



Illuminating Progress, Obscuring Complexity: Metaphorical Highlighting and Hiding in Scientific Discourse

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Abstract. It should be noted that scientists use a variety of metaphors in their works to convey complicated phenomena using easily perceivable concepts. But based on the Conceptual Metaphor Theory, metaphors not only illuminate a part of knowledge about a particular subject matter but also veil other aspects of it from consideration. Therefore, this work aims at investigating illumination and veiling processes involved in scientific discourse. Specifically, a corpus-based cognitive linguistic analysis will be employed in studying a 100,000-word-sized corpus consisting of scientific and institutional English-language publications dated between 2020 and 2025. As for methodology, the MIPVU framework was used consistently and produced 1,247 metaphorical units. The quantitative and qualitative analyses of this sample have allowed us to identify the three most frequent types of metaphor: MACHINE (31%), NATURAL FORCE (27%), and MOVEMENT (24%). The results prove that MACHINE metaphors illuminate efficiency and control, whereas trial-and-error elements get concealed. At the same time, NATURAL FORCE metaphors emphasize inevitability and scale while completely hiding human agency, decision making, and responsibility. Finally, MOVEMENT metaphors create a picture of gradual improvement, which hides the reality of recursion, chaos, and ambiguity inherent to scientific exploration. The study highlights the profound rhetorical consequences of these choices and calls for metaphor-aware communication to foster a more nuanced public understanding of scientific processes.

Keywords: Scientific Discourse; Conceptual Metaphor Theory; Highlighting and Hiding; Corpus Linguistics; Cognitive Linguistics.

1. Introduction

Scientific language has long been perceived as the most prestigious means of expression used to propagate knowledge—be it from the laboratory to society, or from the indefatigable scientist to the inquisitive researcher. Nevertheless, scientific language falls short of being the clear conduit it is meant to be. The process of conveying messages using scientific language is constantly hindered by the intrinsic complexity of ideas, specialized vocabulary, and excessive amounts of data that are likely to overwhelm, rather than enlighten, those who are supposed to benefit from them. To overcome the barriers of interpretation, science employs a unique method of conveying its messages indirectly through metaphorical devices, which bridge the gap between the unknown and the familiar (Boyd, 1993).

The genome is the blueprint of life, while the immune system acts as the body's army; these metaphors allow for immediate comprehension and are more than mere embellishments—they provide the framework in which scientific concepts and ideas are shaped and expressed (Alharbi, 2023). Moreover, according to Li, Shi, and Lei (2025), recent research conducted on a large scale in multiple disciplines has shown that lexical metaphors serve as a gateway for effective scientific communication.

Metaphor, however, is not a process of translation devoid of value judgments. As Lakoff and Johnson have stated so compellingly in their influential work, every metaphor, while bringing into focus particular aspects of a domain, at the same time and inevitably hides other aspects of that very same domain. This tension represents the core of the discussion presented in this paper. For instance, the use of a metaphor about the nature of science as an "engine" draws attention to notions of speed, power, and predictability. Funders,

politicians, and society will be assured of the great promise of such a metaphor and feel reassured about the rapidity of discoveries and innovations. At the same time, however, the precise depiction of those attributes will make other, perhaps less attractive, characteristics of the research process obscure and invisible, making it appear more predictable than it really is, and hiding the long and difficult path of discovery filled with failures and setbacks (Byrne & Mulvogue, 2026).

Whereas earlier studies have achieved success in documenting patterns of metaphor use in scientific writing (Semino, 2008; Cameron, 2010), and later studies have improved techniques used to identify metaphors through projects such as the VUA and TOEFL shared tasks highlighted by Leong et al. (2020), few attempts have been made to systematically analyze the balancing act between highlighting and concealing metaphors within the scope of a recent corpus from 2020 to 2025. In addition, most of the research done up to this point has been either limited to a certain type of metaphor, such as journey metaphors in biology, or focused on a particular scientific discipline. The relationship between different source domains and how these affect the rhetorical impact of metaphor remains relatively uncharted territory. While McGrath and Liardét (2023) have considered the variability of grammatical metaphor across disciplines, and Saneie Moghadam and Ghafar Samar (2020) have studied metaphor use in second language academic writing, neither has directly addressed the issue of selective concealment involved in everyday scientific discourse.

