Science and Religion as Languages: Using the "Language" Metaphor to Understand Science, Religion, and Their Relationship

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Short Abstract

In the field of science and religion, there is a need for a model that represents the dynamic science-religion interface without curtailing its rich complexities. This thesis proposes the "language" metaphor to describe and explore science, religion, and their relationship and sets out to assess its potential in this respect by considering its application in six areas of interest—namely, the definition of language; its changes over time; variations within languages; the relation between language and worldview; the relation of language, identity and power; and the significance of bilingualism and the role of translation.

The systematic exploration of the metaphor reveals the multidimensional aspects of science and religion. Science and religion can both be seen as systems of communication made of mental constructs and rules. Science excels in communicating the knowledge of the physical world, while religion conveys faith, meaning, and life orientation. Science and religion change over time in response to factors that shift the needs of the linguistic community. Science and religion also structure people's experiences of the world and shape their worldviews. Moreover, science and religion help to form people's identities and power relations.

The metaphor also yields an understanding of the fluid and dynamic science-religion relationship. When seen as languages, science and religion are not always in conflict or separated independently. Rather, for bilinguals, they are an integrated whole, used for different purposes and in different contexts, and conveying advantages such as cultural sensitivity and an expanded worldview. Bilinguals can facilitate the science-religion dialogue as translators who relay accurate information between different communities. It is concluded that the "language" metaphor is an innovative model that not only provides a helpful way of envisaging the complexities of the science-religion relationship but also advances the quest for understanding through perceiving a wide range of connections and associations.

Long Abstract

The science-religion interaction has been the subject of continued interest in the field of philosophy, religion, science, and theology since the 1960s. Some scholars, such as Ian Barbour, Roland L. Numbers, and Mikael Stenmark, tried to model the relationship using specific typologies. Other scholars used metaphors like "two books," "wave-particle duality," and "three body problem" to illustrate the interrelation. In the 2010s, Peter Harrison criticised the past science-religion discourse for treating "science" and "religion" as discrete, universal entities with enduring essence. He argued that the analysis of the historical cartography of the two terms reveals that "science" and "religion" are concepts with shifting boundaries depending on time and context. In recent years, studies that acknowledge the immense diversity in science and religious practices have tried to provide a limited but detailed look at the science-religion engagement using narrowly-focused theological questions or practical questions. Despite these movements, the field of science and religion still needs more ways of modelling the complex concepts of "science," "religion," and their relationship while avoiding pitfalls of essentialism and generalisation.

In response to the need for a historically and contextually sensitive representation of the science-religion interface, this thesis presents the "language" metaphor, which views science and religion as two languages. In linguistics, a metaphor is defined as a figure of speech that uses words to say one thing and thereby communicate another thing. Cognitive linguists George Lakoff and Mark Johnson suggest a special type of metaphor—namely, conceptual metaphor—to refer to the understanding of one domain of experience (the target; typically abstract) in terms of another (source; typically concrete). [1] Lakoff and Johnson also explain that conceptual metaphors are processed by selecting elements from the source domain and mapping them onto the aspects of the target domain. The system of conceptual correspondences or mappings between two domains is called cross-domain mapping.

The "language" metaphor, according to cognitive linguistics, is a *conceptual* metaphor, introducing the "language" concept to understand the abstract "science" and "religion" concepts. It is also identified as a *novel* metaphor, relatively rare in natural language. Moreover, the "language" metaphor is a *deliberate* metaphor that intentionally diverts attention from the target to the source domain for processing the meaning. The conceptual, novel, and deliberate metaphors are processed by cross-domain comparison or mapping. This thesis applies the cognitive linguistic view of metaphor to interpret the "language" metaphor.

The concept of "language," as the source domain, has tremendous potential for uncovering the complexities of science and religion because it has many dimensions of understanding. Language is a system of symbols and rules that work together to convey meaning. As a medium of communication, it is an integral part of everyday activity in a social context. Language can be studied at the level of the individual, as a cognitive function, and at the level of community, as a tool for social solidarity, identity formation, and power control. Moreover, the concept of language is a subject of study in various fields, not only limited to linguistics but also psychology, neuroscience, cognitive science, sociology, politics, and anthropology. Given its versatility, the "language" concept is a fitting source domain for exploring the target domains of "science" and "religion."

[1] George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago; London: University of Chicago Press, 1980).

The thesis aims to assess the utility and usability of the "language" metaphor for understanding science, religion, and their relationship. Using the cross-domain comparison to process the metaphor, this thesis selects six topics or themes in linguistics that are mapped onto the domains of "science," "religion," or their relationship. Each chapter in the thesis addresses one topic that acts as a lens to represent the science and religion interface from a particular angle. Together, the six themes produce a comprehensive, multidimensional, and detailed understanding of the science-religion relationship. Due to the limited scope of discussion, the domain "science" denotes natural empirical sciences, and "religion" refers to Christianity, the world's largest religion, as the representative for the purpose of this thesis.

The assessment of the "language" metaphor begins with the definition of language. Language is defined as *a system of symbols and rules used in a social context to carry out communicative functions.* In this definition, there are three focal points: (1) language is a *system* made up of various components; (2) language is a *social* phenomenon; and (3) language performs communicative *functions.* Mapping these features of language onto the domains of "science" and "religion" reveals that science is a system made up of scientific constructs and tools guided by the scientific method to produce scientific knowledge of nature, and religion is a system of symbols and rituals working together to create coherent, authentic expressions of faith. The cross-domain mapping of the definition of language highlights that science and religion are not simple, mechanistic systems but meaningful discourses produced by the particular community situated in a particular sociocultural context.

The next phase of evaluation focuses on how language changes over time. Since language responds to the shifting needs, values, and contexts of the linguistic community, all areas of language, including phonology, syntax, discourse style, and lexicon, evolve. Under the metaphorical framework, the feature of diachronic change is mapped onto science and religion. One of the common errors in the study of the science-religion relationship was not taking the historical aspect into consideration. Thus, the language metaphor offers a corrective, showing that change and adaptability are intrinsic to science and religion, and any discussion regarding the science-religion relationship must have historical sensitivity. Furthermore, this metaphor enables further exploration of whether the development over time is progress and whether the essence of science and religion change over time.

After examining the diachronic change in language, the thesis turns to synchronic variation. There are more than 7,000 languages and countless subvarieties in the world today. Language diversifies due to various factors, including geographical location, age, ethnicity, sociocultural status, and context. The term "dialect" refers to a language variant associated with the characteristics or identity of the language user, whereas the term "register" refers to linguistic variety used for a particular communicative situation. When mapping the concepts related to language variation onto the "science" and "religion," scientific disciplines appear as different registers used for a particular subject of study, and Christian denominations are viewed as different dialects. The metaphor also underscores the importance of identifying which science and religion varieties are involved in the science-religion interface.

The fourth point of correspondence mapped onto science and religion is the topic of linguistic worldview. According to the Sapir-Whorf hypothesis, the language used by a given community influences thoughts and experiences of the world. This hypothesis, transferred to the science and religion domain, unfolds that science structures one's experience of the world using its distinct scientific constructs and produces a detailed but limited view of the natural

world. In the case of religion, Christianity organises one's experience using narratives, propositional statements containing theological constructs, and performative speech-acts and helps to create an overarching worldview that encompasses both physical and metaphysical reality. The assessment regarding the linguistic worldview underscores that by using the languages of science and religion together, language users can experience an expanded, enriched worldview.

The "language" metaphor also posits identity and power as tools to uncover valuable insight into the "science" and "religion" domains. While all languages assist with identity formation and construction and maintenance of power, the Korean language, with the unique history of the invention of Korean script, linguistic assimilation policy during the Japanese annexation, and the emergence of the Korean language as the national identity, provides a rich resource for making connections with science and religion. The process of comparison affirms that the language of science is an emblem of professional scientists, yielding them certain sociocultural privileges as experts. The language of Christianity also demonstrates one's non-negotiable identity as a Christian, even amid severe persecution. The linguistic identity and power concepts are particularly important for assessing scientism and Christian fundamentalism, which demand their language as the only correct, standard language for interpreting reality. Under the "language" metaphor, scientism and fundamentalism are instances of linguistic imperialism.

The last elements drawn from the "language" domain are bilingualism and translation. Bilingualism broadly denotes the ability to use two different languages. Bilinguals have varying degrees of proficiency in their languages and use them for different contexts, purposes, and situations. They benefit from certain cognitive, social, and economic advantages. Moreover, they can train to become translators, facilitating communication between two distinct linguistic communities. Bringing this concept to science and religion affirms that bilinguals in science and religion are bicultural, have dual membership in scientific and religious communities, and exhibit cultural sensitivity and openness. They are responsible for producing fruitful dialogues between science and religion. In addition, the "language" metaphor informs that skilled translators can help alleviate conflict situations by correcting misunderstandings and promoting meaningful discussions between scientific and religious communities.

The "language" metaphor, through the unique processing of cross-domain comparisons on six different linguistic features, discloses a comprehensive, rich representation of science, religion, and their relationship in all dimensions of reality. No past or current models and metaphors have matched the "language" metaphor on the criteria of explanatory success, utility, contextuality, vivid imagery, and intuitiveness. In addition to its contributions to the field of science and religion, the "language" metaphor also encourages the application of cognitive linguistics to theology in understanding the nature of metaphorical language about God. The "language" metaphor also reaches a wider readership beyond science and religion for its innovative interdisciplinary work, making connections with various fields of study. Considering these factors, the "language" metaphor is an invaluable heuristic tool for not only conceptualising science, religion, and their relationship but also making connections and bringing various disciplines into a conversation.

Introduction

When we consider what religion is for mankind, and what science is,
it is no exaggeration to say that the future course of history depends upon the decision of this generation as to the relations between them. – A. N. Whitehead[2]

Past views of science, religion, and their relationship

In the 21st century, science dominates almost every sphere of modern life. Consider the "gifts" of science. New technologies such as smartphones, electric cars, laptops, and vaccines are integral and indispensable parts of everyday life. More and more people regard science and technology as sources of practical, valuable, and authoritative knowledge that improves the quality of life.

While science enjoys tremendous power in society, the influence of religion in social and political spheres is diminishing, at least in the secularising Western world. Fewer people identify with a particular religious affiliation and attend religious rituals. Nevertheless, religion remains a powerful force in transforming one's life and shaping societal values and culture.

Ever since the late 19th century publications of John William Draper's *History of the Conflict Between Science and Religion* and Andrew Dickson White's *A History of the Warfare of Science with Theology in Christendom*, many assume that science and religion are in a perennial conflict for power and control.[3] For instance, in an ABC News interview in 2010, English theoretical physicist Stephen Hawking said, "There is a fundamental difference between religion, which is based on authority, [and] science, which is based on observation

[2] Alfred North Whitehead, *Science and the Modern World*, Reprint ed. (Cambridge: Cambridge University Press, [1926] 1933), 3.
[3] John William Draper, *History of the Conflict between Religion and Science*, The International Scientific Series, (New York: D. Appleton and Company, 1875); Andrew Dickson White, *A History of the Warfare of Science with Theology in Christendom* (New York, NY: D. Appleton and Company, 1896).

and reason. Science will win because it works."[4] News articles headlined "Do science and religion conflict? Yes – and it matters" or "Dan Brown declares that 'God cannot survive science'" continue to capture the public's attention.[5] In addition, the "New Atheists" such as Richard Dawkins, Daniel Dennett, Christopher Hitchens, and Sam Harris vehemently criticised religion as irrational and urged people to abandon religion. The portrayals of science and religion as opposing forces in the popular press and other media outlets sustain the idea that science and religion are incompatible. However, the conflict thesis is not the only way of explaining the relationship between science and religion.

Beginning around the 1960s, Ian Barbour led the intellectual discussion about the constructive interaction between science and religion. In *Issues in Science and Religion,* Barbour indicated that the greatest impediment to seeing beyond the conflict thesis has to do with the epistemology of religion— "the assumption that the scientific method is the only road to knowledge."[6] While acknowledging the success of the scientific method, Barbour called attention to the inherent limitations of science. He observed that science is not value-free and purely objective but value-laden and dependent on cultural, social, and other factors. Noting these characteristics of science, Barbour proposed what he labelled "*critical realism*," which "sees theories as limited accounts of aspects of the world as it interacts with us."[7] He positioned critical realism between the extreme positions of classical or naive realism, which treated theories as the exact and complete replicas of the world, and instrumentalism, which took scientific theories as useful human constructions for calculating, predicting, and controlling

[4] Stephen Hawking, "The Conversation: Stephen and Lucy Hawking," interview by Diane Sawyer, *ABC News*, Jun 7, 2010.
[5] Connor Wood, "Do Science and Religion Conflict? Yes - and It Matters," The Blog, *Huffington Post*, May 9, 2016, https://www.huffingtonpost.com/connor-wood/do-science-and-religion-c_b_9829960.html; Thomas D. Williams, "Dan Brown Declares That 'God Cannot Survive Science'," *Breitbart*, Oct 17, 2017, http://www.breitbart.com/big-government/2017/10/17/dan-brown-declares-that-god-cannot-survive-science/.
[6] Ian G. Barbour, *Issues in Science and Religion* (London: SCM Press, 1966), 137.
[7] Ibid., "A Personal Odyssey," *Theology and Science* 15, no. 1 (2017): 11, https://doi.org/10.1080/14746700.2016.1265215.

nature. Barbour's account of critical realism accepted that science corresponds to an objective reality but also admitted that science is limited and requires interpretation. In Barbour's words, critical realism "acknowledge[s] both the creativity of man's mind, and the existence of patterns in events that are not created by man's mind. Critical realism acknowledges the indirectness of reference and the realistic intent of language as used in the scientific community."[8]

For Barbour, the use of models and metaphors lay at the heart of critical realism. In *Myths, Models, and Paradigms,* Barbour indicated that models are not literal, photographic representations of the natural world or useful fictions but provisional imaginative tools for ordering and representing selected features of reality.[9] Accordingly, he argued that theoretical models prevalent in science play an important role in offering a symbolic representation of aspects of the natural world that are not directly accessible or observable.

Barbour's critical realist understanding of scientific theories enabled a way to see how science and religion are related, especially on the matter of making claims. While not dismissing the crucial differences between science and religion, Barbour identified the similarities as (1) the fact that scientific and religious claims rely on interpreted experiences, (2) the significance of the scientific and religious communities, and (3) the use of models, analogies, and metaphors to offer coherent but partial views of reality. Having observed these parallels, he highlighted that both scientific communities and religious communities use interpretive language realistically and referentially.[10] Given various analogous features of science and religion, Barbour argued that science and religion should lie on a continuous spectrum with varying degrees and types of subjective and objective characteristics instead of

[8] Ibid., *Issues in Science and Religion*, 172.
[9] Ibid., *Myths, Models and Paradigms: The Nature of Scientific and Religious Language* (London: SCM, 1974).
[10] Ibid., *Issues in Science and Religion*, 267.

assuming a sharp dichotomy.[11] Thus, Barbour set out critical realism as the "bridge" between science and religion.

Having established critical realism as the methodological basis of science-religion interaction, Barbour offered a systemic overview of the patterns of science and religion interface in his monograph *Religion in an Age of Science.*[12] Here, he categorised the science-religion relationship into four typologies: conflict, independence, dialogue, or integration.[13] Barbour saw that the interaction moves in a trajectory—from initial competition to independence and ultimately to dialogue or integration. While Barbour's fourfold model had been highly influential in illustrating that the science-religion relationship can take various forms other than conflict, it was criticised as being too static and oversimplified. As Geoffrey Cantor and Chris Kenny pointed out, it overlooked the complexity of history "that cannot be incorporated in simplistic taxonomies."[14] Moreover, this model, mainly concerned with purely intellectual matters, failed to accommodate social and cultural dimensions that influence science-religion interaction. Nevertheless, Barbour's fourfold typology based on critical realism inspired many scholars to explore the intersections between science and religion and develop other models and metaphors for apprehending the science-religion engagement.

Instead of reducing the science and religion interaction into meta-narratives, John Hedley Brooke focused on the complexities of the science-religion relationship. "serious scholarship in the history of science has revealed so extraordinarily rich and complex a relationship between science and religion in the past that general theses are difficult to sustain. The real lesson turns out to be the complexity."[15] Brooke asserted that the complexity lies in

[11] Ibid., 176.
[12] Ian G. Barbour, *Religion in an Age of Science*, Gifford Lectures, (London: SCM, 1990).
[13] Ibid., *Issues in Science and Religion*.
[14] Geoffrey Cantor and Chris Kenny, "Barbour's Fourfold Way: Problems with His Taxonomy of Science-Religion Relationships," *Zygon* 36, no. 4 (2001): 774, https://doi.org/10.1111/0591-2385.00395.
[15] John Hedley Brooke, *Science and Religion: Some Historical Perspectives*, Canto Classics, (Cambridge: Cambridge University Press, [1991] 2014), 6.

uncovering the diverse, subtle, and ingenious methods employed to probe fundamental questions regarding one's relationship with nature and God.[16]

In *Science and Religion,* Brooke criticised conventional views of the science-religion relationship for using rigid definitions of "science" and "religion." Brooke noted that the boundaries between science and religion have shifted over time. For instance, people like Isaac Newton in the seventeenth century considered themselves not pursuing "natural science" but "natural philosophy," which integrates interests in God and the physical world. He also mentioned how the modern term "religion" denotes a wide range of meanings, including a belief in supernatural being(s), a commitment to some transcendent "other," and an organised institution that attempts to provide answers to life's meaning, purpose, and destiny, or any deeply held convictions.[17] Considering the multifaceted and changing understandings of "science" and "religion," Brooke argued that any talk about their relationship is somewhat artificial, constrictive, and lacking historical and contextual sensitivity. To avoid such issue, Brooke opted to offer "a historically based commentary" on specific topics or instances of science-religion interaction in particular historical, social, and cultural contexts.[18] Overall, Brooke's work has been instructive in revealing the complexity of the relationship between science and religion and the value of a historical and contextual method in studying how "science," "religion," and their relationship are construed.

Given the complicated, broad notions of "science" and "religion," Willem Drees, Stephen J. Gould, and Bruno Latour tried to present a focused outlook of the science-religion relationship by outlining clear conceptual boundaries of "science" and "religion." Willem Drees took a strong naturalist view of "science" and "religion." Seeing religion as a human phenomenon in a sociocultural context, Drees identified nine arenas of debate produced by the

[16] Ibid., 6-7.
[17] Ibid., 8.
[18] Ibid., 6.

three challenges of religion from the natural sciences interacting with the three core elements of religion.[19] Using this 3x3 classification model delineating the specific areas of dispute, Drees attempted to avoid the perils of extreme complexity, anachronism, or generalisation that often plague the discussion on the science-religion interaction.[20]

For Stephen J. Gould, "science" and "religion" were defined as disciplines, each with its legitimate magisterium or teaching authority. According to Gould, "science" dealt with the empirical constitutions of the universe, whereas "religion" engaged with moral values and spiritual meanings of human lives.[21] Consequently, he saw "science" and "religion" as having non-overlapping magisteria (NOMA) and argued that their relationship could only be that of independence.[22]

Unlike Gould, who regarded "science" and "religion" as two distinct mental competencies brought to bear on two different realms, Latour insisted that the two exist as mediators in the *same* broad set of competencies but going in two *different* directions.[23] Latour argued that "science" reaches towards the worlds that are invisible because they are too small, too distant, too odd, too counterintuitive, and only accessible through complicated and indirect networks of instruments, models, and images.[24] On the other hand, he viewed "religion" as a performative speech-act, like a love talk, not a system of factual knowledge or beliefs. He asserted that "religion," like "science," leads towards the invisible, but this invisible is close and present but often concealed by the intuitions and prejudices of common sense.[25] Since

[19] Willem B. Drees, *Religion, Science and Naturalism* (Cambridge: Cambridge University Press, 1996).
[20] Ibid., 45.
[21] Stephen Jay Gould, *Rocks of Ages: Science and Religion in the Fullness of Life* (London: Jonathan Cape, 2001); ibid.
[22] Gould's later writings, however, show a willingness to allow some degree of interaction and crossfertilization between science and religion: Alister E. McGrath, "A Consilience of Equal Regard: Stephen Jay Gould on the Relation of Science and Religion," *Zygon* 56, no. 3 (2021), https://doi.org/10.1111/zygo.12733.
[23] Bruno Latour, "'Thou Shall Not Freeze-Frame' or How Not to Misunderstand the Science and Religion Debate," in *Science, Religion, and the Human Experience*, ed. James D. Proctor (Oxford; New York: Oxford University Press, 2005), 46.
[24] Ibid.
[25] Ibid.

