiments to test the impact of different metaphorical messages on different audiences. We have begun this work in our labs and look forward to updating our recommendations as the data come in.

Another critical limitation is that our discussion has principally centered on English metaphors, Anglo environmental discourse, and Western cultural models. Conceptions of the environment differ across languages and cultures, so it is vital that this research be extended to other languages and other parts of the world. A deeper consideration of cultures that place a high value on maintaining a positive and dynamic interrelationship with nature is recommended (Rout & Reid, 2020).

We have also neglected to consider research on other framing effects in climate communications. This includes the role of narratives and imagery and the impact of highlighting the collateral benefits of addressing climate change, such as economic and social improvements (Bain et al., 2016; O'neill, Boykoff, Niemeyer, & Day, 2013). Most importantly, messaging

Table 4
Promising metaphors in environmental communications

Target issue	Candidate metaphor	Discussion
Our relationship to nature	The earth is *our common home*	This metaphor is perceived as relatively apt and systemic, highlighting the symbiotic relationship between humanity and nature (Thibodeau et al., 2017). It does require the audience to have a positive association with home
Our impact on the environment	Environmental impact is *destruction*	This is an arousing, negatively valenced metaphor that provides a concrete, urgent depiction of our impact on the environment. It appeals more to liberal moral concerns of harm and care (Feinberg & Willer, 2013; Wolsko et al., 2016). Any message on this issue should be paired with concrete steps that offers hope for addressing environmental concerns
	Environmental impact is *impurity*	This is a moderately arousing, negatively valenced metaphor that provides a concrete, fairly urgent depiction of our impact on the environment. It appeals more to conservative moral concerns of purity (Feinberg & Willer, 2013; Wolsko et al., 2016). Any message on this issue should be paired with concrete steps that offers hope for addressing environmental concerns
How to address environmental problems and achieve sustainability	*War* metaphors, such as: "We need to *recruit* everyone to *fight the deadly battle* against climate change"	War metaphors are not completely apt, but in the short term, they can increase a sense of urgency and risk perception, as well as a willingness to change behavior (Flusberg et al., 2017). Emotions fade quickly, so pairing this message with concrete action steps is recommended
	Humanity is moving down a *runway* and there are only three options…	The runway metaphor is an apt way to frame our current situation and possible pathways to sustainability (i.e., *burn fuel* to *take off*, or *decelerate* to *slow down*). It highlights the need for decisive action while making clear that the "right" pathway is unknown (Karlsson, 2016). It is limited by the fact that it does not connect to concrete action plans, so the communicator's desired pathway—and how to get there—should be articulated. There might also be other possible pathways we could pursue, depending on how long the runway is
	Communities should *reduce* their *ecological footprint*	This conventional metaphor has its uses for encouraging communities reduce waste and energy consumption (Nerlich & Hellsten, 2014). To promote true sustainability, emphasizing structural and policy changes may be more effective than appeals to reduce personal waste. This metaphor dovetails with the *deceleration* strategy in the runway metaphor
	Organizations and nations should sign onto a fossil fuel *nonproliferation treaty*	This is a unique metaphor that provides a plausible path toward global carbon emission reductions (Calma, 2020). While it is narrowly focused, it is concrete, apt, and emotionally resonant as a specific sustainability strategy. This metaphor dovetails with the *deceleration* strategy in the runway metaphor

alone is never enough. Framing effects are fleeting, and people are bombarded with thousands of messages and images every day that compete for their attention (Bernauer & McGrath, 2016; Schwartz & Loewenstein, 2017). For messaging to influence real-world behavior and sustainability, it needs to be accompanied by immediate opportunities for action and embedded in broader political and social movements (Lakoff, 2010).

4.3. Conclusion

Metaphors are pervasive in environmental discourse. On the one hand, this is neither surprising nor special: metaphors are pervasive in all our public conversations. This is because the issues we are most concerned with—politics, education, economics, climate change—are complicated and abstract. It is virtually impossible to communicate or think about these subjects without using metaphors. On the other hand, the use of metaphor in climate and sustainability discourse has been criticized as haphazard and ineffective (Forgács & Pléh, 2022). Our analysis sheds additional light on this issue. This work provides insights into which metaphors may be most apt and impactful, and why this might be the case. However, future research is needed to systematically test and refine these metaphorical messages, and to tailor them for different use cases and target audiences. We suggest that attending to the properties of the metaphors and the values of the target audience is critical. These efforts are worthwhile: the earth is our common home, but it is accumulating filth and threatening to collapse. We can clean and repair it, but it will take an all-out offensive.

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