For this reason, this study aims to achieve three main goals. First, to discover the most common sources of metaphorical meaning that fuel the scientific discourses of today between 2020 and 2025. Second, to examine, for each dominant metaphor type, which parts of scientific activity are illuminated (prominent and valuable) and which are occluded (hidden, marginalized, or eliminated). Third, to explain the potential implications of this choice for public understanding of science, in both empowering and disempowering ways.

1.1 Organization of the Paper

In what follows, this paper will be organized as described below:

The literature review section presented hereafter will locate the study within the theoretical and methodological frameworks of Conceptual Metaphor Theory and metaphor studies in the context of corpora, based on the theoretical advances presented by Alharbi

(2023) and the methodological progress by Leong et al. (2020). Following, the methodology section will describe the process of corpus constitution, systematic analysis following MIPVU, and the analytical approach adopted in the study through cognitive and critical approaches. Finally, the analysis and discussion sections will focus on the three main metaphors identified: MACHINE, NATURAL FORCE, and MOVEMENT, illustrating the illuminating and concealing aspects of these metaphors through a series of annotated tables.

2. Literature Review and Theoretical Framework

2.1 Conceptual Metaphor Theory in Science

Conceptual Metaphor Theory (CMT), whose ideas provide theoretical groundwork for the current paper, has transformed our understanding of figurative language. For the first time, Lakoff & Johnson (1980) suggested that metaphors do not constitute merely decorative elements of language; they are cognitive devices that guide our thoughts and actions.

In science, metaphorical language serves an even more innovative purpose as it helps contemplate some puzzling phenomena by borrowing ideas from common life experiences (Kövecses, 2017). In fact, the well-known metaphor of the electric circuit as flow of water is not only an element of decorative language but a source from which we derive hypotheses about resistance and conductivity. Nonetheless, CMT points out the confining aspect of metaphors as well. The use of particular frames in a field of study excludes other perspectives and obliges the researcher to follow a predetermined path, leaving no opportunity to explore others (Esbrí Blasco, 2021).

For this case in particular, the theoretical basis presented by the concept of CMT proves to be vital for the main hypothesis concerning the need for a two-tiered action in scientific metaphors, which means the disclosure of some aspects of the world that surrounds us, as well as their concealment at the same time (Ghazinoory & Aghaei, 2024). As for the latter issue, as it has been discussed in the research carried out by Zhang et al. (2022), there are certain consequences related to the realm of aesthetics and affection.

2.2 Corpus-Based Metaphor Studies

For all their intellectual profundity, early metaphor analyses often suffered from a bias towards introspection and abstract, context-free examples. However, with the introduction of corpus linguistics, a

new paradigm emerged, allowing researchers to find consistent patterns in metaphor use across large corpora (Abdul Malik, Ya Shak, Mohamad, & Joharry, 2022). One particularly important development in this field was the introduction of a well-developed Metaphor Identification Procedure VU University (MIPVU), which required analysts to make a comparison between the contextual meaning of a linguistic unit and its more fundamental or concrete meaning. This approach added rigour and clarity to what could otherwise become subjective.

While manual analyses have continued to dominate the field, many interesting computer-assisted studies have been published as well. Ge, Mao, and Cambria (2022) showed how it is possible to build an explainable metaphor identification model based on the framework of the CMT. In their systematic review on figurative language detection, Banou et al. (2025) highlighted some of the successes in multilingual and cross-domain metaphor analysis but also drew attention to the problems that researchers still face. Studies of scientific discourse using corpora have discovered a number of prominent source domains, including journey, building, machine, and organism (Saneie Moghadam & Ghafar Samar, 2020).

Nevertheless, as pointed out by Abdul Malik et al. (2022), the majority of previous research concentrated on synchronic perspectives while the study of the diachronic change in the preferences of figurative language remains underresearched. In this regard, the current study contributes to the corpus-based approach by studying the recent period between 2020 and 2025 specifically.

2.3 The Dynamics of Highlighting and Hiding

However, while the concept of highlighting and backgrounding is attributed to Lakoff & Johnson (1980), its operationalisation is a task that the later generations of researchers faced. Recently, Burgers & Reijnierse (2026) raised a critical question regarding the function of metaphors in making abstractions concrete – a question that goes to the root of the relationship between highlighting and backgrounding. When an abstraction is highlighted, what do we sacrifice by necessity? Empirical studies carried out in different discourses revealed this dilemma. Thus, according to the results of Aulit & De Cock's (2024) study on digital activism discourse, metaphors of warfare and rescue highlight the importance and urgency of actions as well as the moral aspect of the matter, while simultaneously hiding from attention the painstakingly slow negotiations of institutions.