Latour believed that "science" and "religion" produce true meaning while continuing and elongating the cascade of mediations, he considered that the conflict thesis "ignor[es] the *flowing* character of science and religion."[26]

While Drees, Gould, and Latour illustrated a particular picture of the science-religion interaction using specific definitions of "science" and "religion," scholars such as Roland L. Numbers and Mikael Stenmark continued to create an overarching model accounting for various science-religion interactions. According to Numbers, Brooke's complexity thesis "left many feeling emotionally and intellectually unsatisfied, because…Brooke's complexifying history seems to have little to recommend it besides its truth."[27] As a result, Numbers aimed to "(re-)simplify the increasingly complex story of the historical relationship between science and religion" by offering five mid-scale generalisations or themes—namely, naturalisation, privatisation, secularisation, globalisation, and radicalisation. [28] He argued that the generalisations or themes of the relationship neither abandon the complexity thesis nor retreat to uncomplicated master narratives. Nonetheless, as Numbers explained, these categories of understanding the science-religion relationship are subjective and may not be relevant to the non-American, non-Christian audience.

Unlike Numbers, who identified the patterns in the history of science and religion, Mikael Stenmark proposed the multidimensional model classifying the science-religion relationship as irreconciliation, reconciliation, independence, or replacement. He insisted that each typology is complicated by various factors, such as the different branches of Christianity, diverse views of science, historical and cultural context, and dynamic changes over time.[29] For

[26] Ibid., 45.
[27] Ronald L. Numbers, "Simplifying Complexity: Patterns in the History of Science and Religion," in *Science and Religion: New Historical Perspectives*, ed. Thomas Dixon, G. N. Cantor, and Stephen Pumfrey (New York, NY: Cambridge University Press, 2010), 263.
[28] Ibid., 276.
[29] Mikael Stenmark, "Ways of Relating Science and Religion," in *The Cambridge Companion to Science and Religion*, ed. Peter Harrison (Cambridge, MA; New York: Cambridge University Press, 2010).

example, the reconciliation typology is subdivided into reformative reconciliation, supportive reconciliation, or reformative-supportive reconciliation based on how science impacts religion.[30] While both Numbers and Stenmark tried to provide a more manageable picture of the complex science-religion relationship by either identifying the thematic trends or complication factors, their attempts remained too subjective or too complex to be helpful.

If some scholars created models to represent the interaction, other scholars used specific images or ideas as metaphors to highlight limited features of the science-religion relationship. A few representative metaphors include "two books," "wave-particle duality," "building bridges," and "three body problem" metaphors.

The "two books" metaphor used in science-religion discourse was first established in the Middle Ages and gained its currency during the rise of modern science.[31] People like Copernicus, Kepler, Galileo, and Newton considered that God is revealed in a complementary pair of sources: the Book of Scripture and the Book of Nature. The Book of Scripture explains God's redemptive intention, and the Book of Nature expresses God's power displayed in creation. For the proponents of this metaphor, a war between science and religion could not be possible because both books lead to a deeper knowledge of God. For the postmodern audience, however, this metaphor appeared to be a less convincing rhetorical device.

Charles Coulson and Donald MacKay employed Neil Bohr's theory of complementarity or "wave-particle duality" in quantum physics as a framework for affirming a positive understanding of the science-religion interface.[32] Coulson referred to science and religion as complementary accounts of *one* reality.[33] Similarly, MacKay saw science and religion as complementary descriptions of a *common* referent from different perspectives, just

[30] Ibid., 285.
[31] Ted Peters, "Science and Religion: Ten Models of War, Truce, and Partnership," *Theology and Science* 16, no. 1 (2018), https://doi.org/10.1080/14746700.2017.1402163.
[32] Barbour, *Myths, Models and Paradigms*, 76-77.
[33] Charles A. Coulson, *Science and Christian Belief* (Chapel Hill, NC: University of North Carolina Press, 1955).

like an electron's wave-like and particle-like behaviours.[34] While Coulson and MacKay's "wave-particle duality" metaphor assisted in recognising the complementary relationship of science and religion, it did not offer a satisfactory view of how the interactions change and vary depending on the different contexts of human life.

Barbour proposed the "building bridges" metaphor to demonstrate the positive dialogue taking place in theology and science. He explained,

> The metaphor expresses the fact that there is a breach evident at the surface between theology and the sciences in our present cultural context. There will be no intellectual traffic without active *construction.* All the elaborate engineering detail that goes into bridge building aptly expresses the sometimes technical and painstaking labors associated with making connections and free traffic possible between these aspects of our culture.[35]

In using this metaphor, Barbour stressed various methods that theology and science have in common, acting together as the solid, stable bedrock which underlies and connects the landmasses to be bridged. He suggested that the bridge-building between science and religion is necessary because it brings human beings closer to "a vision of a unified conception of human rationality and of the world, a vision in which the spiritual and the intellectual impulses of humanity are harmonised in an ethically, socially, and environmentally healthy way."[36] Although this metaphor generated a vivid image of the active interdisciplinary traffic between science and religion, Barbour also warned against possible misconceptions. He asserted that the metaphor could be misleading if taken to imply that theology and science are independent, well-defined, tightly focused activities and that the bridges constructed are permanent and have timeless validity. In addition, Barbour cautioned that the metaphor does not suggest the

[34] Donald M. MacKay, "Complementarity," *Aristotelian Society Supplementary Volume* 32, no. 1 (1958): 120-21, https://www.jstor.org/stable/4106698.
[35] Ian G. Barbour, "General Introduction," in *Religion and Science: History, Method, Dialogue*, ed. W. Mark Richardson and Wesley J. Wildman (New York, NY; London: Routledge, 1996), xii.
[36] Ibid., xiv.

intellectual connections drawn between science and religion to be artificially imposed "add-ons" but extensions possessing similar intrinsic properties of the two disciplines.[37]

James D. Proctor advanced the "three body problem" metaphor from celestial mechanics to represent the complex and dynamic nature of the science-religion interface. He asserted that just as the introduction of a third celestial body to the orbit of the two celestial bodies creates a complex and unpredictable phenomenon, the human experience shifts and complicates the interaction between the two entities of science and religion.[38] He argued, "the realities toward which science and religion point, and the forms of human experience in which they are grounded, may all interrelate in complex and unpredictable ways."[39] Aiming to be more faithful to life by recognising how science and religion take place in their historical, political, geographical, and psychological context, Proctor's metaphor treated the human experience as a separate, independent entity "pulling" on the bodies of science and religion. Unfortunately, the "three body problem" metaphor fails to recognise that science and religion are *parts* of the human experience. Moreover, it is unsuccessful in accounting for the internally complex and dynamic nature of science and religion, whose subject matter boundaries shift over time.

The past typologies, models, and metaphors in the scholarship of science and religion up to the 2010s had struggled with two challenges: (1) the difficulty in defining the terms "science" and "religion"; and (2) the difficulty in representing the complex relationship of science and religion in an intelligible and pedagogically useful manner. Since the domains of science and religion were extensive, science and religion could refer to a range of concepts, including sets of beliefs, ways of life, natural human phenomena, academic fields, and mediators of meaning, depending on the model. Also, given that science and religion were not

[37] Ibid., xiii.
[38] James D. Proctor, *Science, Religion, and the Human Experience* (Oxford; New York, NY: Oxford University Press, 2005), 8.
[39] Ibid., 9.

only mental concepts but also integral parts of human experience, the science-religion interaction is influenced by the sociocultural, historical context. Considering these factors, understanding the relationship between science and religion remained highly challenging.

In the 2011 Gifford Lectures, Peter Harrison raised an issue with the actual categories of "science" and "religion." Harrison criticised past science-religion discourse for treating "science" and "religion" as discrete entities with some unitary and enduring essence. He argued that a critical study of "science," "religion," and their relationship requires careful consideration of the historical conditions. [40] He explained,

> Science and religion are not natural kinds; they are neither universal propensities of human beings nor necessary features of human societies. Rather they are ways of conceptualizing certain human activities—ways that are peculiar to modern Western culture, and which have arisen as a consequence of unique historical circumstances.[41]

To show that "science" and "religion" are not natural kinds, Harrison presented a historical cartography of the two terms. He explained that the notion of science (*scientia*) understood by the thirteenth-century priest Thomas Aquinas denoted a habit of mind or an intellectual virtue that assisted in a movement toward knowledge.[42] From the Middle Ages to the end of the seventeenth century, "science" transitioned from primarily signifying the personal attribute acquired through the practice of logical demonstrations to denoting the systematic body of knowledge.[43] "Science" in the modern period gradually lost its interior qualities, and it now refers almost exclusively to the natural and physical sciences. As for the word "religion," Aquinas treated religion (*religio*) as a moral virtue related to justice. This medieval notion of *religio* as inner piety persisted into the Renaissance. From the sixteenth century onward, the connotation of interior disposition in "religion" disappeared, leaving the word to mean a

[40] Peter Harrison, *The Territories of Science and Religion* (Chicago, IL: The University of Chicago Press, 2015), 6.
[41] Ibid., 194.
[42] Aquinas Thomas, *Summa Theologica*, trans. Fathers of the English Dominican Province, Complete English ed. (New York, NY: Benziner Bros., 1948), 1a2ae.49.1; 1a2ae.50.3; 1a2ae.52.2; 1a2ae.53.1.
[43] Harrison, *The Territories of Science and Religion*, 12-13.

generic system of beliefs and practices. From this discussion, Harrison showed that only with the emergence of the modern, Anglophone renderings of "science" and "religion" was the talk about the relationship between science and religion possible. Furthermore, Harrison directed attention to the notions of "theology" and "natural philosophy," which are less linguistically similar to the modern categories of "science" and "religion" than *scientia* and *religio* but nonetheless vital in understanding the genealogical ancestry of the two concepts of interest. The historical analysis that Harrison undertook revealed that "science" and "religion" are not some valid, trans-historical categories of human culture but products of the modern West with boundaries that shifted over time and that the range of possibilities for present science-religion relations is delimited by the modern categories themselves.[44]

Many scholars have responded to Harrison's call for the awareness of the historical context of the two entities, "science" and "religion," when talking about the science-religion interaction. In *Against Methodology in Science and Religion,* Josh Reeves criticises the belief that science and religion have essential nature.[45] Noting the plurality, flexibility, and rich history of the categories of science and religion, Reeves argues that the field of science and religion should focus more on the question of how science and religion are parts of human life influenced by experiences and imagination than on how the two categories fit together.[46] Nathan Ristuccia considers the parallel between Harrison's study and Ludwig Wittgenstein's philosophy and asks how the field could take into account Wittgenstein's philosophy.[47] Michael Fuller also responds to Harrison's challenge by suggesting that there are four possible options for science-religion engagement: (1) return to the past; (2) explore new epistemic

[44] Peter Harrison and Paul Tyson, eds., *New Directions in Theology and Science: Beyond Dialogue*, 1st ed., Routledge Science and Religion Series (London: Routledge, 2022), 4.
[45] Josh A. Reeves, *Against Methodology in Science and Religion: Recent Debates on Rationality and Theology*, 1st ed., Routledge Science and Religion Series, (London: Routledge, 2018).
[46] Ibid., 4.
[47] Nathan J. Ristuccia, "Peter Harrison, Ludwig Wittgenstein, and the Problem of Pre-Modern Religion," *Zygon* 51, no. 3 (2016), https://doi.org/10.1111/zygo.12280.

frameworks for the encounter of science and religion; (3) extend the boundaries beyond the context of the physical sciences and Western culture; and (4) investigate ways in which scientific and theological practitioners collaborate on practical problems.[48] Harrison views the fourth proposal of shared participation in practical projects as having the greatest potential for future discussions.[49] Various philosophical and theological thinkers contributing to the two collections, *New Directions in Theology and Science* and *After Science and Religion*, engage with Harrison and present fresh opportunities for interdisciplinary science-religion discourse.[50]

One recent trend inspired by Harrison's anti-essentialist thesis is called *science-engaged theology*. John Perry and Joanna Leidenhag explain that science-engaged theology is a mindset or disposition to use scientific theories and findings as resources for reflection on narrowly-focused theological questions.[51] This approach poses the following question: "how does *y* finding shed new light, or correct a distortion, or corroborate a position in *x* theology"?[52] Perry and Leidenhag describe that the science-engaged theology project considers science not as an *authority* over theology but as a *source* for theology alongside Scripture, tradition, reason, and experience.[53] This approach posits theology as neither subservient nor superior to science**,** underscores the specificity of theological doctrines and scientific theories, and considers products of the scientific subdisciplines as *tools* for understanding, albeit partial and imperfect. [54] Although this project underscores the granularity of the science-religion connection, Carmody Grey questions whether science-engaged theology, still operating with

[48] Michael Fuller, "Into Terra Incognita: Charting Beyond Peter Harrison's the Territories of Science and Religion," *Zygon* 51, no. 3 (2016), https://doi.org/10.1111/zygo.12271.
[49] Peter Harrison, "The Modern Invention of 'Science-and-Religion': What Follows?," *Zygon* 51, no. 3 (2016), https://doi.org/10.1111/zygo.12284.
[50] Harrison and Tyson, *New Directions*; Peter Harrison and John Milbank, eds., *After Science and Religion: Fresh Perspectives from Philosophy and Theology* (Cambridge: Cambridge University Press, 2022).
[51] John Perry and Joanna Leidenhag, "What Is Science-Engaged Theology?," *Modern Theology* 37, no. 2 (2021), https://doi.org/10.1111/moth.12681; Ibid., *Science-Engaged Theology* (Cambridge: Cambridge University Press, 2023), 7, https://doi.org/10.1017/9781009091350.
[52] Ibid., *Science-Engaged Theology*, 65.
[53] Ibid., "What Is Science-Engaged Theology?," 248.
[54] Ibid., 252.

the very terms that Harrison cautions against, faces the danger of reproducing the issue of essentialisation of "science" and "religion."[55]

There are other attempts besides science-engaged theology that move beyond the broad, generic categories of "science" and "religion." For example, Ted Peters draws attention to how today's science and religion interact in various ways and at various junctures by outlining ten popular conceptual models.[56] Some models, such as scientism and theological authoritarianism, offer a nuanced view of the conflict between science and theology. Other models, like dialogue accompanied by creative mutual interaction (CMI) or theology of nature, presume both hypothetical consonance and critical realism and locate amicable partnership at the level of theological reflection. Niel Henrick Gregersen depicts science and religion as one entity, one academic discipline that pursues second-order interpretation of the past, present, and future relations between sciences and religions with the awareness of its semantic, pragmatic, and contextual dimensions.[57] Gregersen compares the field of science and religion with the head of an octopus that is organically connected to its many disciplinary arms. He explains that the field is able to develop ever new arms that engage with distinctive scientific theories, specialised philosophy of science, representative theological proposals, particular religious worldviews, and various cultural studies while maintaining a self-reflective attitude about its core concerns.[58] Using ten models or the "octopus" metaphor, Peters and Gregersen highlight the multiplicity, granularity, flexibility, and contextuality of the contemporary science-religion discourse. Nevertheless, it remains doubtful whether their views succeed in de-essentialising "science" and "religion."

[55] Carmody Grey, "A Theologian's Perspective on Science-Engaged Theology," *Modern Theology* 37, no. 2 (2021), https://doi.org/10.1111/moth.12695.
[56] Peters, "Science and Religion."
[57] Niels Henrik Gregersen, "Prospects for the Field of Science and Religion: An Octopus View," *Zygon* 49, no. 2 (2014), https://doi.org/https://doi.org/10.1111/zygo.12091.
[58] Ibid., 419.

The field of science and religion today is moving away from the unproductive characterisation of "science" and "religion" as artificial, trans-historical categories restricting the range of possible relationships and encouraging fresh insights drawn from various disciplines to uncover the complex, dynamic, and historically conditioned nature of the science-religion relationship. Since the terms "science" and "religion" have the potential to produce naïve generalisation, should the field dispense the categories of "science" and "religion" altogether? Although we cannot ignore the risk of essentialism, abandoning the familiar and popular terms of "science" and "religion" seems even more problematic and unrealistic. Concurring with this position, Harrison and Reeves insist that we should not remove or replace the two terms but use them critically and with a sense of their history and context.[59] Then, how should we frame our language to reflect the understanding that "science" and "religion" have no core elements or defining borders and address propositional and practical dimensions of these categories? Also, how should we talk about the complexity, granularity, and multiplicity of the science-religion relationship in a way that is familiar, easy to understand, pragmatic, and pedagogically useful?

The most popular approach taken by the current scholarship of science and religion is the use of specific language. Scholars in this field investigate a narrow scope of interaction and utilise fine-grained assessment tools. They deal with specific sciences, theologies, metaphysical presuppositions, and contexts. However, if we only conduct a detailed analysis of particular phenomena, we may lose sight of the general direction in which the field is going. As Willem Drees rightly notes, "If one were to study all individual trees at length, one would

[59] Peter Harrison, "Naturalism and the Categories 'Science' and 'Religion': A Response to Josh Reeves," *Zygon* 58, no. 1 (2023), https://doi.org/10.1111/zygo.12865; Josh A. Reeves, "A Defense of Science and Religion: Reflections on Peter Harrison's 'After Science and Religion' Project," *Zygon* 58, no. 1 (2023), https://doi.org/10.1111/zygo.12861.

not notice the forest."[60] Is there a way we can talk about the overall trends as well as the particularities of science-religion engagement while sidestepping the pitfall of essentialism?

Revisiting the concept of metaphor

In this thesis, I argue that metaphorical language possesses the power to offer a historically informed, multifaceted description of science and religion and produce both global and local outlooks of their complex relationship. In the past, various metaphors aimed to highlight particular characteristics of the science-religion discourse by employing specific objects or ideas. To name a few, the "two books" metaphor underscored separate but complementary relationship; the "building bridges" metaphor depicted the bidirectional communication between science and religion; the "octopus" metaphor emphasised the unity between the academic field of science and religion and its disciplinary arms. Since these metaphors chose a particular object or idea for comparison, there were limited points of similarities. But if we choose a concept that is flexible, expansive, and has multiple levels of understanding, this metaphorical language can yield fruitful insights into science and religion. To explore the full potential of metaphor for science-religion discourse, it is imperative that we first have a firm footing in the theories of metaphor.

What is a metaphor?

A metaphor is a figure of speech that uses words to say one thing and thereby communicate another thing. In the metaphor "X is Y," the primary subject X is described as and in terms of the secondary subject Y by bringing in various attributes of Y and comparing them with X. The metaphorical construction not only allows the identification of resemblances and the making of connections between two unlikely subjects but also transforms the understanding of

[60] Drees, *Religion, Science and Naturalism*, 5.

X. The secondary subject is typically more concrete and perceptible than the primary subject, so the more familiar features transferred from the secondary subject can enlighten the primary subject. A metaphor involves an appeal to the imagination to bring about "an alchemical transformation of the reader's response" to the primary subject.[61]

A metaphor is often compared with another form of figurative language, a simile. It directly compares literally unrelated subject matters. Usually introduced by the words "like" or "as," a simile makes an explicit comparison between two subjects and highlights their similarities. "Everything resembles everything else in some respect: and the greater or more significant the resemblance, the greater the 'degree of truth' in the simile."[62] Since similes merely point to similarities, metaphors are generally considered more compelling and forceful than similes.

A metaphor is also distinguished from the term "analogy." Quite often, a speaker uses analogy interchangeably with metaphor. An analogy, however, refers to a process of comparing and contrasting two different things to accentuate the features in which they are similar. It focuses on identifying the resemblances of attributes, processes, or interactions to produce further inferences.[63] Therefore, metaphors are based on analogies in the sense that metaphors rely on the analogical process of finding the relational similarities between unrelated subjects.

Another closely related term to metaphor is the term "model." Daniela Bailer-Jones defines a model as "an interpretative description of a phenomenon that facilitates access to that phenomenon" by focusing on specific aspects while deliberately disregarding others.[64] Models, like metaphors, are rooted in analogies and describe something. Yet, models' primary purpose is to systematically represent and structure a particular phenomenon. Metaphors can also

[61] Roger Scruton, "Imagination and Metaphor," in *The Aesthetics of Music* (Oxford University Press, 1999), 82.
[62] Ibid.
[63] Daniela M. Bailer-Jones, "Models, Metaphors and Analogies," in *The Blackwell Guide to the Philosophy of Science*, ed. Peter K. Machamer and Michael Silberstein (Malden, MA: Blackwell, 2002), 124.
[64] Ibid., 108-9.

function as a model if it provides an analogical representation of a phenomenon for better comprehension and future applications.

Upon reviewing various terms for comparing two things, metaphor stands out as the optimal choice for this thesis. Given that a metaphor is more compelling than a simile or an analogy, this thesis aims to present a metaphor that invites the interpreter to actively explore a wide range of analogous features to derive an understanding of science and religion. Moreover, it hopes to use a metaphor for representing the complex science-religion interactions. Then, the proposed metaphor can also be considered a model that exploits various analogies to structure the science-religion interactions. Regardless, this thesis intends to take advantage of the generative power, emotional impact, and heuristic function of metaphor for science-religion discourse. Now, we turn to how a metaphor works.