Just like Ghazinoory and Aghaei, Zibin and Solopova (2024) point out, while developing an agenda for the study of metaphors across cultures, that which is veiled in one language or culture may be that which is made visible in another culture, a revelation that has major repercussions for the worldwide dissemination of scientific knowledge. Although there have been many insightful contributions in this field, the majority of the current research has been limited to one metaphorical genre or one specific communicative situation. No research has attempted to investigate the interaction between illumination and obscurity in multiple source domains such as machine, force of nature, and motion within the same framework, especially after 2020 (Ghazinoory & Aghaei, 2024). This gap in literature seems even more glaring when we consider the dire necessity of understanding how scientific discourse constructs and occasionally misleads the public perception of research.

2.4 Theoretical Framework

Any research project that aims to uncover the hidden aspects of metaphorical language requires a well-defined theoretical framework. In this case, the current research draws on two complementary approaches: cognitive linguistics and discourse analysis. To begin with, cognitive linguistics, more specifically Conceptual Metaphor Theory by Lakoff and Johnson (1980), provides a core theoretical assumption that all metaphors have a conceptual nature rather than an ornamental one, meaning they play an instrumental role in shaping our perception, reasoning, and actions in the real world. In this context, such notions as highlighting and hiding are crucial because every metaphor highlights some aspects of its target domain and hides others at the same time. Additionally, the cognitive paradigm provides an analytical toolkit for pinpointing the source domains and analyzing their implications.

Nevertheless, cognitive linguistics fails to address the communicative role of metaphors, which lies beyond the scope of the cognitive paradigm. With its emphasis on critical discourse analysis, the framework pays attention to the way language, power, and knowledge interrelate with each other. A metaphor that compares scientific progress with the “engine” may have an intelligible cognitive underpinning; however, to have such a strong influence on its addressees, such a statement should be examined from a discursive perspective.

The combination of these two theoretical frameworks enables one to consider the mental representation of metaphors at the cognitive level and its

communicative performance at the discursive level. In her discussion about PIMS, Reijnierse (2023) argues that the bridge between theory and practice can only be established with the help of an approach that would take into consideration both the psychological aspect of metaphor as well as its concrete realization. The work of Tianyinga and Bogoyavlenskaya (2023), which focuses on the applicability of cognitive linguistic theories to the analysis of semantic transformations and cultural adaptations in multilingual discourse, helps to acknowledge the role played by language and culture in this dynamic process. Therefore, the proposed theoretical framework can be considered an embodiment of the dialogical approach in which cognitive linguistics contributes with the microscope, whereas discourse analysis provides a telescope. Together, they enable a form of inquiry that is at once empirically grounded and critically aware—capable of counting metaphorical frequencies yet never forgetting that each counted metaphor carries the weight of what it chooses to leave in the dark.

2.5 Research Gap

Based on the above lines of discussion, two undeniable conclusions emerge from the literature. Firstly, metaphors occur inescapably and play a meaningful cognitive role in scientific discourse (Kövecses, 2017; Burgers & Reijnierse, 2026). Secondly, the principle of highlighting and hiding is an objective phenomenon of empirical nature with considerable rhetorical significance. Still, when one delves into the extant research, several important gaps can be identified.

Firstly, there has not been a comprehensive analysis of an unbiased sample of scientific texts dated from 2020 to 2025—a period characterized by the acceleration of scientific communication, public interest in coronavirus studies, and advances in generative artificial intelligence. Secondly, different kinds of metaphors have been discussed in isolation from one another, without any attempt to compare their patterns of highlighting and hiding. Thirdly, no effort has been made to analyze the three most common source domains of metaphors: MACHINE, NATURAL FORCE, and MOVEMENT (Reijnierse & Burgers, 2023; Abdul Malik et al., 2022). Thirdly, and potentially most importantly, there is no specific evidence in the form of highly annotated tables or similar displays which demonstrate the tradeoff for each metaphorical category in relation to each other. According to Banou et al. (2025)'s systematic literature review on the topic, even advanced computer techniques for identifying metaphors do not take into

account the cost of a particular metaphor in terms of what is obscured.

In this regard, the current study bridges several connected gaps simultaneously through using the methodology proposed by Reijnierse & Burgers (2023), called the MIPVU method, and applying it to a corpus of 100,000 scientific texts written between 2020 and 2025. The two aspects that are equally relevant to the research process include revealing the illuminated meaning of metaphors (progress, predictability, directionality, inevitability) and the obscured aspect of those metaphors (complexity, contingency, failure, non-linearity, human agency). As Zibin & Solopova (2024) argue, metaphorology needs to become ethically aware that every illumination necessarily includes an act of concealment.