Linguistic perspective of metaphor

The conventional view of metaphor, inherited mainly from Aristotle, contends that metaphorical expressions replace some literal expressions with the same meaning. In the fourth century BC, Aristotle saw that a metaphor allows a term, which routinely stands for one thing, to stand for another related thing for particular expressive purposes.[65] He believed that a metaphor points out the underlying similarities between objects and their descriptive categories but does not refer to a form of propositional knowledge because it depends on the prior level of literal descriptive language.[66] Consequently, the Aristotelian view regarded metaphor as a simple substitution of the literal expression and, thus, a categorical mistake within the confines of rhetoric and poetry.

[65] Aristotle, "Poetics," in *Poetics. Longinus: On the Sublime. Demetrius: On Style*, ed. Stephen Halliwell (Cambridge, MA: Harvard University Press, 1995), 21, 1457b 6-16, 20-22.
[66] Paul Ricœur, *The Rule of Metaphor: The Creation of Meaning in Language* (London: Routledge, 2003).

Unlike the proponents of Aristotle, modern metaphor theorists reject the "substitution" model of metaphor. Moving away from conventional rhetoric and poetics, they argue that metaphors have a unique character that cannot be reduced to literal expressions. Furthermore, they assert that the essence of metaphor lies in its special process for arriving at or construing a meaning.

Setting out from the "substitution" view of metaphor, Max Black proposes the *interaction theory*. He argues that a metaphor, which takes the formula "A is B," works by interacting with the "systems of associated commonplaces" or implications of two distinct subjects (A and B) (see **Figure 1**).[67] Black identifies the focus as the word that is being used metaphorically (B) and the frame as the word that is not being used metaphorically (A).[68] According to him, a metaphor "selects, emphasises, suppresses, and organises features of the

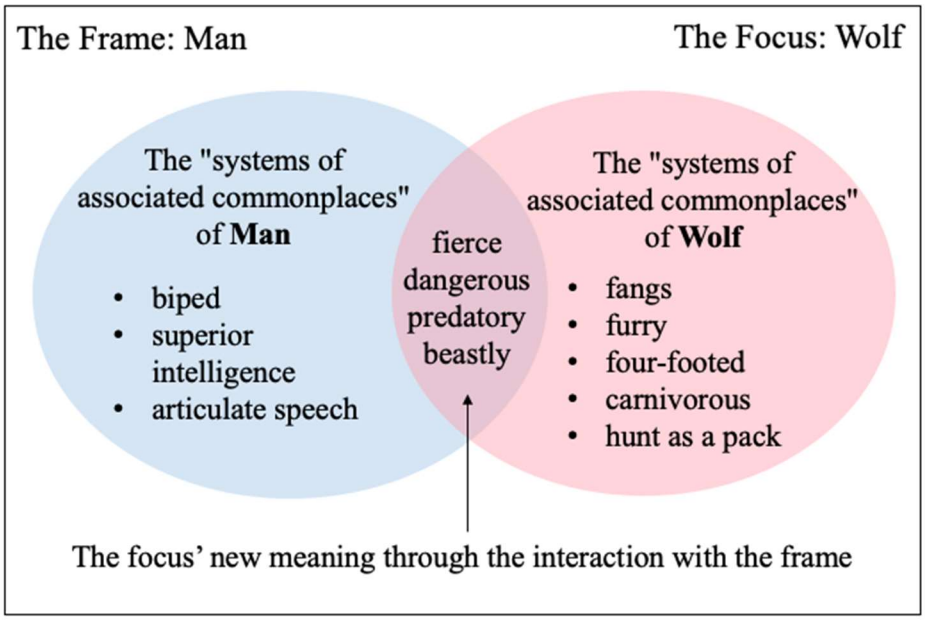

Figure 1: Black's interaction theory of metaphor is illustrated with the example, 'Man is a wolf.'

[67] Max Black, "Metaphor," *Proceedings of the Aristotelian Society* 55 (1955): 291; ibid.
[68] Max Black, *Models and Metaphors: Studies in Language and Philosophy* (Ithaca, NY: Cornell University Press, 1962), 25-28.

principal subject by implying statements about it that normally apply to the subsidiary subject."[69] Hence, the focus of the metaphor gets projected upon the frame, and the secondary subject acquires a new meaning, which is not expendable.

Since the publication of George Lakoff and Mark Johnson's work *Metaphors We Live By* in 1980, a large amount of research on metaphor has confirmed that metaphors are not simply ornamental devices in language but powerful cognitive tools for our conceptualisation of the world.[70] Such a view is known as *conceptual metaphor theory* (CMT). According to this theory, a conceptual metaphor is defined as "the understanding of one domain of experience (that is typically abstract) in terms of another (that is typically concrete)."[71] The concrete domain, which is highly structured, easily understood, and perceptible, is often called the "source." The domain that people seek to understand is the "target." The proponents of CMT argue that a conceptual metaphor, grounded in physical experience, is processed and understood when the elements of the source domain are mapped onto the aspects of the target domain.[72] The system of conceptual correspondences or mappings between two domains of experiences created by a metaphor is called *cross-domain mapping*. **Figure 2** illustrates the cross-domain mapping in the example 'Argument is war.' In short, CMT holds that metaphors are defined as a set of correspondences between two domains of experiences which structures understanding and helps to experience abstractions.[73]

[69] Ibid., "Metaphor," 291-92.
[70] Lakoff and Johnson, *Metaphors We Live By*.
[71] Barbara Dancygier, "Figurativeness, Conceptual Metaphor, and Blending," in *The Routledge Handbook of Metaphor and Language*, ed. Elena Semino and Zsófia Demjén (London: Routledge, 2016), 13.
[72] Alice Deignan, *Metaphor and Corpus Linguistics*, vol. 6, Converging Evidence in Language and Communication Research, (Philadelphia: J. Benjamins Pub., 2005), 13-24.
[73] Zoltán Kövecses, "Conceptual Metaphor Theory," in *The Routledge Handbook of Metaphor and Language*, ed. Elena Semino and Zsófia Demjén (London: Routledge, 2016), 14.

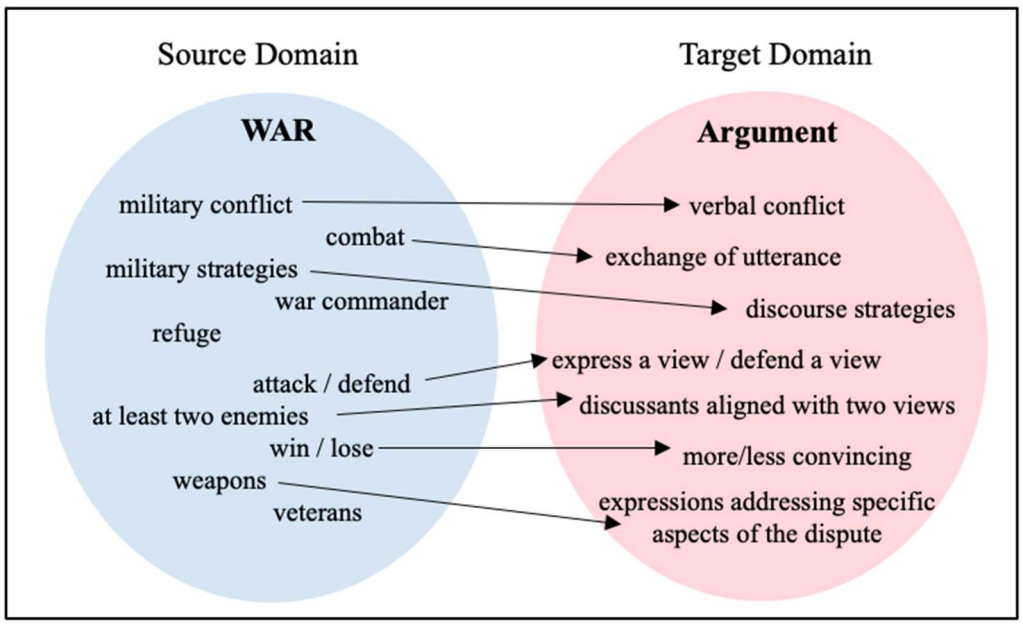

Figure 2: Cross-domain mapping of 'Argument is war' under CMT.

In the 1990s, Gilles Fauconnier and Mark Turner adapted CMT to prose the *conceptual blending theory* (CBT). According to CBT, metaphor is a conceptual integration or blend of two or more distinct sources.[74] CBT agrees with CMT that a metaphor blend is a pervasive phenomenon in human thought and everyday language. However, in CMT, four spaces or domains are involved in the metaphor processing (see **Figure 3**). The *blending* process works by constructing a partial cross-mapping between two input spaces with the help of the generic space and selectively projecting inferences from the input spaces into a novel blended mental space.[75] According to Joseph E. Grady, CBT advances from CMT in a few ways. First, it describes a complex idea or object with a metaphorical image that cannot be a straightforward projection of the source onto the target. It also directly explains how multiple metaphorical patterns are combined within a single complex conceptualisation. Moreover, it allows the

[74] Gilles Fauconnier and Mark Turner, "Blending as a Central Process of Grammar," in *Conceptual Structure, Discourse and Language*, ed. Adele E. Goldberg (Stanford, CA: CLSI, 1996).
[75] Ibid., *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities* (New York, NY: Basic Books, 2002).

blended space to provide some feedback on any of its inputs. Finally, it emphasises dynamic real-time processing.[76]

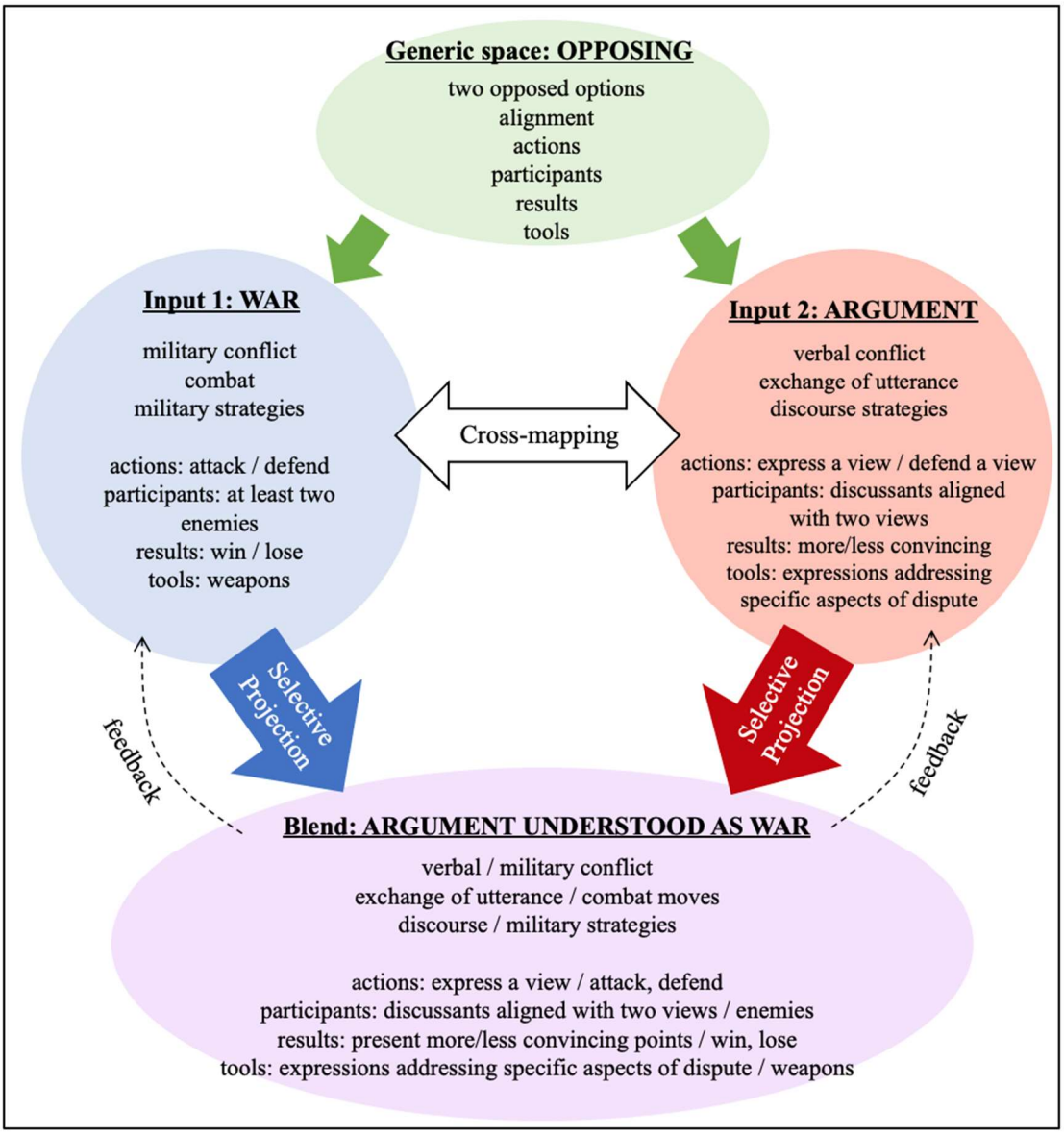

Figure 3: 'Argument is war' under CBT.

In 2008, Lakoff applied CMT to neuroscience and proposed the *neural theory of metaphor*.[77] According to this theory, the individual neurons in the brain form neuronal groups

[76] Joseph E. Grady, "Metaphor," in *The Oxford Handbook of Cognitive Linguistics*, ed. Dirk Geeraerts and H. Cuyckens (New York, NY; Oxford: Oxford University Press, 2007), 200-1.
[77] George Lakoff, "The Neural Theory of Metaphor," in *The Cambridge Handbook of Metaphor and Thought*, ed. Raymond W. Gibbs, Jr. (Cambridge: Cambridge University Press, 2008).

called “nodes,” forming various types of neural circuitry, such as the mapping circuit, linking circuit, and gestalt circuit. Through experience, nodes in one circuit type get linked to nodes in another, building complex binding circuits.[78] The neural theory of metaphor explains that a metaphor is a *neural mapping*, which works when a meaningful node in the source domain circuit leads to the activation of one or more other meaningful nodes in the target circuit.[79] In addition, the theory predicts that new conceptual metaphors are easy to learn and make sense because they add connections to the pre-existing circuitry of knowledge.[80] The neural theory of metaphor considers a neural binding across the source and target equivalent to the “blend” in CBT.[81]

Although CMT has enormous influence and demonstrates its popularity across various disciplines, it still faces some challenges.[82] One criticism of CMT comes from the *relevance theory* (RT) supporters. They argue that metaphor is a pervasive feature of everyday linguistic communication and an example of “loose talk” that is often the best way to achieve optimal relevance.[83] According to RT, the addressees interpret the meaning of a metaphor by following a path of least effort in constructing an interpretation of the metaphor up to a point at which their expectations or relevance are satisfied.[84] Unlike CMT, which asserts that a metaphor arises in cognition and requires unique processing, RT argues that a metaphor emerges in discourse due to speakers using language loosely to convey complex thoughts.[85] The

[78] Ibid., 21.
[79] Ibid., 29.
[80] Ibid., 27.
[81] George Lakoff, "Mapping the Brain’s Metaphor Circuitry: Metaphorical Thought in Everyday Life," *Frontiers in Human Neuroscience* 8 (2014): 11-12, 958, https://doi.org/10.3389/fnhum.2014.00958.
[82] For further discussion about the broader impact of conceptual metaphor theory, see Raymond W. Gibbs, Jr., *Metaphor Wars: Conceptual Metaphors in Human Life* (Cambridge: Cambridge University Press, 2017), 5-7.Gibbs 2017, 5-7.
[83] Robyn Carston, "Relevance Theory and Metaphor," in *The Routledge Handbook of Metaphor and Language*, ed. Elena Semino and Zsófia Demjén (London: Routledge, 2016), 43; Markus Tendahl and Raymond W. Gibbs, Jr., "Complementary Perspectives on Metaphor: Cognitive Linguistics and Relevance Theory," *Journal of Pragmatics* 40, no. 11 (2008): 1824, https://doi.org/10.1016/j.pragma.2008.02.001.
[84] Carston, "Relevance Theory and Metaphor," 45.
[85] Ibid., 49.

proponents of RT assert that a metaphor is situated within the literal—loose—metaphorical continuum. Therefore, they insist that metaphors are nothing special in terms of their processing, even if they often convey special cognitive effects or meanings not easily communicated by more direct literal speech.[86]

Another strong charge levelled at CMT is that metaphoricity in a language is driven primarily by non-cognitive factors. The critics, especially those working in anthropology, educational linguistics, and corpus linguistics, argue that CMT researchers focus only on the cognitive dimension of metaphor and do not pay sufficient attention to the ideological, cultural, and contextual factors and social-pragmatic functions of metaphor.[87] For instance, using corpus data on metaphor, Alice Deignan stresses that metaphors are shaped by their informational content as well as the linguistic context, genre, culture, and ideology.[88] Furthermore, anthropologists and linguists suggest that idiosyncratic historical and linguistic factors play essential roles in shaping the metaphorical use of language.[89] Given the complexities of real-life discourse, critics urge that CMT scholars must pay attention to metaphors' syntactic and pragmatic features.

As shown above, the challenges to CMT have led to battles among metaphor scholars across academic disciplines, including cognitive linguistics, philosophy, sociology, psychology, and poetics. But Raymond Gibbs Jr. interprets these ongoing theoretical debates in metaphor scholarship as natural outcomes because the participants have different motivations and goals for studying the metaphor.[90] He writes,

> Some researchers wish to explore how metaphors reflect individual creativity, artistic traditions, and cultural motifs. Different scholars want to understand what metaphors

[86] Raymond W. Gibbs, Jr., "Evaluating Conceptual Metaphor Theory," *Discourse Processes* 48, no. 8 (2011): 7, https://doi.org/10.1080/0163853X.2011.606103.
[87] Ibid., "Metaphor, Language, and Dynamical Systems," in *The Routledge Handbook of Metaphor and Language*, ed. Elena Semino and Zsófia Demjén (London: Routledge, 2016), 61.
[88] Alice Deignan, "Corpus Linguistics and Metaphor," in *The Cambridge Handbook of Metaphor and Thought*, ed. Raymond W. Gibbs, Jr. (Cambridge: Cambridge University Press, 2008), 293.
[89] Gibbs, "Metaphor, Language, and Dynamical Systems," 61.
[90] Ibid., 57.

> reveal about people's communicative abilities in changing social circumstances. Other metaphor enthusiasts focus on the effects of metaphors on people's thoughts, emotions, and interpersonal relationships. Still other researchers study the ways people interpret metaphorical meaning as a window into the nature of meaning, as well as conscious and unconscious human cognition.[91]

Indeed, each theory explaining how metaphors work in language, thought, and communication is influenced by the theorists' interests and goals. Each metaphor theory is somewhat biased and limited in applicability because it examines metaphors in a specific context for a specific purpose. Thus, Gibbs contends that identifying the *type* of metaphor and applying relevant theories are crucial steps in understanding how the metaphor is used cognitively, rhetorically, and socially.[92]

Overall, the studies on metaphors reveal that metaphors are not mere linguistic embellishments but foundations for thought processes and conceptual understandings that enable the transfer of meaning from one knowledge domain to another.[93] They make connections between abstract concepts and concrete physical experiences. Furthermore, metaphors evoke imagination when exploring a pool of ideas that can be tested about the target domain. They even shape the mind, structure our experiences, and affect behaviour.[94] Thus, metaphors are powerful tools for producing knowledge of abstract concepts, such as science and religion, based on familiar embodied experiences.

Role of metaphors in science and religion

The role of metaphors in science and religion has been widely considered by philosophers, scientists, theologians, and religious scholars. In the field of science, metaphors are central to

[91] Gibbs, *Metaphor Wars*, 7.
[92] Ibid., 101-2.
[93] Cynthia Taylor and Bryan M. Dewsbury, "On the Problem and Promise of Metaphor Use in Science and Science Communication," *Journal of Microbiology & Biology Education* 19, no. 1 (2018): 1, https://doi.org/10.1128/jmbe.v19i1.1538.
[94] Lakoff and Johnson, *Metaphors We Live By*.

scientific thought, discourse, and practice.[95] For example, Robert Hooke first named the smallest unit of life "cell" when a microscopic image of a piece of cork reminded him of small cells in monasteries. In genetics, DNA is often called the "blueprint" of life because it contains instructions on building molecules needed for an organism to grow, develop, function, and reproduce. Using everyday objects like a cell or blueprint, metaphors in science help to conceptualise and understand specific natural phenomena. According to Mary B. Hesse, theoretical explanation in science is a "metaphorical redescription of the domain of the explanandum."[96] Adopting Black's interaction view of metaphor, Hesse suggests that the interactions between the features of a familiar domain as explanans and the features of the scientific domain as explanandum allow the scientists to make certain aspects of a phenomenon noticeable, recognise certain patterns, draw inferences, and explore new territories of a continually expanding world of nature.[97] In addition to the explanatory power of metaphors expounded by Hesse, scientific metaphors also serve a didactic function. For example, the metaphorical description of atoms as miniature solar systems assists students in visualising the unobservable atom and fostering the learning process.[98] Accordingly, metaphors are useful for teaching scientific theories and models to a lay audience.

In the field of religion, many theologians have pointed out the vital role of metaphor in religious language, especially the theological language, to speak about God. Thomas Aquinas considered that metaphorical language is befitting of Scripture because it shows that God takes into consideration the limited capacity and spiritual weakness of humans and chooses to convey divine truth through corporeal things.[99] In the 20th century, theologians, including Sallie

[95] Bailer-Jones, "Models, Metaphors and Analogies."
[96] Mary B. Hesse, *Models and Analogies in Science* (Notre Dame, Indiana: University of Notre Dame Press, 1966), 171.
[97] Ibid., 176-77.
[98] Richard Boyd, "Metaphor and Theory Change: What Is "Metaphor" a Metaphor For?," in *Metaphor and Thought*, ed. Andrew Ortony (Cambridge: Cambridge University Press, 1993), 485-86.
[99] Thomas, *Summa Theologica*, 1a.1.9.

McFague and Janet Soskice, led the theological discussion on metaphors. McFague pursued the issue of metaphor in her books *Metaphorical Theology* and *Models of God*. She describes that metaphorical thinking involves noticing a thread of similarity between two dissimilar objects and using the better-known one as a way of speaking about the lesser-known.[100] In *Models of God,* McFague expounds,

> Metaphor always has the character of "is" and "is not": an assertion is made but as a likely account rather than a definition. That is, to say, "God is mother," is not to define God as mother, nor to assert identity between the terms "God" and "mother," but to suggest that we consider what we do not know how to talk about – relating to God – through the metaphor of mother. The assumption here is that all talk of God is indirect: no words or phrases refer directly to God, for God-language can refer only through the detour of a description that properly belongs elsewhere. To speak of God as mother is to invite us to consider some qualities associated with mothering as one partial but perhaps illuminating way of speaking of certain aspects of God's relationship to us.[101]

Given that metaphor is the only way of talking about God, whom we have no direct access to, no experience of, and no comprehension of, McFague insists that all religious language is an intermediary and irreducibly metaphorical.[102] For Janet Soskice, the principal function of metaphor is not to evoke an emotional or spiritual response. Rather, she regards metaphors as primarily serving a cognitive function in disclosing what has not been previously available and generating new perspectives.[103] She points out:

> the purpose of metaphor is both to cast up and organize a network of associations. A good metaphor … [is] a new vision, the birth of a new understanding, a new referential access. A strong metaphor compels new possibilities of vision.[104]

Similar to McFague, she also indicates that metaphors enable people to talk about something without explicitly defining it. Therefore, metaphors allow religious believers to refer to and talk meaningfully about God while acknowledging the mystery of the divine. Although the

[100] Sallie McFague, *Metaphorical Theology: Models of God in Religious Language* (Philadelphia, PA: Fortress Press, 1982), 15.
[101] Ibid., *Models of God: Theology for an Ecological Nuclear Age* (Philadelphia, PA: Fortress Press, 1987), 33-34.
[102] Ibid., 196.
[103] Janet Martin Soskice, *Metaphor and Religious Language* (Oxford: Clarendon Press, 1985), 109.
[104] Ibid., 57-58.

works of McFague and Soskice were seminal in uncovering the nature of religious language, there are clear possibilities for further development in this area by incorporating the theories of conceptual metaphor and conceptual mapping.[105]

The contemporary science-religion discussion also highlights the importance of metaphorical language. The pervasiveness of metaphors for describing and communicating aspects of the natural and supernatural world has been noted by various scholars as a key similarity connecting science and religion. Ian Barbour, for instance, explains that both scientific and religious communities construct observation and experience expressed through metaphors.[106] Hesse insists that metaphors in science and religion help to describe things that cannot be observed directly and show science as subjective as religion. McFague indicates how metaphors provide order in theology and stimulate new discoveries in science. Soskice stresses that science and religion rely upon metaphors to refer to what really exists without being exhaustively descriptive.[107] In addition to demonstrating the correlation between science and religion, the notion of metaphors has been crucial for theorising and modelling different facets of the science-religion interface. Unfortunately, it seems that much of the preeminent work on conceptual metaphors in cognitive linguistics is still unbeknownst to many scholars in the field of science-religion.

Today, scholars wrestle with issues of how to conceptualise "science" and "religion" critically and with attention to their history and context and how to address the complex,

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[105] See, for example, Rachel J. Kirkwood, "'Stand Still in the Light': What Conceptual Metaphor Research Can Tell Us About Quaker Theology," *Religions* 10, no. 1 (2019); Nerina Bosman, "The Cup as Metaphor and Symbol: A Cognitive Linguistics Perspective," *Hervormde Teologiese Studies* 75, 3 (2019); John Sanders, *Theology in the Flesh: How Embodiment and Culture Shape the Way We Think About Truth, Morality and God* (Minneapolis, MN: Fortress Press, 2016); Robert Masson, *Without Metaphor, No Saving God: Theology after Cognitive Linguistics* (Leuven, Belgium: Peeters, 2014); Erin Kidd, Jakob Karl Rinderknecht, and Robert Masson, *Putting God on the Map: Theology and Conceptual Mapping* (Lanham: Fortress Academic, 2018). For the importance of the cognitive linguistics approach for theological metaphors for God, see Mary Therese DesCamp and Eve E. Sweetser, "Metaphors for God: Why and How Do Our Choices Matter for Humans? The Application of Contemporary Cognitive Linguistics Research to the Debate on God and Metaphor," *Pastoral Psychology* 53, no. 3 (2005), https://doi.org/10.1007/s11089-004-0554-5.

[106] Barbour, *Issues in Science and Religion*.

[107] Soskice, *Metaphor and Religious Language*, 133.

diverse, general, and particular features of the science-religion relation. When considering the impact of conceptual metaphors in shaping the way people think and act about certain things, there is no better way of talking about the concepts of "science," "religion," and their interactions than metaphors. First, conceptual metaphor uses familiar embodied experience to make "science" and "religion" more accessible for comprehension. Second, the epistemic function of metaphorical language provides the method for describing the broad notions of "science" and "religion" without defining these complex concepts. Since metaphors are open-ended and do not restrict the conceptualisation in specific boundaries, effective metaphors can allow meaningful science-religion discourse without the problem of essentialism. Third, the exploratory nature of conceptual metaphors helps to investigate multiple layers of understanding of "science" and "religion," including their cognitive, social, cultural, historical, and practical dimensions. Finally, an insightful conceptual metaphor of science and religion can foster learning about the complex science-religion relationship and call forth some responses. Metaphors indeed have limits in allowing only certain relations and inferences to be mapped onto the domains of comparison. Yet, considering its exegetical, exploratory, mediatory, affective, and pedagogical role, conceptual metaphor has tremendous value in science-religion discourse for disclosing a wide range of understandings about science, religion, and their relation and changing participants' experience.

Revitalising the "language" metaphor

The excursion into the linguistic perspective of metaphor taken so far reveals that metaphorical language is a superior method for addressing the complex concepts of "science," "religion," and the science-religion interface. Since metaphorical construction requires a familiar source domain to be transferred onto the target domain, selecting a rich source domain with various elements available for mapping is imperative for achieving the desired goal of representing

science, religion, and their relationship. The past source domains, such as "wave-particle duality" or "octopus," pointed to only limited aspects of the science-religion relation. At present, what is needed is a source domain that is a part of everyday experience and is capable of addressing science, religion and their relation from different angles and dimensions. The concept of "language" is an ideal candidate for such purpose, as will become clear in this thesis.

The word "language" is an expansive concept with various nuances. Generally, it is a primary method of human communication consisting of sounds, words, and grammar. It is the product of the activation in the neural networks responsible for language function. It is also a social, communal activity that brings the community together. It is a carrier of social and cultural values and worldviews. From these simple propositional descriptions regarding language, we see the cognitive, neuroscientific, social, and cultural aspects of language. Since there is a wide range of ideas related to language, the concept of "language" can serve as a metaphor for addressing many aspects of the complex, fluid science-religion relationship.

This thesis uses "language" as the source domain to explore various similarities and differences between language and science or language and religion. The "language" concept facilitates access to and represents the science-religion interface as well. In this respect, the "language" metaphor can also works as a model for science, religion, and their relationship. From now on, I refer to this imaginative way of seeing the concepts of "science," "religion," and their relation through the lens of "language" as the following: the "language" metaphor or the "language" model.

Past views of the "language" metaphor

The notion of "language" is not a new source domain for metaphors describing the science-religion relationship. The past treatment of the metaphors related to language, however, has been extremely short-sighted and unhelpful because these metaphors accounted for only a few

features of "language" and thereby had very limited points of analogy with the science-religion interactions. Additionally, the narrow understanding yielded by the past metaphors of language highlighted one of Barbour's typologies and presupposed essentialism.

The most famous metaphor related to the notion of language is often called the "two languages" metaphor or model. This metaphor has gained popularity since the late twentieth century to establish that science and religion are separate entities that respect each other's sovereign territory.[108] Neoorthodox theologian Langdon Gilkey has long advocated the "two languages" metaphor for highlighting the independence of "science" and "religion," each with its distinct domains, characteristics, and functions. He argues that science seeks to explain objective, public data of proximate origins, whereas religion deals only with the ultimate questions regarding the origin, meaning, destiny, and experience of one's inner life.[109] In other words, science asks the *how* question and religion asks the *why* question. Using the "two languages" metaphor, Gilkey desires to demonstrate the possibility of embracing Christian faith and scientific practice without conflict. Ian Barbour also introduces the "two languages" metaphor as an effective way of separating science and religion according to their unique functions—science for prediction and control and religion for recommending a way of life that is primarily practical and normative.[110] He sees science and religion, which arise in different situations, refer to separate but not antagonistic entities.[111]

Although the "two languages" metaphor aims to present an alternative picture challenging the conflict thesis, it has achieved just that and nothing more. This is due to a simplistic conceptualisation of two languages as being always separate and entirely different.

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[108] Peters, "Science and Religion," 24.
[109] Langdon Gilkey, *Maker of Heaven and Earth: A Study of the Christian Doctrine of Creation* (Garden City, NY: Anchor Books, 1965); Ibid., *Creationism on Trial: Evolution and God at Little Rock*, Studies in Religion and Culture, (San Francisco, CA: Harper, 1985), 108-16.
[110] Ian G. Barbour, *Religion and Science: Historical and Contemporary Issues*, Revised and expanded ed. (London: SCM Press, [1990] 1998; repr., *Religion in an Age of Science*), 87.
[111] Ibid., *Myths, Models and Paradigms*, 78.

In reality, however, two languages can exhibit many similar linguistic features and be mutually intelligible depending on their historical relationship. Take, for example, Spanish and Italian. Also, even if there are not many resemblances between the two languages, there are still instances where they interact. For instance, Chinese and German are very different, but both languages can borrow vocabulary from each other to express ideas unique to Chinese or German culture. Additionally, the two languages of bilingual speakers are never completely independent but rather integrated and exerting influence over the other. From this thorough understanding of the concept of "language," the "two languages" metaphor need not be restricted to portraying the conceptual boundaries of science and religion as wholly separate without any contact points. In today's globalising world, where people using different languages communicate more frequently, the interactions between two languages can actually disclose how some scientific and religious territories overlap from time to time and generate mutually enriching experiences.

Another language-related metaphor advocated by Fraser Watts is called the "two discourses" metaphor. According to this metaphor, science and theology are two discourses—distinct and different in their descriptions but still about the same world—and, therefore, complementary to each other.[112] Unlike the previous "two languages" metaphor, which focuses on the different communicative functions of science and religion as two independent languages, Watts treats the various levels of description as his source domain. When someone says that he is anxious, this statement can imply something about his experience (that he feels frightened), his physiological state (high levels of adrenalin), or his behavioural propensities (being tempted to escape).[113] These descriptions of anxiety are indeed different, but they work together in a complementary way. Watts insists that just like these descriptions, science and religion

[112] Fraser Watts, "Science and Theology as Complementary Perspectives," in *Rethinking Theology and Science: Six Models for the Current Dialogue*, ed. Niels Henrik Gregersen and J. Wentzel Van Huyssteen (Grand Rapids, MI: William B. Eerdmans Pub., 1998).
[113] Ibid., 167.

represent multiple levels of the same reality. Religious discourse is a higher-level discourse; it is broader in its scope and reference, being personal and moral, and making claims about the nature of reality. On the other hand, scientific discourse addresses in more detail the particularities of reality which fall under the purview of religion. As a result, the worldviews the two discourses generate are not identical because they approach reality from different dimensions. But they are nonetheless linked as they bear on the same world. Using the "two discourses" metaphor, Watts demonstrates that science and religion are complementary discourses.

Watts' preference for the term "discourse" over "language" stems from his intention of avoiding the overtone of independence associated with the "two languages" metaphor. By referring to science and religion as two discourses of the same reality, Watts wants to emphasise the complementarity of science and religion. However, he can still use the word "language" to convey a complementary relationship because discourse is simply language expressed in a specific context. The American linguist Zellig Harris asserts the interconnectedness between "language" and "discourse" in his assertion that "language does not occur in stray words or sentences, but in connected discourse." [114]

The "two languages" and "two discourses" metaphors employ a narrow understanding of the "language" concept in order to fulfil the agenda of representing the independent or complementary relationship of science and religion as an alternative picture to the conflict thesis. But with a more critical, in-depth discussion regarding "language," it is possible to see the tremendous potential of this concept for the wider science-religion discussion. The notion of "language" is rich with elements for comparison with science and religion. It can be used to address not only independence or complementarity relations but also their systematicity, importance of context, social function, historical development, diversity, influence on thought,

[114] Zellig Harris, "Discourse Analysis," *Language* 28 (1952): 1.

power, complex relationships and many more. Thus, we need to abandon the short-sighted view of "language" adopted by the past language-related metaphors and begin to explore the vast territory of the "language" concept. We need a reconfiguration and a revival of the "language" metaphor.

Why "language"?

The "language" concept is proposed as the source domain for understanding "science," "religion," and their relationship based on intellectual merits rather than my own bias towards the subject. The following strengths of the "language" metaphor provided the rationale for my recommendation.

First, the concept of "language" is very versatile and has multiple levels of investigation, making the "language" metaphor applicable to many areas. Language is not only a mental faculty but also an integral part of everyday activity. Considering how language constitutes who we are, Canadian philosopher Charles Taylor even calls human beings the "language animals."[115] Language can also be studied at the level of an individual as well as the level of the discourse community. Moreover, the field of linguistics is closely related to many other disciplines, including psychology, neuroscience, sociology, politics, and anthropology.

Second, the "language" metaphor does not treat "science" and "religion" exclusively as two abstract, trans-historical, trans-contextual entities but also looks at the way scientific or religious discourse takes place in time and in the lives of individuals and communities.[116] The "language" metaphor does not consider scientific and religious activities occurring in a vacuum, free from any social or cultural influence. Instead, it recognises and analyses the external factors that impact science and religion and seeks to be more faithful to life.

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[115] Charles Taylor, *The Language Animal: The Full Shape of the Human Linguistic Capacity* (Cambridge, MA: The Belknap Press of Harvard University Press, 2016).
[116] Barbour, *Religion and Science*, 87.

Third, this metaphor offers a way to talk about "science" and "religion" as well as their relationship. Many past metaphors and models of science and religion have been chosen to enlighten aspects of "science" and "religion" or their interaction as characterised by Barbour's typology. On the other hand, the "language" model aids the understanding of "science" and "religion" as parts of human experience and, at the same time, describes the dynamic science-religion interaction by comparing it with how two languages of individuals interact in a given context.

Fourth, the "language" metaphor offers a vivid, realistic picture of the science-religion relationship and avoids the problem of essentialism. During colonisation, colonisers impose their language onto the colonised to assert the supremacy of their culture and exert control over the subjects' thoughts, values, and culture. Here, the relationship between the language of the colonisers and that of the indigenous people is antagonistic. In another instance, the two languages of a bilingual speaker exist in harmony, complementing each other and enabling the speaker to express a wide range of ideas and experiences. Since the interactions between two languages occur in real life, the "language" metaphor presents concrete images to apprehend the science-religion relationship.

Lastly, the "language" model is intuitive and easily accessible. When comparing the science-religion interface with the "wave-particle duality" phenomenon, someone without knowledge of quantum physics will not understand the metaphor. They will not know that the "wave-particle duality" points to the complementary nature of science-religion interaction. To them, the "wave-particle duality" metaphor would be useless and meaningless. The "language" metaphor does not require any technical knowledge to understand what it means because everyone speaks a language in one form or another. As a result, this metaphor is both simple to understand and easily accessible to everyone.

Given this brief discussion, the "language" metaphor appears to be an indispensable heuristic tool for understanding the complex science-religion phenomenon based on its explanatory success, contextuality, comprehensiveness, vivid imagery, and intuitiveness. It describes the complex and wide-ranged concepts of "science" and "religion" in an easily conceivable yet elaborate manner. The resulting perspective of science and religion grounded in everyday experience is comprehensive, attending to their conceptual, experiential, social, communal, and cultural aspects. The "language" metaphor levels the playing field for examining the science and religion relationship. Both concepts are investigated using the same tools provided by the "language" domain.

Despite these merits, Alister McGrath warns that metaphors can often mislead and misrepresent if adopted without acknowledging their limits.[117] Therefore, it is necessary to critically examine which areas the "language" metaphor excels in and which areas it is limited in performing the intended heuristic function.

Classifying the "language" metaphor

In order to unlock the full potential of the "language" metaphor, we must draw on the current metaphor studies in cognitive linguistics that reveal how metaphors work in thought. Recalling Gibb's recommendation for identifying the type of metaphor and applying appropriate metaphor theories, we first categorise the "language" metaphor and then investigate how this type of metaphor is processed cognitively.

According to CMT, a metaphor is called *conceptual* if it uses a concrete source domain of experience to express and understand an abstract target domain. But one may question, is "language" concrete enough to function as the source domain of a conceptual metaphor? In

[117] Alister E. McGrath, *The Foundations of Dialogue in Science and Religion* (Malden, MA; Oxford: Blackwell Publishers, 1998), 171.

linguistics, the difference between concrete and abstract concepts is often based on what can be observed from the physical world.[118] Things, events, and properties that can be experienced through the senses are called "concrete"; ideas and concepts that are distant from immediate perception are regarded as "abstract." According to this categorisation, "language" could be either concrete or abstract because the spoken, written, or signed words of a language are physical, whereas the language module is abstract. Moreover, if concreteness is based on physicality, any abstract idea could be considered concrete because it emerges from the physical activity of the brain.[119] If the distinction is based on direct experience, any abstract idea could be concrete if one experienced it. If the criterion for concreteness is imageability, it is difficult to judge whether one concept is more readily imagined than another. From these observations, determining the standard for abstract/concrete distinction is challenging.[120]

An alternative to the abstract/concrete dichotomy is the abstract-concrete spectrum, with concepts having varying degrees of concreteness. In support of this view, Anna Jelec argues that the mapping of the conceptual metaphor should be viewed as less-abstract-to-more-abstract rather than concrete-to-abstract.[121] Furthermore, empirical studies support the possibility of metaphorical mapping between two abstract concepts by highlighting the common elements.[122] Aleksander Szwedek also contends that abstract-to-abstract metaphors can function as structural metaphors where the source domain transfers physical, structural

[118] Lakoff, "Mapping the Brain's Metaphor Circutry," 5.
[119] Ibid.
[120] Anna Jelec, *Are Abstract Concepts Like Dinosaur Feathers?: Conceptual Metaphor Theory and Conceptualisation Strategies in Gesture of Blind and Visually Impaired Children* (Poznań: Wydawnictwo Naukowe UAM, 2014), 57.
[121] For Jelec, the criterion for assessing the concreteness of a concept is based on the notion of objectification, "a process through which non-physical concepts acquire the properties of physical objects in the mental lexicon which permits us to imagine, manipulate and talk about them as if they were concrete "'things'." Ibid., 63.
[122] Xuqian Chen, Guixiang Wang, and Yuchan Liang, "The Common Element Effect of Abstract-to-Abstract Mapping in Language Processing," *Frontiers In Psychology* 7 (2016).

constituents onto the target domain or as orientational metaphors that map values from the source domain onto the target domain.[123]

Under the abstract-concrete spectrum view, "language" appears less abstract compared to "science" and "religion" because it utilises physical symbols and is manifested in almost all areas of life. It also influences thought, behaviour, and experiences of the world. Moreover, language has a systematic structure which can model the complex domains of "science" and "religion." Since the "language" metaphor works with the less abstract concept of "language" to interpret the more abstract concepts of "science" and "religion," it is labelled a *conceptual* metaphor.