3. Methodology

3.1 Research Design

In order to grasp the complexity of the relationship between illumination and obscurity created by metaphors within science writing, one methodological viewpoint is not enough. The current study uses a methodology referred to as mixed-methods methodology since it involves both quantitative precision of numbers counted and qualitative analysis of metaphorical meaning. In terms of the quantitative part, the study examines the quantity of metaphors used and identifies dominant source domains. In terms of the qualitative part, the study explores the effects of different metaphor types and discusses what is being illuminated and what is being obscured as a result.

In summary, the current methodology could be regarded as descriptive and interpretative based on two theoretical approaches, namely cognitive linguistics and critical discourse analysis. As stated by Thomas (2025), when examining knowledge behaviors, concealment and revelation processes are rarely absolute and call for a research methodology that accounts for paradoxes related to them. Jones, Wall, Sankaran et al. (2023) have also addressed the issue of strategic concealment and its relationship to the formation of relational wellbeing, highlighting the importance of concealing as an active process. Thus, in the realm of metaphor analysis, a mere count of the metaphors would only give the impression of figuration; it is the interpretation of the figures that makes it come alive.

3.2 Data Collection

The corpus used in this study is made up of 100,000 running words of scientific prose in English language, compiled from sources dating back to the period from 2020-2025. The selection of this timeframe is meant to cover contemporary trends of scientific communication, characterized by accelerated dissemination of research findings, global effects of pandemic science, and increased interest in understanding scientific discoveries in lay terms. In addition, twenty scientific articles and research reports from two kinds of publications, namely highly impactful journals such as *Nature* and *Science*, and research reports from prominent institutions like Royal Society and Max Planck Institute.

Using both kinds of publication for the construction of the corpus ensures that both highly academic scientific prose and popular scientific prose are taken into account. In order to ensure balance in the choice of sources, the texts included in the corpus represent different disciplines, with forty percent being texts written within the field of physical and life sciences, thirty percent from the social sciences, and the rest from inter-disciplinary studies. Selection criteria were deliberately inclusive yet principled: each text must be written in English, must constitute either a primary research article or a comprehensive review, and—following an initial screening—must contain explicit metaphorical language that warrants close analysis.

While this selection process may appear inherently subjective at a first glance, the operational definition of the metaphor that the analysis will make objective later was followed throughout. In line with the observations made by Li and Bogoyavlenskaya (2023) in their exploration of semantic transformations and linguistic adaptations, metaphorisation in multilingual context can never be considered an entirely neutral process; similarly, the process of corpus compilation cannot either, as any selection of a text for further analysis will always be interpretively loaded. The current corpus is not claimed to reflect all aspects of scientific discourse but should rather be regarded as a deliberately compiled set of texts, extensive enough to allow generalisations to be made yet small enough to be manually annotated.

3.3 Data Analysis (MIPVU)

The process of identifying metaphors in the corpus involves the use of the Metaphor Identification Procedure VU University (MIPVU). This procedure is rigorous and systematic and has been modified from its original formulation by Steen et al. (2010) to the Procedure for Identifying Metaphorical Scenes (PIMS) by Reijnierse (2023). The rationale for

adopting MIPVU is based on the fact that MIPVU has proven reliability and that it is firmly grounded in cognitive linguistic principles, unlike other impressionistic methods that have come before it. MIPVU requires that the analyst compare the meaning of each lexical unit in its context with its more basic meaning in order to identify metaphorical cases where there is a contrast and the context is comprehensible via comparison.

There were five steps in the process. First, each of the twenty texts was carefully read in its entirety. Second, all lexical units were analyzed in their linguistic context. Third, each lexical unit was then considered to see if it had a more basic meaning elsewhere. Fourth, if there were a basic meaning and if the contextual meaning contradicted it but still could be understood using some kind of comparison, the unit was considered metaphorical. Fifth, all identified metaphorical units were registered in a searchable database, along with information regarding the source domain (such as MACHINE, NATURAL FORCE, MOVEMENT) and its occurrence in the text. The credibility of this approach was verified by calculating inter-coder reliability based on a random sample of ten percent of the corpus, that is, 10,000 words, independently analyzed by two experts familiar with the MIPVU procedure.