Another classification category of metaphor is the *conventional* vs *novel* distinction. Incorporating CMT into their studies, corpus linguists focus much attention on the *conventional* metaphor.[124] This type refers to metaphors ubiquitous in natural language and integral to the corpus of the linguistic community. Unlike conventional metaphors, *novel* metaphors are relatively rare in natural language and, therefore, generally overlooked by corpus linguists. Yet, novel metaphors are of particular interest to neurolinguists. Neuroscientific studies attest that conventional and novel metaphors have different processing mechanisms in the brain, and the knowledge of the distinct processes is crucial for interpreting the meaning of each metaphor.[125]

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[123] Aleksander Szwedek, "The Nature of Domains and the Relationships between Them in Metaphorization," *Review of Cognitive Linguistics* 12, no. 2 (2014), https://doi.org/10.1075/rcl.12.2.04szw.

[124] It is useful to note that conventional metaphors do not equate to "dead" metaphors which are not vital or requires active processing. According to Charles Denroche, conventional metaphors differ from dead metaphor only by the degree of conventionality. He states that dead metaphors are "metaphors which have become so conventionalised that we are no longer aware of their original literal sense" whereas conventional metaphors are metaphoric expressions, which have gained acceptance in the shared lexicon of a language community and still retains some original literal sense. Charles Denroche, *Metonymy and Language: A New Theory of Linguistic Processing*, Routledge Studies in Linguistics, (New York, NY: Routledge, 2015), 18.

[125] Miriam Faust, "Thinking Outside the Left Box: The Role of the Right Hemisphere in Novel Metaphor Comprehension," in *The Handbook of the Neuropsychology of Language* (Chichester, West Sussex, U.K.: Wiley-Blackwell, 2012).

In the field of science and religion, there are some language-related metaphors, but none of them has been pervasive enough to be classified as conventional. Many members of the scientific community or the religious community do not often associate science or religion with the "language" concept. Also, not many studies have worked out the full meaning of the "language" metaphor. Hence, the "language" metaphor is a *novel* metaphor.

Considering its communicative dimension, a metaphor can be regarded as *deliberate* or *non-deliberate*. Gerard Steen criticises the view of metaphor confined to language and thought and asserts that metaphors are also a matter of communication expressed in a specific context with a particular value to the interlocutors.[126] Deliberate metaphor, according to Steen, is the "intentional use of metaphor *as* a metaphor."[127] It signals the addressee to move away their attention momentarily from the target domain to the source domain, which contains referents for processing the utterance's meaning.[128] Non-deliberate metaphors are those not presented as metaphors to the addressee but intentionally used as a means to talk about a wide range of topics.[129]

Under Steen's classification, the "language" metaphor is a *deliberate* metaphor because the "language" domain is intentionally juxtaposed with "science" or "religion" to uncover various aspects of "science" and "religion" that were hidden in plain sight. Additionally, the metaphor allows ideas about two languages interacting in real life to transfer onto the science-

[126] Gerard Steen, "Developing, Testing and Interpreting Deliberate Metaphor Theory," *Journal of Pragmatics* 90, no. C (2015): 68, https://doi.org/10.1016/j.pragma.2015.03.013.
[127] One of the strongest criticisms of Steen's deliberate metaphor theory comes from Raymond Gibbs Jr. He states that many of the assertions proposed by Steen fatally undermine the empirical validity and theoretical credibility. Gibbs' criticisms are mostly directed to the "non-deliberate" metaphors, especially non-deliberate, conventional metaphors and to the claim that non-deliberate metaphors are not processed by cross-domain mappings. Nonetheless, Gibbs agrees with Steen that metaphors can be used deliberately *as* metaphors in discourse for specific rhetorical purposes and such is the case for the "language" metaphor of this thesis. Since Steen's theory provides a helpful understanding of how a deliberate, novel metaphor is processed, "deliberate" metaphor typology will be adopted. Ibid., 67.
[128] Gerard Steen, "The Contemporary Theory of Metaphor- Now New and Improved!," in *Metaphor and Metonymy Revisited Beyond the Contemporary Theory of Metaphor: Recent Developments and Applications*, ed. Francisco Gonzálvez-García, Maria Sandra Peña Cervel, and Lorena Pérez Hernández (Amsterdam; Philadelphia, PA: John Benjamins Publishing Company, 2013).
[129] Ibid., "Developing, Testing and Interpreting," 67.

religion relationship. From the analysis of the type of the metaphor, the "language" metaphor turns out to be a *conceptual, novel,* and *deliberate* metaphor.

How is a conceptual, novel, and deliberate metaphor processed?

Having classified the metaphor, what do the theories of metaphor say about its processing mechanism? Because the unique processing of conceptual metaphors was mentioned in the section above about CMT and CBT, the discussion here centres on the theories that deal with novel and deliberate metaphors and how they are processed.

One theory that proposes distinct processing operations for novel and conventional metaphors is the career-of-metaphor hypothesis by Brian Bowdle and Dedre Gentner.[130] Before presenting the mechanism, they noticed how novel and conventional metaphors differ in their behaviours. For instance, the metaphor '*music is a language'* conveys that music is a means of communicating a message across people. Since the metaphor of music as a language is common, it takes less time to process. In contrast, '*music is an identification card'* is a novel metaphor. By introducing the identification card as the new source domain, the metaphor yields a different meaning than the previous one. Since the meaning of the metaphor is not easily accessible, the audience must work out the underlying meaning. Depending on the context, *'music is an identification card'* can mean that some songs allude to the composer or that the style of music one prefers can tell a lot about who the listener is. As this example shows, a conventional metaphor is intuitive, whereas a novel metaphor is cognitively taxing.

[130] Brian F. Bowdle and Dedre Gentner, "The Career of Metaphor," *Psychological Review* 112, no. 1 (2005), https://doi.org/10.1037/0033-295X.112.1.193.

They also noted that, unlike the novel metaphors, conventional metaphorical terms have relatively consistent meanings regardless of what targets they are paired up with. For instance, the phrase '*gold mine'* used in metaphor generally denotes something valuable (e.g. a gold mine of information, a gold mine of ideas, a gold mine of food).[131] Furthermore, they found that people prefer novel metaphors in simile form over their metaphor counterparts because similes invite them to make a direct comparison. But in the case of conventional metaphors, Bowdle and Gentner discovered that the audience prefers the metaphor form. From these observations, Gentner and Bowdle hypothesised that there are some critical differences between how novel and conventional metaphors are processed (see **Figure 4**).

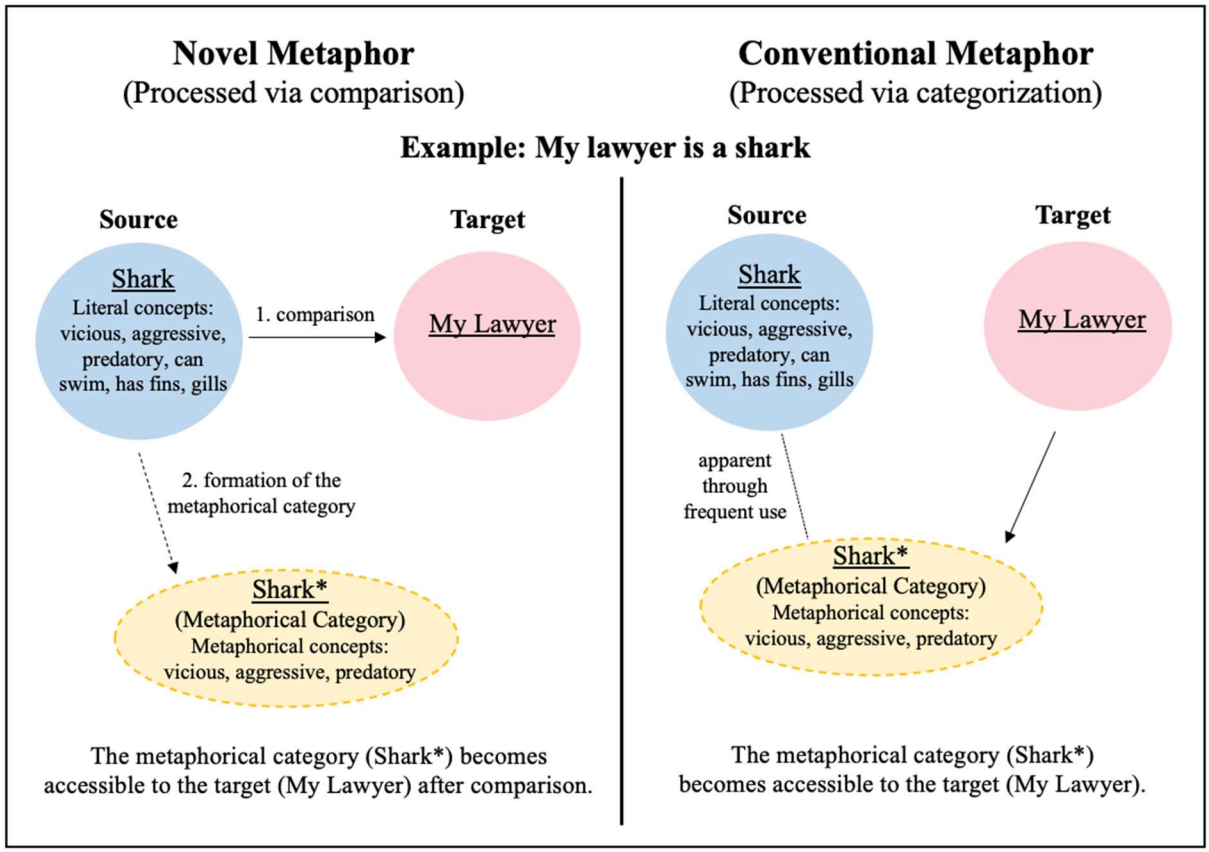

Figure 4: The career-of-metaphor theory using the example "My lawyer is a shark."[132]

[131] Dedre Gentner and Brian Bowdle, "Metaphor as Structure-Mapping," in *The Cambridge Handbook of Metaphor and Thought*, ed. Raymond W. Gibbs, Jr. (Cambridge: Cambridge University Press, 2008), 115-16.
[132] Adapted from Gentner and Bowdle 2008, Figure 6.1, 6.3; Glucksberg 2008, Figure 4.1b

After numerous studies, they theorised that novel metaphors are processed by *direct comparison* or by finding structural correspondences between the two literal concepts of the source and the target.[133] When the novel metaphors get conventionalised through frequent use, the mode of processing shifts from comparison to categorisation. That is, the metaphorical abstraction of the source, which was once more computationally costly than comparison, becomes more salient and gets applied to the target as a category of representation.[134]

Although Bowdle and Gentner highlight the different processing strategies of the novel and conventional metaphor, they emphasise that the underlying mechanism in comparison and categorisation is the same—making structural alignments.[135] They argue that structure mapping occurs in three stages (see **Figure 5**). In the initial mapping stage, the target and the source are compared and searched for many-to-one matches. There is no directionality at this stage. In the second stage, the local matches coalesce and form structurally aligned concepts, yielding literal and metaphorical interpretations. In the final step, many inferences are directionally projected from base to target as natural outcomes of comparison. These inferences reflect the feature-specific and relational aspects of the metaphor comprehension process.[136]

[133] Bowdle and Gentner use the term “base” to refer to the source of the metaphor.
[134] Gentner and Bowdle, "Metaphor as Structure-Mapping," 116.
[135] The structure-mapping used in the career-of-metaphor theory has rough similarities to that of CMT because both approaches see metaphor emerging from certain kinds of cross-domain mapping. However, as Gibbs points out, structure-mapping sees cross-domain comparisons as beginning anew with each metaphor encountered and does not acknowledge the possibility that entrenched conceptual metaphors, which arise from various linguistic and non-linguistic experiences, actively constrain metaphor production and interpretation. Gibbs, *Metaphor Wars*, 107.
[136] Phillip Wolff and Dedre Gentner, "Structure-Mapping in Metaphor Comprehension," *Cognitive Science* 35, no. 8 (2011), https://doi.org/10.1111/j.1551-6709.2011.01194.x; Gibbs, *Metaphor Wars*, 107.

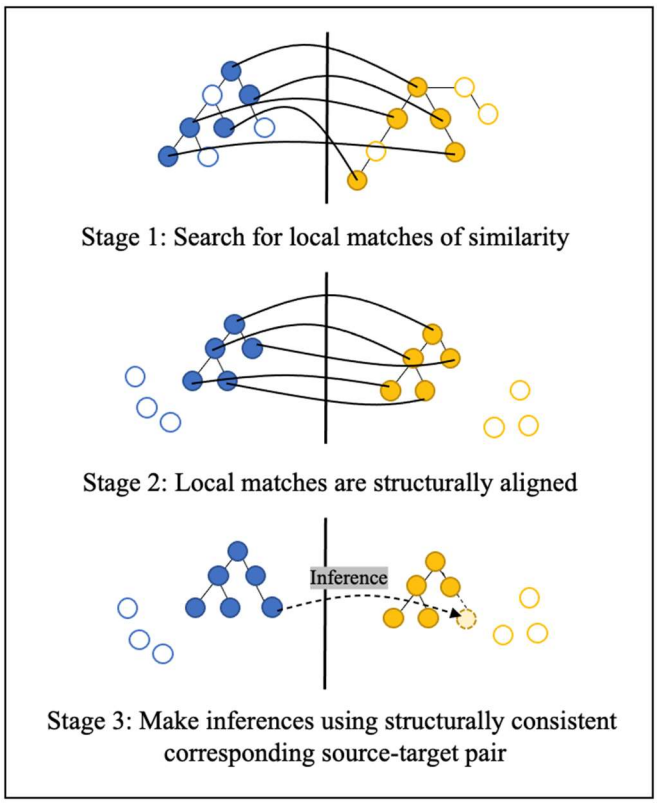

Figure 5: Stages of structure mapping[137]

According to Gentner and Bowdle, what distinguishes novel metaphors from conventional metaphors is not the mode of processing (i.e. comparison vs categorisation) but the *direction* of alignment. While both novel and conventional metaphors establish correspondences, novel metaphors make *horizontal* alignment between isomorphic conceptual structures of the target and source, and conventional metaphors produce *vertical* alignment between the literal category of the target and the metaphorical abstraction category of the source.

According to the career-of-metaphor theory, novel metaphors are processed via comparison, but what about deliberate metaphors? Does this type of metaphor have a different method of processing? According to Steen, deliberate metaphors, which explicitly and intentionally ask the readers to direct attention to another domain, also undergo the process of cross-domain comparison. He argues that since deliberate metaphors use alien source domain

[137] Adapted from Gentner and Bowdle 2008, Figure 6.1

referents to provide perspective from which the target domain referents are viewed, "this function of perspective requires a comparison between the two domains to resolve the distant relationship between the two sets of referents."[138] Therefore, deliberate metaphor theory posits that deliberate metaphors utilise comparison for communicative purposes.

From the discussion so far, the conceptual metaphor theory, the career-of-metaphor theory, and deliberate metaphor theory point to *cross-domain comparison* as the general approach for processing conceptual, novel, and deliberate metaphors. Although there are ongoing debates about the exact processing mechanism for metaphor comprehension, various empirical studies confirm that conceptual, novel, deliberate metaphors are processed via comparison.[139]

How is the "language" metaphor understood?

The "language" metaphor, identified as a conceptual, novel, deliberate metaphor, undergoes the process of comparison. Since the aim of this thesis is not to investigate the precise method of processing the "language" metaphor but to explain what this metaphor communicates and what new meanings are generated from this metaphorical use, I will highlight four significant features of metaphor processing. They are the following: (1) A conceptual, novel, deliberate metaphor is processed by comparison or mapping between two domains; (2) mapping is directional; (3) mapping is partial; and (4) knowledge of the context of the metaphor is essential. We shall explore each of these points in what follows.

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[138] Steen, "Developing, Testing and Interpreting," 69.

[139] Vicky Tzuyin Lai and Tim Curran, "Erp Evidence for Conceptual Mappings and Comparison Processes During the Comprehension of Conventional and Novel Metaphors," *Brain and Language* 127, no. 3 (2013), https://doi.org/10.1016/j.bandl.2013.09.010; Catrinel Haught, "A Tale of Two Tropes: How Metaphor and Simile Differ," *Metaphor and Symbol* 28, no. 4 (2013); N. Mashal et al., "Enhanced Left Frontal Involvement During Novel Metaphor Comprehension in Schizophrenia: Evidence from Functional Neuroimaging," *Brain and Language* 124, no. 1 (2013), https://www.sciencedirect.com/science/article/pii/S0093934X12002155.

Scholars of metaphor in various disciplines agree that because metaphor, by definition, is seeing one thing in terms of another, it requires two distinct, unrelated domains. Specifically, it demands a less abstract source domain and a more abstract target domain. In this thesis, the "language" metaphor establishes two *cross-domain mappings*—one between language and science, another between language and religion. The "language" domain is the source with which the two targets, science and religion, are compared (see **Figure 6**). Moreover, cross-domain mapping enables the production of inferences about the science-religion relationship based on how two languages interact.

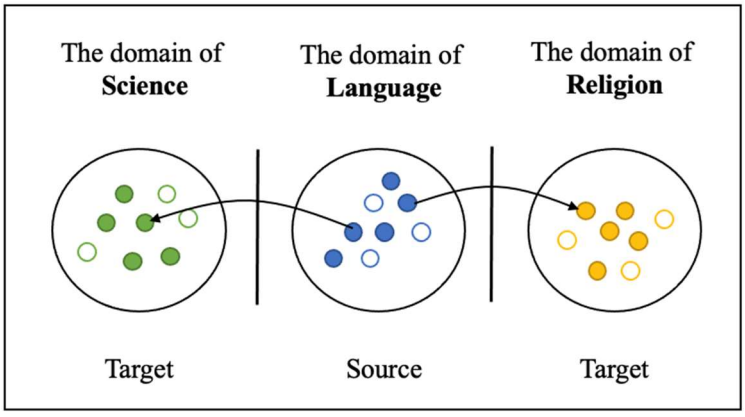

Figure 6: Cross-domain mapping in language-science and language-religion[140]

Directionality is the second feature important in processing the "language" metaphor (see **Figure 7**). The emphasis on directionality has been noted from the onset of CMT. In *Metaphors We Live By,* Lakoff and Johnson stress how metaphorical mappings always occur from the source to the target domain.[141] Using various examples, they demonstrate that more-physical source domains get projected onto more-abstract targets. In his explanation of CMT, Zoltán Kövecses argues, "In our efforts to understand the world, it makes a lot more sense to move conceptually in this particular direction: that is, to conceptualise the cognitively less

[140] The source and target domains are represted by a circle, but this does not imply that the domains have fixed boundaries. It simply shows that source and target domains are distinct areas of thought.
[141] Lakoff and Johnson, *Metaphors We Live By*.

easily accessible domains in terms of more easily accessible ones."[142] Besides CMT, the career-of-metaphor hypothesis and the deliberate metaphor theory univocally endorse that the mapping of inferences occurs from the source to the target. Looking at the "language" metaphor, the concept of language is more concrete than the concepts of science and religion because the ability to communicate via a language is one of the defining characteristics of human beings. Moreover, language has multiple dimensions; there are physical, cognitive, social, and cultural aspects of language. As a result, the diverse angles of reflection regarding language will facilitate comprehension of science, religion, and the relationship between the two. It is important to note, however, that directionality from language to science or language to religion does not mean that science and religion contribute nothing to the conceptualisation of language. In fact, science and religion have been influential in advancing the understanding of language. But considering the complexities of the science-religion interaction, a more tangible, versatile, and familiar concept of "language" is necessary as the source domain.

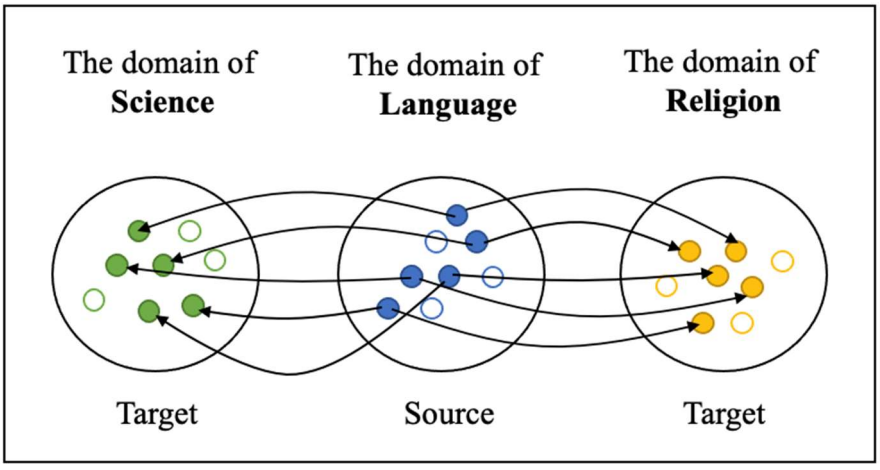

Figure 7: Two cross-domain mapping expressing directionality and partiality
The arrows express directionality; asymmetry is indicated by the solid vs empty dots. The solid dots indicate mapped properties, while the empty dots express unmapped properties.