The rate of agreement was eighty-six percent, a result that can be classified as high enough for qualitative metaphor research (Reijnierse, 2023). It should be noted, nevertheless, that no matter how rigorous one's methodology, a certain amount of circularity is inevitable: one's understanding of what "basic meaning" means is itself influenced by culturally and linguistically biased assumptions. As Tianyinga & Bogoyavlenskaya (2023) point out in their analysis of semantic change, which follows similar principles, objectivity may not be achieved but at least systematics can be striven for.

4. Analysis and Discussion

The application of the analytical framework of MIPVU through the methodological process outlined above resulted in the identification of 1,247 metaphorical units within the 100,000-word corpus. In and of itself, the sheer volume of figurative expressions found above indicates the omnipresence of metaphor within the domain of contemporary scientific discourse, which is wholly supported by the macro-level analysis of Li, Shi, and Lei (2025) demonstrating the indispensable role that lexical metaphors play as launching pads for effective communication within science at large. However, the prevalence of metaphor alone merely scratches the

surface of the insight gained from analyzing the imagery underlying metaphorical units.

METAPHORS of MACHINES represent the largest class with a share of thirty one percent, NATURAL FORCES with twenty seven percent, and METAPHORS of MOVEMENT with twenty four percent. Thus, the three classes together make up slightly more than four fifths of the entire sample of metaphors. The rest of eighteen percent includes METAPHORS from diverse source domains such as WAR, ORGANISM, BUILDING, and CONTAINER, among others, and thus mirrors the trends of domain diversity described by McGrath and Liardét (2023). As rightly suggested by Reijnierse and Burgers (2023), however, such an analysis is not sufficient, since it reveals little information on how the use of each of the source domains influences the discourse in rhetorical

and cognitive terms. It is with respect to the question of influence that the following discussion will focus, dealing with three groups of metaphors separately.

Machine Metaphors: The rhetoric of efficiency and the eclipse of contingency

The metaphoric cluster of MACHINE dominates the language of science with the unassuming confidence of the workshop and the assembly line. Whether referring to the “engine of scientific advancement” or to an idea as a “smoothly operating machine,” scientists draw upon a rich source domain characterized by concepts of exactness, deterministic cause-and-effect, and efficiency. Table 1 lists a few of these metaphors found in the text, organized to reveal the systematic compromise of what each reveals versus conceals.

Table 1: MACHINE Metaphors – Highlighting and Hiding

Example from Corpus	Literal Meaning (Basic)	Metaphorical Meaning	What is HIGHLIGHTED	What is HIDDEN
<i>“the engine of scientific progress”</i>	A mechanical device that converts energy into motion, producing power	The driving force that propels advancement and innovation	Efficiency, raw power, sustained forward momentum, causal clarity	The slow, incremental, often serendipitous nature of real discovery; the role of intuition and accident
<i>“research mechanisms must be calibrated”</i>	A set of moving parts within a machine; to adjust an instrument to precise specifications	Methods and procedures require fine-tuning for optimal operation	Precision, control over variables, quantifiable measurability, the ideal of exactitude	Interpretative flexibility, the inherent messiness of qualitative insights, uncertainty as a productive force
<i>“this model is a well-oiled machine”</i>	A lubricated mechanical device functioning without friction	A smoothly operating system where all components work in harmony	Reliability, predictability, seamless integration, freedom from friction	Breakdowns, anomalies, exceptions that do not fit the model; the friction of peer disagreement
<i>“we need to turbocharge data collection”</i>	To increase the power output of an engine by forcing in more air/fuel mixture	To accelerate the pace and volume of research output	Velocity, quantitative output, urgency, competitive edge	Quality-trade offs, ethical delays in data acquisition, the value of slow science
<i>“the machinery of peer review”</i>	The mechanical apparatus of a factory	The procedural system that evaluates and filters research	Order, standardisation, impartiality, industrial efficiency	Subjectivity, bias, the labour of human judgement, the occasional caprice of reviewers

MACHINE metaphors reign supreme within engineering, computing, and biomedical sub corpora, areas where the subject of study itself can be seen to be an artefact of technology (Li et al., 2025). But their scope goes further still, seeping into the discourse of the social sciences and interdisciplinary studies as well. What is emphasized by such metaphors? Agency, efficiency, and control: a vision of science as a deliberate, optimizable process that may be quantified, fine-tuned, and expedited. There is value here.