[142] Kövecses, "Conceptual Metaphor Theory," 16.

The third main feature of the "language" metaphor processing is *partiality* (see **Figure 7**). When the concepts in the source domain are mapped onto the target domain, the transfer is partial, as only certain ideas of the source have correspondences in the target. This property is present even in Black's interaction theory when he explains that metaphor emphasises some features while suppressing others. Consider the metaphor '*Argument is war'* outlined in **Figure 2**. In this example, the idea of military conflict in the "war" domain aligns with the concept of verbal conflict in the "argument" domain. However, the concepts of the *war commander, refuge,* and *veterans* have no matching features in the domain of "argument." Consequently, these ideas cannot be used for making metaphorical inferences about the notion of "argument." For the "language" metaphor, the entire domain of language does not map onto the domains of science and religion. While some features of "language" are selected and transferred to the domains of "science" or "religion," some other attributes of language are left unengaged. Yet, the concepts of the source and the target that are left out from the mapping process will be equally enlightening as those that are mapped because the remainders reveal the limits of the "language" metaphor.

The final characteristic that must be stressed regarding metaphor processing is the importance of the *context* in which the metaphor is used. Although theories of metaphors vary in their emphasis on the role of context, all concur that the context in which the metaphor is uttered plays a vital role in understanding the meaning. The syntactic, semantic, and pragmatic context limits the range of possible metaphorical correspondences between the source and the target. In addition, compared to conventional metaphors, novel metaphors require the audience to pay more attention to the context during metaphorical meaning-making. The audience must examine what was said before and after the metaphor to avoid misinterpretation. Besides the linguistic context, culture and experience heavily influence how the audience construes the metaphor. As Lakoff and Johnson rightly note, the meaning of a metaphor is partly culturally

determined and partly tied to personal experience because the concepts addressed by the metaphor may vary widely from culture to culture, from individual to individual.[143] For instance, *God is a shepherd* metaphor would mean very different things to a person who has never seen a sheep or a shepherd.

Regarding the context of the "language" metaphor, the metaphor is situated in the interdisciplinary discussion. This discourse draws in ideas from various disciplines not limited to science and religion. Some talks about history, philosophy, sociology, and informatics are included in this interdisciplinary discourse. The interpretation of the "language" metaphor expounded in this thesis also relies on my personal background and experiences related to language.

Qualifications for the "language" metaphor

Having established what type the "language" metaphor is and how it works, we are nearly ready to embark on a critical study of what "science and religion as languages" means. Before developing these points, it is important to lay out the ground for this exploration by making some qualifications.

(1) A few qualifications of the term "science" and "religion" must be noted, reflecting the restrictions placed on the scope of this thesis resulting from limits on its space. While the general notion of science may include formal science such as logic, mathematics, and the social sciences, the term "science" is used here primarily to denote natural, empirical sciences, such as chemistry, physics, biology, and earth science, and excludes applied sciences, including engineering, medicine, computer science, and the social sciences. Additionally, while "religion" refers to a wide variety of traditions, including Christianity, Islam, Hinduism, Buddhism, and

[143] Lakoff and Johnson, *Metaphors We Live By*, 142.

other forms of folk religion, there is simply no space to be able to address all religious traditions within this thesis. Consequently, Christianity, currently the largest religion in the world, has been chosen as a representative example. Although the notion of "religion" is depicted by Christianity, it is important to appreciate that the "language" metaphor presents various findings that are relevant and applicable to many other religious traditions. Nevertheless, it is also clear that Christianity is not representative of all the religions in the world; therefore, other religions should be studied in their own right.

(2) It will be helpful to note my own qualifications for developing and advocating the "language" metaphor. My personal experience and educational background have been of major importance in stimulating and informing my reflections on metaphor comprehension, as well as my thinking on understanding science and religion as languages. Born and raised in South Korea, my first language is Korean. English is my second language, acquired in Grade 5 by attending an international school in Korea. I received secondary and higher education in the United States. At Cornell University, I studied biology with a specialisation in neuroscience. During my studies at Cornell, I had a chance to learn about language faculty, neural mechanisms of language production and comprehension, language development, and literacy. At Harvard Graduate School of Education, I attended a class titled "Learning in a Globalizing World: Language Acquisition, Cultural Awareness, and the Roles of Neuroscience in International Education Policies and Practices," gaining further knowledge of second language acquisition and multilingualism. After moving to Oxford, I studied theology for two years and pursued a Master's in Science and Religion prior to beginning this doctoral research project. As someone who is bilingual in Korean and English, I have first-hand experience with the dynamic relationship between the two languages. Furthermore, formal education in biology, theology, science and religion has equipped me with comprehensive knowledge of a wide range of

subjects. Thus, my diverse experience living in different cultures, studying different subjects, and speaking different languages provides me with an exceptionally rich context for developing and interpreting the "language" metaphor.

The structure of this thesis

In this thesis, I assess whether the "language" metaphor is a suitable model for explaining the concepts of "science," "religion," and their relationship. As with any process of determining the usefulness of a conceptual model, the "language" metaphor must be tested on various grounds to determine its practicality and versatility for the field of science and religion. The objective of the thesis is not to prove that this is the "right" or the "best" way of understanding the relationship between science and religion; rather, the thesis aims to explore the grounds of this metaphor and assess its utility in framing and understanding this complex relationship. To achieve this goal, I identify six areas of focus in linguistics: definition of language, diachronic change, language variation, linguistic worldview, linguistic identity and power, and finally, bilingualism and translation. In the subsequent chapters, I evaluate the plausibility of the "language" metaphor for representing the science-religion interface along six different axes.

Chapter 1 concentrates on the characterisation of "language" and its implications for understanding science and religion. Outlining the main features of the "language" domain acts as a springboard for the discussion on how "science" and "religion" are perceived through "language." The "language" metaphor allows us to take note of how scientific and religious practices are used by their distinct linguistic communities for different purposes, thus enabling the view of science and religion as conceptual entities as well as communal discourses performing specific functions.

Chapter 2 considers the merits of the "language" metaphor in the field of science and religion by concentrating on the issue of change over time. Language is never fixed in time but

constantly and continually changes in response to the shifting needs of the linguistic community. This chapter shows that, in common with any language, the notions of "science" and "religion" have evolved over time, and their relationship has also changed.

Chapter 3 develops the "language" metaphor further by considering the varieties of language. English has various dialects (such as British English, American English, and Australian English) and different registers (such as formal register, casual register, and vulgar register). In the same way, considering science and religion as two languages helps us appreciate that they possess different dialects and registers and explore how this helps us understand their relationship. Attentiveness to the various language varieties of science and religion enables a richer account of the interaction of science and religion.

Chapter 4 considers the topic of a "linguistic worldview" in assessing the usefulness of the "language" metaphor for studying science and religion. The concept of linguistic worldview refers to how someone's language shapes their views and experiences of the world. This chapter regarding science and religion as two different languages informs how science and language represent the world and how scientific or religious worldview impacts their respective linguistic community. This chapter also highlights how acquiring the languages of science and religion can be beneficial.

Chapter 5 investigates whether the "language" metaphor effectively addresses the issues of identity and power in the science-religion interaction. Given that language is an integral part of identity formation and an instrument of power, science and religion as languages carry out the function of shaping one's identity and maintaining power relations. This observation is constructive for probing the conflict thesis of science and religion.

Chapter 6 completes this evaluation of the "language" metaphor by focusing on the theme of bilingualism and translation. For a bilingual speaker, having two sets of languages is an advantage. They have an expanded language repertoire, increased awareness of other

cultures, and higher competitiveness in the job market. Although bilinguals use their languages for different purposes, in different domains of life, with different people, both languages are active in the brain, influencing how one perceives and interacts with the world. Therefore, the relationship between the languages of the bilinguals resembles how science and religion interact in the lives of individuals. Moreover, this chapter discusses the steps required for a bilingual speaker in science and religion to become a competent translator for the scientific and religious communities.

These six evaluations of the fitness of the "language" metaphor can stand by themselves as a discussion on specific aspects of "science," "religion," and their relationship. However, when taken together, the six assessments provide a coherent and thorough analysis of the various dimensions of the science-religion interface and thus produce a comprehensive view of the complex relationship. The metaphorical framework not only offers a concrete picture of science and religion but advances the concept of "language" as an open-ended source of ideas for further exploration. Unfortunately, as much as the "language" metaphor is effective in informing *many* complexities of the science-religion system, it does not represent *all* aspects of the science and religion systems. Nevertheless, even these limitations will illuminate topics for discussion. In light of the valuable insights into the complex notions of science, religion, and their relationship, it is concluded that the "language" metaphor presents a helpful and productive way of envisaging the field of science and religion and developing its potential in the quest for human understanding.

Chapter 1: What is a language?

Most animals possess some kind of communication system. For example, bees dance to signal the location of a food source, sperm whales use clicking sounds to convey information about the physical surroundings, and white rhinos use communal defecation sites to leave messages for other rhinos. However, their communication systems have nothing comparable in scale, complexity, subtlety, or adaptability to the human communication system. Unlike the communication system of other species, human language expresses the infinite possibility of meanings using a fixed set of invariant signs and talks about things unrelated to here and now.[144]

Language is pervasive and essential for human life. Apart from individuals with some form of pathology, humans naturally learn to speak at least one language in the first few years of life and use it for the rest of their lives. Language allows people to transfer complex information, discuss the meaning of events, share feelings and ideas, and communicate with each other. It plays a vital role in constructing society and transmitting culture. In short, language defines humanity.

The "language" metaphor presents science and religion *as* languages. Indeed, communication is integral to science and religion. In the case of science, scientists communicate new research findings, make a speech at conferences, speak to other scientists regarding new research methods, and devise new terms to denote a newly discovered phenomenon. Religion, too, engages in various communicative activities, such as reading scripture, praying, and discussing with other religious adherents about religious beliefs. But the "language" metaphor does not simply say that communicative acts are important aspects of

[144] Victoria Fromkin, Robert Rodman, and Nina M. Hyams, *An Introduction to Language*, Tenth ed. (Andover: Wadsworth Cengage Learning, 2014), 17-18.

science and religion. Instead, it proposes that science and religion are different languages that aid the transfer of information, ideas, and feelings from one person to another.

The first step in uncovering the meaning of the "language" metaphor is to define the word "language." For this thesis, I use the following working definition: *language is a system of symbols and rules used in a social context to carry out communicative functions.*[145] This definition has three focal points: *system, social context,* and *function.* As a *system,* language is made up of various components, like spoken, signed, or written symbols and rules, and the language system has a structure. With an emphasis on its *social context,* language is regarded as a social phenomenon, enabling people to interact and exchange thoughts and feelings. Finally, *function* underscores the fact that language performs certain communicative functions. The definition of language with three keywords covers the main features of the language, providing an all-around outlook of the "language" concept.

The multifaceted definition of language proposed above is imperative to the "language" metaphor comprehension because it lays the groundwork for comparison. Since both "science" and "religion" are complex, the three essential aspects of language act as signposts for exploring the territories of science and religion.

In this chapter, I demonstrate that the "language" metaphor provides an invaluable understanding of science and religion using the definition of language. I discuss the three central attributes of language—namely, language is a system of communication, language is social and communal, and language carries out communicative function—as points of ontological correspondences to the domains of science and religion. I first begin with a focus on the systematic aspect of language and explain that science is a system comprised of scientific constructs, instruments, and rules and that religion is a system made of beliefs, rituals, and

[145] This definition is my modification of Fasold and Connor-Linton's definition Ralph W. Fasold and Jeff Connor-Linton, "Introduction," in *An Introduction to Language and Linguistics*, ed. Ralph W. Fasold and Jeff Connor-Linton (Cambridge: Cambridge University Press, 2014), 1.

regulations. Then, I look at the social nature of language to address that both science and religion are social and communal. Finally, I investigate the communicative function of language and how this aspect gets mapped onto the domains of "science" and "religion." I underscore that science and religion carry out distinct functions in society. By utilising the definition of language proposed here, the "language" metaphor avoids misrepresenting and reducing the rich conceptualisation of science and religion.

1. Language is a system of communication

Since the 20th century, many linguists have focused on the systematicity of language. Ferdinand de Saussure, one of the founding figures of modern linguistics, saw language as a system in which everything holds together ('un système où tout se tient'). [146] Noam Chomsky underscored how grammar as a system of rules forms a language's structure.[147] Following their legacy, contemporary linguists analyse a language by classifying elements that constitute the corpus of utterances and examining grammar rules that interconnect the components.

The systematicity of language is often compared to a house. Just as bricks build a house, words make up language. A word is the smallest unit of language that can stand independently in an utterance.[148] It is also an arbitrary linking of a form (the idealised sound-image of a word) and a meaning (a mental notion or idea). For example, the sounds represented by the letters *hand* in English, *main* in French, 손 in Korean, and يد in Arabic all signify the concept of "hand." The form is arbitrarily connected to the meaning. For instance, the idea of "pig" could be called *cat, cow,* or *pag*, but it is chosen arbitrarily to be called a *pig.* However, some words appear to be non-arbitrary, as in onomatopoeia (e.g. the sound that a dog makes gets incorporated into

[146] P. H. Matthews, *A Short History of Structural Linguistics* (Cambridge; New York, NY: Cambridge University Press, 2001).
[147] Noam Chomsky, *Syntactic Structures* (Berlin; Boston, MA: De Gruyter Mouton, [1957] 2002).
[148] William McGregor, *Linguistics: An Introduction*, Second ed. (London: Bloomsbury, 2015).

the sign for the sound *woof woof*) or phonesthemes, which exhibit statistical regularities in the pairing of similar sounds and similar meaning (e.g. *gl-* relating to light or vision such as glitter, glisten, glow, gleam, glare, glint, gloss). Despite these few exceptions, most words in a language have the meanings they do by convention.[149]

As clay and shale make a brick, phonemes and morphemes form a word.[150] Phonemes are meaning-distinguishing sound types that correspond to individual letters and letter combinations. For example, the English word *through* has three phonemes: the "th" sound, followed by the "r" sound, and then the "oo" vowel sound. Although a wide range of sounds can be produced in actual speech, each language only uses a limited number of phonemes. For instance, the Pirahã language of Mura, Brazil uses 10, English employs 38 or 39 (depending on the American or British/Australian dialect), and the Khoisan language of southern Africa uses 100.[151] Morphemes are the most elemental unit of meaning. They have forms and meanings (or grammatical functions) and cannot be subdivided into smaller linguistic units. Morphemes can be divided by the type of meaning they convey. Lexical morphemes are the ones that carry the "content" of a message, specifying the things, qualities, and events communicated about, exemplified as *farm, happy,* and *dance.* On the other hand, functional morphemes, such as articles, conjunctions, prepositions, and pronouns, offer information about the grammatical structure of the utterance.[152]

To continue the house analogy, building a house requires not only bricks but also a blueprint, a guideline of rules that arranges the brinks in a specific manner. Likewise, a language needs grammar to align and order words in a particular way to convey meaning.

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[149] Although the arbitrariness of language has been assumed a definitional characteristic of language since de Saussure, recent research demonstrates the systematicity of form-meaning mapping, especially in the early stages of language development, and conclude that language is not entirely arbitrary. Padraic Monaghan et al., "How Arbitrary Is Language?," *Philosophical Transactions of the Royal Society of London* 369, no. 1651 (2014), https://doi.org/10.1098/rstb.2013.0299.

[150] In the case of sign languages, phonemes are the basic unit of signed communication.

[151] McGregor, *Linguistics: An Introduction*, 46.

[152] Ibid., 61.

In the language system, there are four major levels of grammar. First, phonological rule (*phonology)* governs how phonemes can be combined to produce speech sounds. Second, morphological rules (*morphology)* specify how the language units can be bound to create meaningful combinations of sounds and words. Third, *syntax* or grammatical structure guides how we combine words to form meaningful phrases and sentences. Fourth, *semantics* assigns meanings to words or phrases when they appear in various sentences or contexts. While there may be some differences in the grammar that exist in the speakers' minds, the shared knowledge of these rules makes communication possible.

There are two ways to view the roles of grammar. The first is the *prescriptive approach,* which considers grammar as a set of rules for the "proper" use of a language; the second is the *descriptive approach*, which attempts to describe rather than prescribe the rules of grammar.[153] Taking the descriptive view, linguists collect samples of the language they are interested in and try to explain the regular structures of the language.[154] Since linguists take language as they find it, they simply characterise the internal structure rather than attempting to regulate it in the direction of the preconceived, "correct" form.[155]

According to Ludwig Wittgenstein, one of the most famous philosophers of language in the twentieth century, grammar is both prescriptive and descriptive. In *Philosophical Grammar,* Wittgenstein writes,

> Grammar describes the use of words in the language.
> So it has somewhat the same relation to the language as the description of a game, the rules of a game, have to the game.[156]

In the first sentence, Wittgenstein asserts that grammar derives from the observation or description of the uses of language by actors in a situation. Nevertheless, Wittgenstein goes on

[153] Fromkin, Rodman, and Hyams, *An Introduction to Language*, 10.
[154] George Yule, *The Study of Language*, 4th ed. (Cambridge: Cambridge University Press, 2010), 86-87.
[155] The prescriptive approach is, of course, still important in learning a language.
[156] Ludwig Wittgenstein, *Philosophical Grammar*, trans. Anthony Kenny, ed. Rush Rhees (Oxford: Basil Blackwell, [1933] 1974), par. 23.

to underscore the prescriptive feature using the analogy that grammar relates to language in the same manner as the description and rules relating to the game. Just as the rules of a game prescribe certain moves and proscribe others and thereby constitute the identity of the rules, grammar dictates certain linguistic moves and proscribes others and, as a result, forms the identity of the concepts required for making certain linguistic moves.[157] Hence, the shared knowledge of the rules that are both prescriptive and descriptive makes communication possible.

As a system, language has a structure. Some linguists see language as hierarchically structured: phonemes and morphemes are combined to form words, then phrases, and finally complex sentences. In Noam Chomsky's tree diagram analysis, a sentence is not merely a string of words but a combination of words into constituents that create a deep hierarchical tree structure. For instance, the sentence "the rabbit ate the carrot" divides into the noun phrase "the rabbit" and the verb phrase "ate the carrot" made up of a verb and another noun phrase. Each phrase can be divided further into the determiner "the" and noun "dog" or "the" and "carrot" (**Figure 8**).

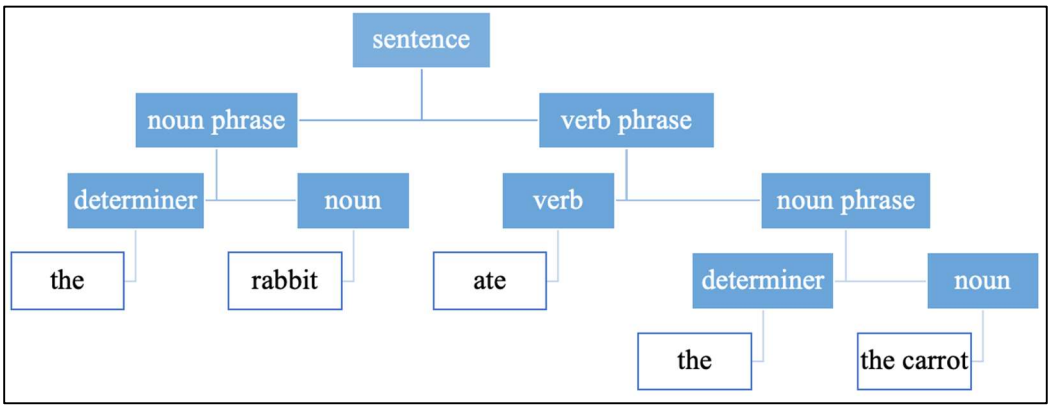

Figure 8: Tree diagram of "The rabbit ate the carrot"

On the other hand, some linguists argue that a sequential sentence structure, rather than a hierarchical structure, is fundamental for the comprehension, production, and acquisition of

[157] Michael N. Forster, *Wittgenstein on the Arbitrariness of Grammar* (Princeton, N.J.: Princeton University Press, 2004), 8.

human language.[158] Using the recent studies of human brain activity, behaviour, and the statistics of text corpora, they assert that a sentence is processed in sequential order, that is, by looking at how words combine into components that have a linear order.[159] The difference between the hierarchical and sequential structure is illustrated in **Figure 9**:

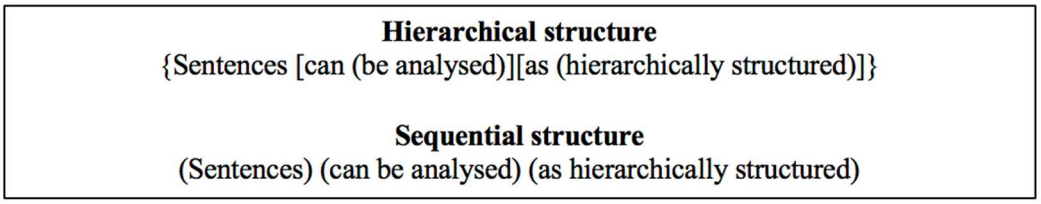

Figure 9: Hierarchical vs sequential structure

Whether one views sentences as hierarchically or sequentially structured, hierarchical and sequential orderings are required in everyday language use.