It imbues people with a belief in the power of science to solve problems, convinces funding organizations that their research will be conducted efficiently, and allows the general populace a sense of comfort in knowing that progress will continue apace (Byrne & Mulvogue, 2026). But in the words of Burgers and Reijnierse (2026), is it not the case that metaphors which provide more concrete forms for abstract ideas do so at a price? The price of using MACHINE metaphors is that all that is non-mechanical, human, and unpredictable becomes systematically obscured.

True scientific discovery, as any working scientist can tell you, involves false leads, broken instruments, misread results, and theories that fall apart at the first touch of empirical data. None of these elements have a comfortable place in the well-oiled-machine metaphor. The very idea of calibrated mechanisms presupposes an environment of known inputs and outputs, while genuine science frequently moves forward by way of interpretative leaps which cannot be

translated algorithmically (Alharbi, 2023). In this respect, MACHINE metaphors can unintentionally distort the public understanding of scientific work by leading decision-makers and citizens to expect predictability and linearity in research—misleading assumptions that become acutely clear in cases of vaccine research stumbles and failed clinical trials. According to Thomas' findings in his analysis of knowledge behaviours, it is worth noting that the paradox of concealment lies in the fact that it is what we do not see that holds the greatest power over us; perhaps the machine metaphor's exclusion of contingency is its most important rhetorical function.

NATURAL FORCE METAPHORS: THE RHETORIC OF INEVITABILITY AND THE ERASURE OF AGENCY

While MACHINE analogies cast science as a man-made artifact, NATURAL FORCE analogies serve a distinct—and perhaps even more dangerous—rhetorical purpose. By reconfiguring scientific evolution as an event of geological or meteorological scale—an unstoppable wave, an exploding force, a flood that no defence can withstand—this group of analogies creates a powerful illusion that hides more than it reveals. Examples of each type are documented in Table 2.

Table 2: NATURAL FORCE Metaphors – Highlighting and Hiding

Example from Corpus	Literal Meaning (Basic)	Metaphorical Meaning	What is HIGHLIGHTED	What is HIDDEN
<i>“an explosion of genomic data”</i>	A sudden, violent release of energy and matter from a confined space	A rapid, dramatic increase in the volume of available genetic information	Scale and magnitude, drama, perceived inevitability, a sense of being overtaken	The slow, deliberate, painstaking work of data curation and quality control
<i>“the wave of AI adoption”</i>	A moving swell or ridge of water on the surface of a body of water	An irresistible, sweeping trend toward artificial intelligence integration	Momentum, naturalness, the feeling that resistance is futile	Human choices, institutional resistances, the active labour of technology diffusion
<i>“data flood social media research”</i>	An overflowing volume of water that submerges land	An overwhelming outpouring of digital information that inundates researchers	Force majeure, urgency, the sense of drowning, the need for immediate response	Selective sampling strategies, systematic biases in data collection, the ethics of data use
<i>“scientific currents shifted”</i>	A directed, continuous flow of water in a particular direction	A paradigm change or reorientation of a research field	Directionality, natural force, collective movement, power beyond individual control	Contingency, active scholarly disagreement, the role of individual pioneers or dissenters
<i>“the tide of public opinion turned against the hypothesis”</i>	The periodic rising and falling of sea levels driven by lunar gravity	A gradual yet inexorable reversal of collective scientific consensus	Cyclical predictability, inevitability, the sense of being swept along	Deliberative reasoning, evidence accumulation, the agency of scientific communities

NATURAL FORCE metaphors posit scientific development as an unstoppable event, similar to an earthquake, a tsunami, or a volcano eruption. The point here is to emphasize the objectivity and impartiality of the scientific process, with the implication that there was nothing one person or decision could have done about it (“It just happened”). Such figures of speech are particularly useful in contexts of communicating science to the general public because they imply a certain inevitability of scientific progress, its certainty, like the inevitability of the tides, like sedimentation, erosion, etc., of mistakes and inaccuracies. Yet the very nature of the NATURAL FORCE metaphor conceals the question of agency, accountability, and responsibility.

If the data overload comes, who is responsible for inadequate data management? If there is an “adoption wave” of artificial intelligence within a particular discipline, who are the decision-makers who either adopted the innovation or resisted it?

In the same way, the “explosion of information” metaphor naturalizes a profoundly social phenomenon of publication, prioritization, and distribution. Such metaphors tend to let scientists—along with the organizations backing them up—off the hook for determining the course of research, by framing trends as natural phenomena, instead of products of human reasoning, rivalry, and, in some cases, whimsical thinking. As Jones, Wall, Sankaran et al. (2023) point out in their investigation of tactical concealment, the practice of hiding in plain sight involves a multifaceted process that can simultaneously be used as a tool of protection and deception.

The metaphor of natural force can offer scientists an alibi for any accusations of prejudice or mistakes made during the work on a project, but it also misleads the general population by conjuring up a picture of science that operates independently of any human intervention—this illusion becomes a lethal one if trust in scientific organizations

depends on accountability. In a systematic review of computational methods used in figurative language detection, Banou et al. (2025) state that metaphors of natural force are especially difficult to detect since they are pervasive within the scientific discourse.

Movement Metaphors: The Rhetoric of Linearity and the Denial of Recursion

The third family of dominant metaphors, METAPHORS OF MOVEMENT, forces the story of linear advancement onto the cyclical, iterative nature of scientific investigation. Scientists who invoke the phrase “a path of discovery” or urge peers to continue “moving forward” employ the source domain of direction, goals, locations, and progress through space. See Table 3 for a selection of metaphors of movement from the corpus, all of which have been analyzed as previously discussed.

Table 3: MOVEMENT Metaphors – Highlighting and Hiding

Example from Corpus	Literal Meaning (Basic)	Metaphorical Meaning	What is HIGHLIGHTED	What is HIDDEN
<i>“the path of discovery”</i>	A beaten track, walkway, or route from one place to another	The sequential unfolding of findings and insights over time	Direction, purpose, a clear destination, the sense of a journey with meaning	Zigzags, detours, dead ends, discoveries made by accident or while looking for something else
<i>“research journey”</i>	The act of travelling from one geographical point to another	The long-term process of conducting a study or building a career	Adventure, learning, personal growth, narrative coherence	Tedium, repetition, the grinding labour of routine experiments, the bureaucratic aspects of research
<i>“moving forward”</i>	Advancing physically in a direction away from a starting point	Making progress, achieving new knowledge or better methods	Improvement, linearity, forward momentum as a value	Sideways moves, regress, circling back to earlier questions, the productive value of going backward
<i>“to navigate complexity”</i>	To steer a ship or vehicle through a challenging passage	To manage difficult, multifaceted research problems	Skill, the possession of a map, control over variables, wayfinding	Getting lost, ambiguity, the absence of any map, the necessity of wandering without guarantee
<i>“the trajectory of the field”</i>	The curved path of a projectile under external forces	The historical development and projected future direction of a discipline	Predictive arc, mathematical elegance, cause and effect	Discontinuities, ruptures, events that redirect trajectories in unforeseeable ways

The METAPHORS OF MOVEMENT emphasize the process of traveling from one point to another, passing through key stations, and reaching the desired destination: healing a disease, solving an equation, or completing a dissertation. Such metaphors are pedagogically valuable, as they help students understand the course of a scientific program and provide the general public with confidence in the direction that science is taking (Saneie Moghadam & Ghafar Samar, 2020). Indeed, the metaphor of the journey resonates strongly with society, as it evokes stories of great exploration, heroism, and adventure from the time of Odysseus to the time of the astronauts. However, the figurative focus on movement does not reveal how science actually works. Science is not always a smooth process, nor does it follow a clear trajectory toward its goal. Instead, science is often characterized by dead ends, failed replications, uninterpretable results, and even paradigm shifts that, as Thomas Kuhn famously pointed out, sometimes depend on the death of an entire generation (Esbri Blasco, 2021).

In the context of “moving forward,” moving backward would be seen as regressing, even though some of the most significant scientific discoveries have resulted from exploring previously discarded theories or analyzing earlier data through a different lens. In the same vein, “navigating complexity” assumes that there is a map, which does not exist in actual scientific work, where there is only the fog, the hunch, and the occasional stroke of luck (Li & Bogoyavlenskaya, 2023). By framing scientific progress as a journey along a path, these metaphors prevent people from understanding that scientific knowledge is always subject to uncertainty and requires failures to be made. Even worse, the metaphor implies that any diversion from the path would be a mistake, while, in reality, such deviations usually yield some of the greatest discoveries, such as the invention of penicillin or cosmic microwave background radiation.

According to Zhang, Atari, Schwarz, Newman, and Afhami (2022), the fluency of the metaphor has a significant impact on its persuasiveness; the fluency of the movement metaphor is so high, so aesthetic, that its concealment becomes almost imperceptible.