Constructing a house involves gathering raw materials like bricks, mortars, and columns and following the blueprint to set the structure. Likewise, language requires gathering phonemes and morphemes to form words, short and long phrases, and sentences according to grammar rules. Once the learners master grammar, they can have more freedom to arrange words and produce meaningful phrases and sentences. Therefore, both components of language—words and grammar—construct the language system.

1.1 Science is a system

In the metaphorical framework spotlighting the systematic aspect of language, science is seen as a system made up of various elements. But philosophers of science differ in their views about what constitutes science.

Henri Poincaré, a French mathematician and philosopher of science, regards facts as an essential ingredient of science. Interestingly, Poincaré uses the house analogy to describe the

[158] Stefan L. Frank, Rens Bod, and Morten H. Christiansen, "How Hierarchical Is Language Use?," *Proceedings: Biological Sciences* 279, no. 1747 (2012), https://doi.org/10.1098/rspb.2012.1741.
[159] Ibid., 4522.

system of science. He states, "Science is built of facts the way a house is built of stones: but an accumulation of facts is no more science than a pile of stones is a house."[160] Here, Poincaré argues that facts, built up of many observations, serve as the essentials for constructing science. But he also adds that facts are not the only ingredient of science. He acknowledges that similar to a house requiring mortar to join bricks, hypotheses, generalisations, laws, and experimental observations are necessary for science.[161] While he admits that facts are important constituents of science, he also underscores the central roles of theories, hypotheses, and laws for scientific activities.

Endorsing Poincaré's systematic view of science, the logical positivists, such as Moritz Schlick, Rudolf Carnap, Hans Hahn, and Carl Hempel, contend that facts and the verification method are central elements of the system of science. The fundamental tenet of logical positivism is that empirical experience and logical reasoning are the only two sources of knowledge. In other words, there is no possibility of synthetic *a priori* knowledge.[162] Logical positivists argue that facts that are observable through sense perception form the basis of scientific knowledge.[163] They also attest that personal opinions or speculative imaginings have no place in science. They believe that scientific activity is impervious to social, institutional, and political influences. Besides facts, logical positivists consider the verifiability principle imperative for producing scientific knowledge. Hans Hahn describes this process in detail:

> …laws of nature are *hypotheses* which we state tentatively; but in stating such laws of nature we implicitly state many other propositions . . . as long as these implicitly stated propositions . . . are confirmed by observation, the laws of nature are corroborated and we continue to hold on to them; but if these implicitly asserted propositions are not

[160] Original in French: on fait la science avec des faits comme une maison avec des pierres; mais une accumulation de faits n'est pas plus une science qu'un tas de pierres n'est une maison. Henri Poincaré, *Science and Hypothesis*, trans. William J. Greenstreet (London: The Walter Scott Publishing Co., LTD, [1902] 1905), 157.
[161] Ibid.
[162] Hans Hahn, Otto Neurath, and Rudolf Carnap, "Wissenschaftliche Weltauffassung. Der Wiener Kreis," in *The Emergence of Logical Empiricism: From 1900 to the Vienna Circle*, ed. Sahotra Sarkar (New York; London: Garland Publishing, 1996).
[163] A. F. Chalmers, *What Is This Thing Called Science?*, 3rd ed. (Buckingham: Open University Press, 1999), 1.

> confirmed by observation, the laws of nature are not corroborated and we go on to replace them by others.[164]

Thus, logical positivists see science as the system that builds durable scientific knowledge about nature using facts and the method of verification.

Karl Popper understands science to be a system of knowledge governed by logic. While most logical positivists stress the role of induction and verification, Popper takes an anti-inductivist stance and argues that proper science is accomplished by deduction and the process of falsification. This methodology is commonly known as the hypothetico-deductive method. According to this approach, scientists begin by proposing a hypothesis, which is an inference or general statement from individual observations that could be falsified by an experiment. They draw predictions from a hypothesis using deductive reasoning and test against experience. If the test outcome runs contrary to expectations, the hypothesis is falsified, and another hypothesis is devised. Otherwise, the hypothesis is corroborated.[165] Although Popper suggests a scientific method different from the logical positivists, his general outlook on science remains similar to that of the positivists—that science is a system of scientific knowledge operated by certain logic.

While the philosophers of science mentioned above adopt a mechanistic view of science, the "language" metaphor presents science as a more flexible, fluid system. Just like a language consists of spoken, manual, or written symbols carrying specific meanings, the language of science comprises scientific constructs that embody specific scientific meanings. The term "scientific construct" refers to a mental category explaining the physical phenomenon of interest. Some examples of scientific constructs include concepts (e.g., symbol "Fe" and the Bohr model of the atom), hypotheses (e.g., the social brain hypothesis), theories (e.g., special

[164] Hans Hahn, "Logik, Mathematik Und Naturerkennen," in *Unified Science*, ed. Brian McGuinness (Dordrecht: Reidel Publishing Company, 1987), 38.
[165] Howard Sankey, "Scientific Method," in *The Routledge Companion to Philosophy of Science*, ed. Martin Curd and Stathis Psillos (Abingdon; New York, NY: Routledge, 2014), 284-85.

relativity and the Big Bang theory), classifications (e.g., biological taxonomy), measurement units (e.g., gram and second), and equations (e.g., $E = mc^2$, $2\ H_2 + O_2 \rightarrow 2\ H_2O$). Basically, scientific constructs are any conceptual items that exist in the mind and convey some scientific information. Some scientific constructs, exemplified by Kelvin and hydrogen, embody a single concept, but others, like energy and thermodynamics, signify multiple underlying concepts.

Besides scientific constructs that act like words to carry meaning, science also constitutes tools to perform scientific activities. There are observation tools like microscopes, telescopes, X-rays, and fMRIs and measurement tools, such as thermometers, scales, barometers, and spectrometers. Computers are indispensable tools in science because they are used in many areas, including data storage, data processing, data analysis, model building, scientific simulation, instrument control, and knowledge sharing.

In addition to the scientific constructs and tools, science is guided by a set of rules operating on various levels. Scientists generally follow a process of experimentation called the scientific method. Used by scientists in all disciplines, the scientific method involves the following steps: (1) make observations, (2) ask a question, (3) generate a hypothesis, (4) test the hypothesis through various means, (5) analyse data, and (6) use the result to make a new hypothesis or refinement. Scientists use inductive reasoning to form a conjecture using observations and rely on deductive reasoning to draw a logical conclusion. In addition to following the scientific method to produce scientific knowledge, scientists comply with ethical standards, discipline-specific code of conduct, and institutional guidelines. Moreover, scientists can be guided by their values and worldviews. Thus, the "language" metaphor represents science as a system of scientific constructs, instruments, and rules.

Regarding the structure of science, scholars like Auguste Comte, Henri Poincaré, and Norman Storer suggest a hierarchical structure. For instance, August Comte proposes the "hierarchy of the sciences," demonstrating that the different branches of science are

synthesised into a single, coherent system of ideas. In *The Positive Philosophy of Auguste Comte,* he argues that the sciences can be ordered by increasing the complexity of phenomena or by decreasing generality: mathematics, astronomy, physics, chemistry, biology, and finally, sociology.[166] For Comte, mathematics is the science that relates to the measurement of magnitudes and is applied to all laws of the universe; biology is the most complex system of the natural sciences, and; sociology is the most sophisticated science that "assumes the task of coordinating the development of the whole knowledge."[167] Poincaré also asserts a hierarchical view of science in *Science and Hypothesis.* He contends that special sciences presuppose experimental physics, which presupposes mechanics, which presupposes geometry, which in turn presupposes arithmetic.[168] Like Comte, Poincaré holds that mathematics must be in place before any empirical science, such as physics. He argues that the higher level is necessarily founded on the lower level but cannot be reduced solely to the lower level. Norman Storer organises sciences using hardness as the degree of rigour, impersonality, and the extent to which mathematics is used. Storer claims that physics is "harder" than chemistry, which is "harder" than zoology.[169] Storer insists that in the "soft" sciences, non-empirical criteria, such as relevance to shared values or elegance of style, play a more significant role in determining the acceptance and success of a contribution.[170]

While Comte, Poincaré, and Storer offer various criteria to arrange the sciences in a hierarchy, authorship and citation data have been used in the last two decades to map the structure of all sciences beginning in the 1970s.[171] According to Martin Rosvall and Carl T.

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[166] Auguste Comte, *The Positive Philosophy of August Comte*, trans. Harriet Martineau (Kitchener, Canada: Batoche Books, [c.1830] 2000).
[167] Michel Bourdeau, "Auguste Comte," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta (Metaphysics Research Lab, Stanford University, 2018). https://plato.stanford.edu/archives/sum2018/entries/comte/.
[168] Poincaré, *Science and Hypothesis*, 2.
[169] N. W. Storer, "The Hard Sciences and the Soft: Some Sociological Observations," *Bulletin of the Medical Library Association* 55, no. 1 (1967): 76.
[170] Ibid., 79.
[171] See Garfield, 2008; Rosvall and Bergstrom 2008, 2011; and Boyack et al., 2005.

Bergstrom, citation patterns among journals provide a glimpse of the flow and communication trends between scientists and highlight dominant fields and their relationships.[172] The 2008 article analysing the interactions between 6,128 journals with 6,434,916 citations argues that science as a system of information consists of several well-connected modules and links representing the avenues of information flow between these modules. With the citation mapping of science illustrated in **Figure 10**, they identify the backbone of the science system

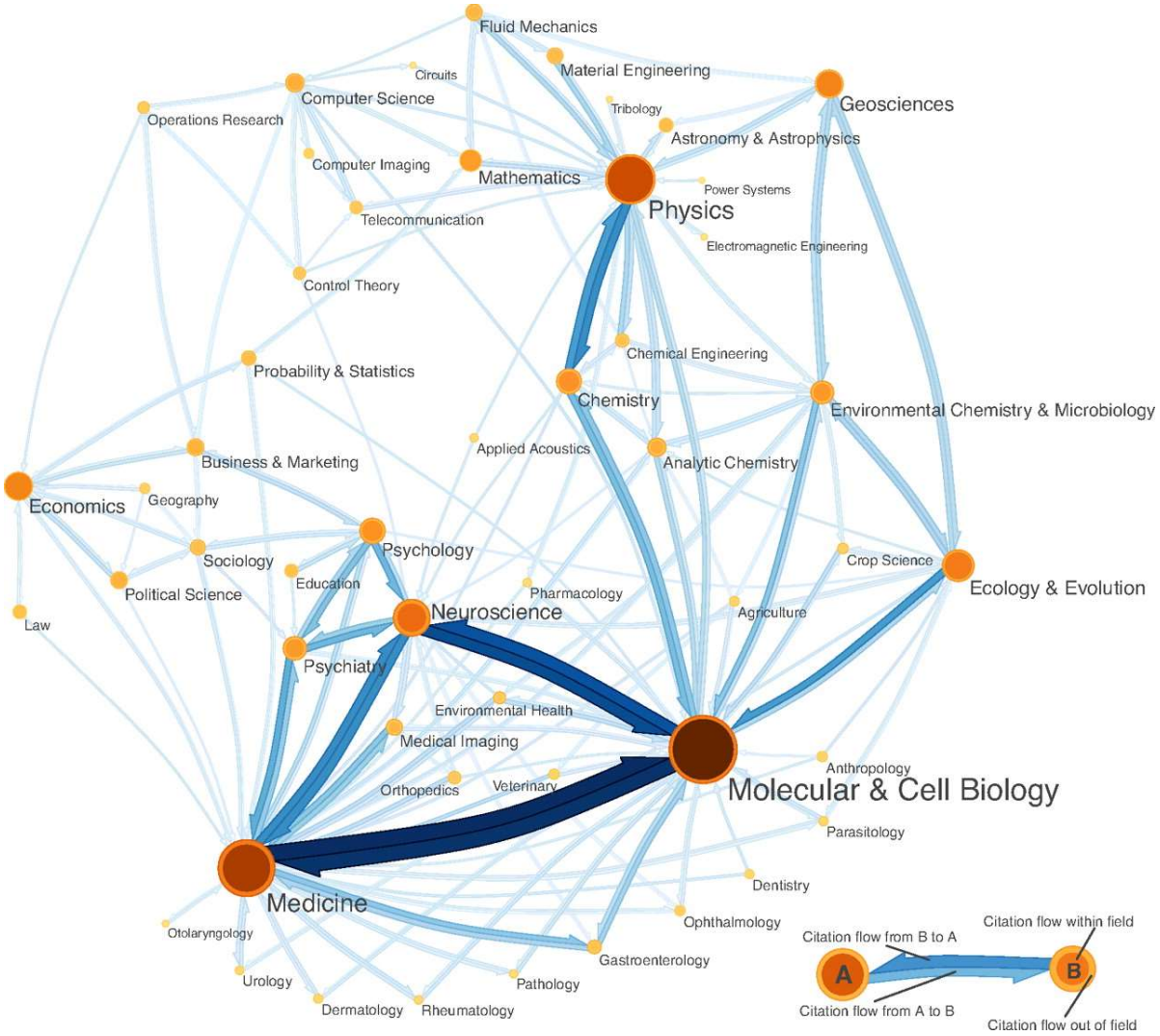

Figure 10: Map of the science based on citation patterns[173]

[172] Martin Rosvall and Carl T. Bergstrom, "Maps of Random Walks on Complex Networks Reveal Community Structure," *Proceedings of the National Academy of Sciences* 105, no. 4 (2008), https://doi.org/10.1073/pnas.0706851105.
[173] Reprinted with permission from ibid., 1122. Copyright 2008 by the National Academy of Sciences of the USA.

to be physics, chemistry, molecular and cell biology, and medicine and the structure of science to be like the letter U.[174]

In the 2011 paper, they describe science to have a hierarchical structure with submodules in modules. Using 7,940 journals connected by 9.2 million citations, they delineate four major science disciplines: life science, physical science, ecology and earth sciences, and social sciences. Furthermore, they note that physical sciences are divided further into two lower levels: physics and chemistry. **Figure 11** shows the multiple levels of interdependencies between the modules of the science network.[175]

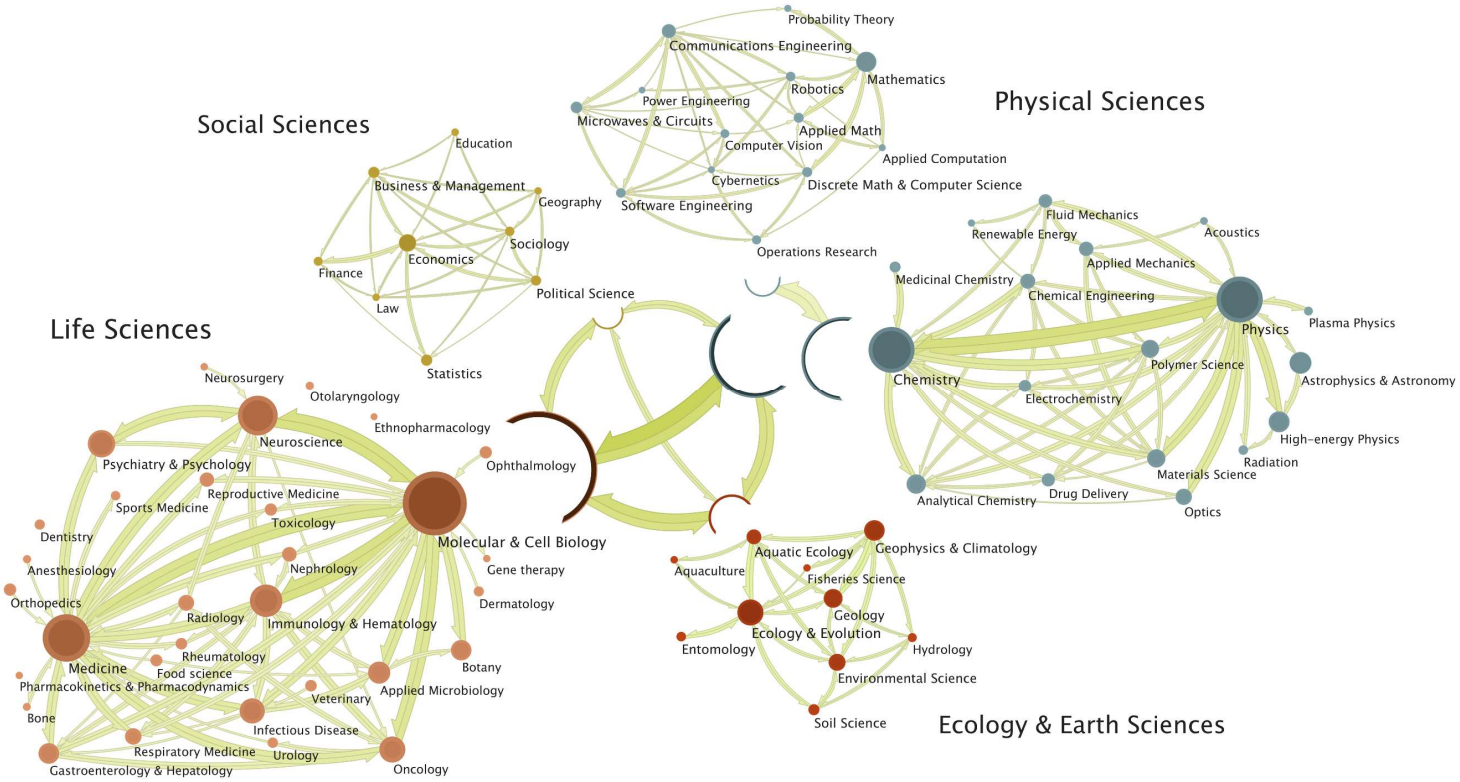

Figure 11: Hierarchical map of science[176]

[174] Ibid.
[175] Martin Rosvall and Carl T. Bergstrom, "Multilevel Compression of Random Walks on Networks Reveals Hierarchical Organization in Large Integrated Systems (Hierarchical Organization in Integrated Systems)," *PLoS ONE* 6, no. 4 (2011): 5, https://doi.org/10.1371/journal.pone.0018209.
[176] Reprinted with permission from ibid. Copyright 2011 by Rosvall, Bergstrom.

From the authorship and citation data tracing the communication patterns between different disciplines, it is evident that the structure of science is somewhat hierarchical but highly dynamic and flexible.

In addition to the citation patterns revealing the structure of science based on communication trends, John Benjafield confirms the hierarchical structure of science by analysing the vocabulary sharing patterns between well-established subjects. He compares the vocabularies of astronomy, physics, chemistry, biology, and psychology and demonstrates that the vocabulary sharing patterns are consistent with the existence of Comte's hierarchy of the sciences with the addition of psychology after biology.[177] He reports that the subjects adjacent to each other in the hierarchy share more vocabulary than the subjects farther apart.[178] For example, chemistry shares more vocabulary with physics than any other subject, biology shares the most with chemistry, and psychology shares the most with biology. While corroborating the patterns of hierarchy existing in the sciences, he asserts that "hierarchy" is not designating superiority but underscoring the diversity of sciences without losing sight of their unity.[179]

What about the concept of the arbitrary connection between word form and meaning? Can it be mapped onto the domain of science? The aspect of arbitrariness is readily observed in scientific terms and symbols. For instance, in chemistry, the nomenclature of the elements is arbitrary. Historically, the discoverers of an element claimed the right to name it, and they often used an array of names commemorating places, people, or things. Although the name and the associated symbol of the elements are assigned arbitrarily, they convey essential ideas, such as the number of protons and electrons and all of the properties associated with them. Another demonstration of arbitrariness in science is related to measurement. *m,* the unit of length, and *kg,* the unit of mass, are arbitrary schemas for describing empirical data. The zero point of the

[177] John G. Benjafield, "Vocabulary Sharing among Subjects Belonging to the Hierarchy of Sciences," *Scientometrics* 125, no. 3 (2020): 1979, https://doi.org/10.1007/s11192-020-03671-7.
[178] Ibid., 1971.
[179] Ibid., 1966.

Celsius scale is arbitrary since it does not correspond to the absence of temperature. And the choices of measurement standards are somewhat arbitrary.

If the terms and symbols used by scientists are arbitrary, does this mean the observations made using these elements are also arbitrary? Although many scientific names, symbols, and measurement units have been assigned randomly, and scientists have the freedom to choose what language, rules, and equipment are used in research, this does not imply that what science produces is arbitrary.