However, the concealment of the metaphor is crucially important for the public understanding. If a well-known research program fails to "move forward," the public, used to years of journey and path metaphors, will consider that the science failed, not recognizing the fact that movement backward is an inherent element of the true scientific process.

5. Summary of Data Analysis: The idealised image and its shadows

Synthesising the three analytical subsections, a striking pattern emerges. The MACHINE, NATURAL FORCE, and MOVEMENT metaphors, despite their distinct source domains, converge upon a remarkably coherent idealised image of science. According to this idealisation, science is:

Efficient (MACHINE) – a well-calibrated system that transforms inputs into outputs with minimal waste and maximal speed.

Inevitable (NATURAL FORCE) – a phenomenon that unfolds with the same inexorable certainty as geological or meteorological events, beyond the power of individuals to halt or redirect.

Directional (MOVEMENT) – a linear progression toward ever-greater knowledge, with clear paths, milestones, and destinations.

What is systematically hidden by this triple figuration is precisely the counter-image—the messy, human, contingent reality that every scientist knows from the inside. The hidden includes:

Trial-and-error, inefficiency, and luck – the false starts, the serendipitous accidents, the hunches that pay off, the equipment that fails at the worst possible moment.

Human agency, disagreement, and choice – the fierce debates at conferences, the editorial decisions that shape publication, the funding priorities that steer entire fields, the resistances and refusals that are as much a part of science as consensus.

Non-linearity, regress, and ambiguity – the backtracking, the circling, the results that refuse to fit any theory, the productive confusion that precedes genuine insight.

According to Abdul Malik, Ya Shak, Mohamad, and Joharry (2022) in their survey of corpus-based metaphor studies, the linguistic packaging here is not part of some conspiracy but is rather the result of the

need to adapt scientific rhetoric to the needs of its discourse. In order for a scientific field to be able to secure financial backing, attract students, and retain public confidence, it must project coherence, progress, and control. Clutter sells poorly. However, at a price, this adaptation is a distortion of the nature of science.

As discussed by Ghazinoory and Aghaei (2024) in their meta-reflection of metaphor research as a research methodology, every methodology entails an ethics, just as every metaphor does. The problem is that these metaphors make science appear to be something more certain, more powerful, and more orderly than it truly is. While this could generate public confidence in the short term, it also creates unreasonable expectations. Should any failure ever arise in science (failure of vaccines, retractions, contradictory findings), then the discrepancy between the two could lead to shock, disillusionment, and even mistrust (Leong et al., 2020; Ge et al., 2022).

A more even-handed scientific rhetoric might also draw on other types of figurative language that emphasize the complexities of scientific knowledge production rather than masking them—metaphors like "science as a chaotic kitchen" (where accidents happen all the time and quick thinking is required) or "research as journeying through a fog" (in which the point is not a destination but simply an orientation). In the view of Tianyinga and Bogoyavlenskaya (2023), metaphors like these, as discussed in their research on the transformation and adaptation of semiotic resources, are not only possible but also increasingly common in particular multilingual and multidisciplinary environments. The goal of the responsible science writer is not to avoid metaphor entirely—an impossible feat—but rather to maintain the flexibility needed for tomorrow's insights to emerge from today's dark shadows.

6. Conclusion

This study aimed at exploring the nature of metaphorical highlighting and concealment within the context of current scientific discourse (2020-2025). By analyzing a 100,000-word corpus and using the MIPVU coding technique, it was possible to identify three major metaphors, namely MACHINE, NATURAL FORCE, and MOVEMENT. These metaphors highlight the desirable aspects (efficiency, inevitability, and directionality) while consistently concealing the untidy, nonlinear, and agent-based aspects of scientific endeavors.

Implications for theory: This study provides an empirical contribution to Conceptual Metaphor

Theory by revealing the unique costs associated with each source domain in a corpus-based analysis.

Implications for practice: Metaphor-awareness must come to science communication professionals, educators, and researchers. Metaphor-selection is not only a question of style but also a rhetorical practice that informs public perception. Where applicable, complementary metaphors that emphasize uncertainty (for example, “science as a mystery story with misleading clues” or “science as a puzzle without some pieces”) should be employed to counterbalance the influence of hegemonic metaphors.

Limitations: The study has been conducted using a limited-sized corpus (100,000 words; English only). It is essential for future research to build a larger corpus by adding other languages besides English and even spoken language used in scientific discourse (e.g., scientific conferences).

It is important, however, to remember that progress does provide light, but at times, it may conceal things. It is crucial for a mature scientific discourse to recognize both light and darkness.

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