In summary, mapping the systematic feature of language onto science spotlights some characteristics of science. Just as words form the basis of language, scientific constructs and tools function as the basic building blocks of science. The scientific method acts as grammar, guiding and directing scientific activity. Some scholars such as Comte and Poincaré describe science as having a hierarchical structure, with mathematics as a foundation for all other subdisciplines. The recent citation mapping offers an alternative picture showing the complex and dynamic networks between the different branches of science.

Although the view of language as a system directs attention to distinct features of science, too much emphasis on systematicity can lead to a skewed perception of science as a mechanical system of scientific knowledge. However, by introducing the angles of community and function in the following sections, the "language" metaphor presents a holistic picture of science, accounting for the role of the scientific community, the dependence on context, and its purpose in the world.

1.2 Religion is a system

In sociology, anthropology, and religious studies, many scholars work with the definition of religion in the most general form, not specific to any particular religion. Using objective tools and methods to understand how religion works in society, they often portray religion as a

system of religious beliefs and practices. For instance, the sociologist Émile Durkheim, the American anthropologist Clifford Geertz, and Catherine L. Albanese, the historian of religion, describe religion as a system.[180]

Émile Durkheim states that "religion is a unified system of beliefs and practices relative to sacred things, that is to say, things set apart and forbidden—beliefs and practices which unite into one single moral community called a Church, all those who adhere to them."[181] According to Durkheim, the fundamentals that make up the system of religion are both beliefs and practices, both mind and body. He also underscores the socially constructed concept of the "sacred," which refers to something not necessarily related to a god or a supernatural being, but anything extraordinary that inspires wonder and awe.

For Clifford Geertz, the elements that make up the religious system are symbols. He claims, "religion is a system of symbols, which act to establish powerful, pervasive, and long-lasting moods and motivations in men by formulating conceptions of a general order of existence and clothing these conceptions with such an aura of factuality that the moods and motivations seem uniquely realistic."[182] Geertz's use of "symbols" refers to the concrete embodiments of ideas, attitudes, judgments, longings, or beliefs that have the power to help individuals to make sense of both their own lives as individuals and their lives together in society.[183] In his definition, Geertz highlights the psychological as well as sociocultural dimensions of religion by characterising religion as a set of symbols rather than beliefs.

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[180] Scholars outside the field of sociology, anthropology, and religious studies also identify religion as a belief system. For instance, Wiech et al. conducting research in the field of neuroscience considers religion as a belief system that can activate top-down pain inhibitory circuit to help believers reinterpret the emotional significance of pain. K. Wiech et al., "An fMRI Study Measuring Analgesia Enhanced by Religion as a Belief System," *Pain* 139, no. 2 (2008), https://doi.org/10.1016/j.pain.2008.07.030.

[181] Émile Durkheim, *The Elementary Forms of the Religious Life*, trans. Joseph Ward Swain, Ebook Central, (Mineola, New York: Dover Publications, Inc., [1912] 2008), 66.

[182] Clifford Geertz, "Religion as a Cultural System," in *The Interpretation of Cultures: Selected Essays*, ed. Clifford Geertz (London: Fontana Press, 1993), 90.

[183] Ibid., 91.

Similar to Clifford Geertz, Catherine L. Albanese considers religion as a system of symbols. In a short descriptive statement, Albanese sums up what religion is: "a system of symbols (creed, code, cultus) by means of which people (a community) orient themselves in the world with reference to both ordinary and extraordinary powers, meanings, and values."[184] From this definition, Albanese identifies three symbolic elements in the religious system: *creed, code,* and *cultus*. First, *creed* is an explanation of the meanings of human life. She notes that creed takes various forms "from highly developed theologies and sacred stories of origin to informal oral traditions and unconscious affirmations that surface in casual conversations."[185] Second, *code* refers to "rules that govern people's behaviour."[186] The articulate moral and ethical systems, the customs acceptable in a society, and the ethos by which people live are all examples of codes.[187] Third, *cultus* denotes rituals to act out, underline, and reinforce the insights and understandings expressed in creeds and codes. In addition to these symbols, Albanese argues that *community*, described as "groups of people either formally or informally bound together by the creed, code, and cultus they share," is an additional component of a religious system.[188] Thus, she considers the four components—creed, code, cultus, and community—as the different forms of religious beliefs manifested in human experience that together construct a religious system.[189] She also views these four elements as the means by which people orient themselves in the world. The strength of Albanese's definition of religion is prioritising concrete human experience and expression over the abstract, intellectual contents of the mind.

[184] Catherine L. Albanese, *America, Religions, and Religion*, 3rd ed. (Belmont, CA; London: Wadsworth, 1999), 11.
[185] Ibid., 9.
[186] Ibid.
[187] Ibid., 10.
[188] Ibid.
[189] Ibid., 11.

While Albanese defines religion in general, her definition is useful for identifying essential components of Christianity as a type of religious system. In Christianity, Albanese's *creed, code, cultus,* and *community* can roughly correspond to theology, doctrine, practice, and church, respectively.

Theology, derived from two Greek words, *theos* and *logos*, essentially means the rational discourse about God or the study of God. Paul Tillich, in his introduction to *Systematic Theology,* describes the two roles of theology: "the statement of the truth of the Christian message and the interpretation of this truth for every new generation"[190] He also adds that theology deals with the two poles, "the eternal truth of its foundation and the temporal situation in which the eternal truth must be received."[191] Since theology is a reflective process and the outcome of conceptualising the Christian faith expressed meaningfully in one's life, Albanese's notion of creed translates to theology.

Within the Christian framework, Albanese's concept of *code* corresponds to doctrine. The word "doctrine" comes from the Latin term *doctrina,* meaning teaching or instruction. Christian doctrine refers to a teaching or a set of teachings about the message of the gospel rooted in the life of Jesus Christ and the content of the faith it elicits. Compared to theology, which implies the faithful thinking of individual believers, doctrine refers to communally endorsed instructions. Alister McGrath describes theology as an opinion approved by an individual or a school of opinion and doctrine as theology accepted by the ecclesiastical community as authoritative teaching.[192] Consequently, doctrines are community-specific and govern the Christian way of life.

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[190] Paul Tillich, *Systematic Theology*, vol. 1 (Chicago, IL; London: University of Chicago Press, 1951), 3.
[191] Ibid.
[192] McGrath, *The Foundations of Dialogue*, 163. Jaroslav Pelikan highlighted the communal dimensions of doctrine when he defined "Christian doctrine" as "what the church of Jesus Christ believes, teaches, and confesses on the basis of the word of God." Jaroslav Pelikan, *The Christian Tradition: A History of the Development of Doctrine* (Chicago, IL; London: University of Chicago Press, 1971). cf. George A. Lindbeck, *The Nature of Doctrine: Religion and Theology in a Postliberal Age*, 1st ed. (Philadelphia: Westminster Press, 1984).

Albanese's concept of *cultus* relates to Christian rituals. The theologians Craig Dykstra and Dorothy Bass define Christian practices as "things Christian people do together over time to address fundamental human needs in response to and in the light of God's active presence in the world."[193] While practices vary slightly depending on the denomination, some standard practices include communal worship, baptism, the Holy Communion, prayer, and missionary work. During the public worship service, there are times for prayer, singing, Bible reading, sermon, and offering. Most Christians, regardless of their denomination, regard the sacraments of baptism and communion as important external rites.[194] Christian practices also take place in smaller groups and in private, usually focusing on prayer and studying the Bible. The forms and styles of practice have diversified throughout history with different Christian denominations. Still, Christians view their practice to be essential for maintaining a close relationship with God.

Finally, Albanese's concept of *community* parallels the church in Christianity. The word "church" or *ecclesia* does not refer to a building or a meeting place but a community of people in faith called out to follow Christ. The origins and identity of this unique community of faith begin with its roots in the story of Israel in the Old Testament.[195] The Old Testament scholar Walter Brueggemann outlines that Israel's sense of identity as YHWH's people develops in three phases: pre-monarchy, monarchy, and exile/post-exile.[196] During the first phase, Israel's identity is defined by a collective commitment to Israel's story. In the second phase governed by a monarchy, the temple and its priesthood, the civic leadership through the

[193] Craig Dykstra and Dorothy C Bass, "A Theological Understanding of Christian Practices," in *Practicing Theology: Beliefs and Practices in Christian Life*, ed. Miroslav Volf and Dorothy C. Bass (Grand Rapids, MI: W.B. Eerdmans Publishing Co., 2002), 18.
[194] Alister E. McGrath, *Christianity: An Introduction*, 3rd ed. (New York: John Wiley & Sons, Inc., 2014), 231.
[195] See especially N. T. Wright, *Paul and the Faithfulness of God* (London: SPCK, 2013). For criticisms of Wright's approach, see Larry W. Hurtado, "Review of N. T. Wright's Paul and the Faithfulness of God," *Theology* 117, no. 5 (2014).
[196] Walter Brueggemann, *A Social Reading of the Old Testament: Prophetic Approaches to Israel's Communal Life*, ed. Patrick D. Miller (Minneapolis, MN: Fortress Press, 1994).

king, the educated group of "sages", and the prophets influence identity formation. Third, during the second temple phase, Israel finds its identity by reminding itself of its past and by holding on to God's promises.

The New Testament discusses the church with the stress on a historical and theological continuity with the people of Israel, whole noting the discontinuity that emerged through the Christian church's distinct emphasis on the identity of Christ.[197] The theologian Daniel Migliore describes *ecclesia* used in the New Testament as "the new community of believers gathered to praise and serve God in response to the ministry, death, and resurrection of Jesus and the power of the Holy Spirit."[198] The New Testament interprets the identity of the church as the people of God (Rom 4:1-16; Gal 3:6-18; 1 Pet 2:19), as a community of salvation (Mt 5:13-16; 28:19), as the body of Christ (1 Cor 12:12-31), as a servant people (2 Cor 4:5), and as the community of the Holy Spirit (Eph 4:30).[199]

Today, *ecclesia* denotes the universal Christian church and the local assemblies of Christians. Tyron Inbody also suggests a dialectical outlook of the church—that is, both a theological reality and a human institution, a universal community of believers transcended and united by Christ and the historically continuous body of believers as Christ's disciples in the world.[200] Since the church is the body of Christ, Christians see that to be in Christ is to be in the church, the community of believers. In the church, the sermons are preached, and the sacraments are administered. The church rooted in Christ bears the four marks described in the creeds of Christendom: "the one, holy, catholic, and apostolic church." Christianity, as a way

[197] For an assessment of these differences and their impact, see Judith M. Lieu, "The Forging of Christian Identity," *Mediterranean Archaeology* 11 (1998). cf. Timothy A. Gabrielson, "Parting Ways or Rival Siblings? A Review and Analysis of Metaphors for the Separation of Jews and Christians in Antiquity," *Currents in Biblical Research* 19, no. 2 (2021), https://doi.org/10.1177/1476993x20970435.
[198] Daniel L. Migliore, *Faith Seeking Understanding: An Introduction to Christian Theology*, Third ed. (Grand Rapids, MI: William B. Eerdmans Publishing Company, 2014), 262.
[199] Alister E. McGrath, *Christian Theology: An Introduction*, 5th ed. (Southern Gate, Chichester; Malden, MA: Wiley-Blackwell, 2011), 376-77.
[200] Tyron Inbody, *The Faith of the Christian Church: An Introduction to Theology* (Grand Rapids, MI; Cambridge: W. B. Eerdmans, 2005), 253.

of life, revolves around the church. Hence, the church community is an indispensable part of Christianity.

Using Albanese's view of religious components as the springboard, the "language" metaphor understands Christianity as a system of theological constructs and practices guided by doctrine. While Albanese uses the word "symbol" as an inclusive category for creeds, codes, and cultus, the "language" metaphor divides Christian symbolic components into conceptual theological constructs and physical practices in much the same way as words have both abstract meanings and physical forms.

Theological constructs denote a mental category that enfolds Christian ideas, beliefs, or concepts. For instance, the doctrine of the Trinity can be seen as a theological construct that systematically expresses God's multiple attributes.[201] Just as linguistic symbols or words form the basic building blocks of language, theological constructs erect the semantic structure of the language of Christianity.

Similar to grammar in language governing the way words, phrases, and clauses form, the "language" metaphor turns attention to the role of doctrine, a set of communally authoritative instructions in guiding the use of theological constructs to express Christian faith. The postliberal theologian George Lindbeck, adapting Wittgenstein's notion of grammar to Christianity, also draws a parallel between doctrine and grammar for their regulatory functions.[202] Lindbeck argues that doctrine is "a communally authoritative teaching regarding beliefs and practices considered essential to the identity or welfare of the group in question…[and]…indicate what constitutes faithful adherence to a community."[203] He claims

[201] Alister E. McGrath, "The Doctrine of the Trinity: Intellectual Construct or Ontological Reality? Reflections from the Philosophy of Science," *International Journal of Systematic Theology* Early View (2022).
[202] Lindbeck proposes doctrines as analogous to grammatical rules governing Wittgensteinian language games. An in-depth discussion on Lindbeck's view of grammar is outlined in the next section regarding the social nature of religion. Lindbeck, *The Nature of Doctrine*. For a criticism of this approach see Hugh Nicholson, "The Political Nature of Doctrine: A Critique of Lindbeck in Light of Recent Scholarship," *The Heythrop Journal* 48, no. 6 (2007), https://doi.org/10.1111/j.1468-2265.2007.00346.x.
[203] Lindbeck, *The Nature of Doctrine*, 74.

that doctrine, focusing on the character of Jesus and his role in the Bible, guides the church's use of Scripture and regulates thoughts, actions, emotions, and attitudes of the theological community.[204] Just as grammar describes "what kind of object anything is," Lindbeck argues that doctrines describe the Christian faith by regulating and structuring beliefs and practices around the narrative of God's love. Reinhard Hütter adopts a similar view, characterising doctrines as "the rules that are decisive for the identity, welfare, and cohesion of a certain group and distinguish that group from others."[205]

Consider the doctrine of Christ established by the Councils of Nicaea, Constantinople, and Chalcedon.[206] During the council meetings, the bishops certified how various theological constructs, like "consubstantial (*homoousios*)," "one person (*prosopon*)," "one substance (*hypostasis*)," and "two natures," should be used to articulate who Jesus Christ is. The councils sanctioned the statement that Jesus Christ is the second person of the Trinity who is consubstantial (*homoousios*) with the Father and became God-man with divine and human natures united without change in one person (*prosopon*) and one substance (*hypostasis*). The doctrine of Christ codified by these councils permitted Christians to discern orthodox statements about Christ from heresies like Arianism and Nestorianism. As this example illustrates, Christian doctrines direct and impose restrictions on one's understanding of God and influence Christian practice.

Like grammar, which has a descriptive role outlining how the language is used and a prescriptive role dictating the "proper" use, Christian doctrine has both descriptive and prescriptive functions. Doctrines describe the Christian way of life and explain the Christian

[204] Ibid., 73-90.
[205] Reinhard Hütter, *Suffering Divine Things: Theology as Church Practice* (Grand Rapids, MI: William B. Eerdmans Publishing Company, 2000), 57.
[206] See, for example, Ian A. McFarland, *The Word Made Flesh: A Theology of the Incarnation* (Louisville, KY: Westminster John Knox Press, 2019). cf. Sarah Coakley, "What Does Chalcedon Solve and What Does It Not? Some Reflections on the Status and Meaning of the Chalcedonian 'Definition'," in *The Incarnation: An Interdisciplinary Symposium on the Incarnation of the Son of God*, ed. Stephen T. Davis, Daniel Kendall SJ, and Gerald O'Collins SJ (Oxford: Oxford University Press, 2002).

understanding of God, self, world, church, and future. It also outlines the faith transmitted from past communities of people who practise the Christian faith. Also, doctrines are normative faith statements of the church. They safeguard the knowledge of God in Christ and regulate the church's performance of the gospel by delineating the acceptable interpretations of its foundational traditions. Moreover, as a corporate conception of the Christian faith, doctrines exercise restraint over the individual's perception of truth.[207] Therefore, Christian doctrines narrate and regulate the life of faith in Jesus Christ.

Regarding the structure of Christianity, there are aspects of the hierarchical structure as well as the linear structure. Regardless of denomination, all Christians accept that there is a vertical relationship between the divine God and the people, the creator and the creatures. While God is at the top of the hierarchical structure, denominations diverge on the issue regarding hierarchy or ordering within the church. Additionally, a strong bond between the followers of Christ established by self-giving love for each other supports the horizontal structure.

The notion of language as a system mapped onto the domain of religion, specifically Christianity, yields the following perception: Christianity is not just a collection of beliefs but a system of theological constructs and practices guided by doctrines, facilitating the production of meaningful expressions of Christian faith. This view confirms that the Christian faith is not a generic abstraction but a combination of the understanding and experience of God within one's life.

Despite the benefit of identifying the key elements of Christianity, too much focus on its systematic nature can lead to a misconception that theology, doctrine, and practice are the exhaustive components of the Christian religion. Christianity is a structured system of symbolic

[207] Alister E. McGrath, *The Genesis of Doctrine: A Study in the Foundation of Doctrinal Criticism* (Grand Rapids, MI; Vancouver, British Columbia: W.B. Eerdmans; Recent College Pub., 1997), 11.

ideas and practices, but other angles have not been explored when focusing on language as a system. Christianity is about building a relationship with not only God the Father, the Son, and the Holy Spirit but also other people. It also involves reforming social relations, cultural values, personal experiences, and purpose in life through Christ. In order to portray a comprehensive picture of Christianity as a way of life, the social nature and function of Christianity will be discussed in what follows.

2. Language is a social phenomenon

Language is indeed a system composed of individual parts like words and grammar, but it is also an intricate system of interconnections and interrelations between constituents produced by a linguistic community. The fact that language is social and context-dependent is foregrounded in pragmatics, the subfield of linguistics dealing with language in use and the contexts of utterance. In contrast to semantics, which focuses on the literal meanings of words, phrases, and sentences, pragmatics focuses on the use of language and the factors outside of language that contributes to its meaning. It also pays attention to what the speaker intends to communicate to the audience. In this section, the language seen as a social phenomenon is at the centre of the investigation.

The social character of language is of primary importance in Ferdinand de Saussure's *Course in General Linguistics.* To understand Saussure's notion of "social," arbitrariness and the importance of linguistic community must be noted. The earlier section mentions that a word or a symbol is an arbitrary linking of an idealised sound-image (Saussure calls this a *signifier*) and a mental concept (what Saussure calls this a *signified*). The link is random because the sound-image does not have a natural relation to the mental concept. The association between

them is purely formal, not based on the substantive quality of the world, and therefore, arbitrary.[208]

If the arbitrary bond between the *signifier* and *signified* is known only to an individual, communication will not be possible, and there will be no language or language system. However, if all the symbols that each individual has been received by other members of the same linguistic community through active use, then communication will be possible. "Language (*langue*)," Saussure states, "is not complete in any speaker; it exists perfectly only within a collective."[209]

For Saussure, the role of the community is imperative for language. David Holdcroft's commentary on Saussure expounds, "what makes *langue* social is the explanation of how members of the same linguistic community acquire similar representations, i.e., how they come to associate systematically the same concept with the same acoustic-image, and the role those representations play in face-to-face communication."[210] Since the community members initiate, endorse, and perpetuate the use of particular signs, Saussure asserts that the community is necessary for the use of language.[211] Therefore, addressing the importance of arbitrariness and the linguistic community, Saussure calls *langue* "both a social product of the faculty of speech and a collection of necessary conventions that have been adopted by a social body to permit individuals to exercise that faculty."[212]

While Saussure understands "social" based on its arbitrariness within the self-contained and autonomous language system, the functionalists like Roman Jakobson and Michael

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[208] Saussure is reluctant to use arbitrariness and conventionality interchangeably because he sees that conventionality is a question of the freedom of choice of words available to the linguistic community, whereas arbitrariness is a question of the freedom of choice of sound-images available to the language system. Roy Harris, *Language, Saussure and Wittgenstein: How to Play Games with Words* (London: Routledge, 1988), 50.
[209] Ferdinand de Saussure, *Course in General Linguistics*, trans. Wade Baskin, ed. Charles Bally, Albert Sechehaye, and Albert Riedlinger (New York; London: McGraw-Hill, 1966), 14.
[210] David Holdcroft, *Saussure: Signs, System, and Arbitrariness*, Modern European Philosophy, (Cambridge: Cambridge University Press, 1991).
[211] Saussure, *Course in General Linguistics*, 113.
[212] Ibid., 9.

Halliday, who are concerned with the functionality of language, view language as social due to its role in society.[213] Language is the medium through which people interact, cooperate, and relate to each other. It allows people to come together as a community and helps to develop and nourish culture. As much as language affects society and culture, language is equally influenced by society, various institutions, history, and culture. Due to the intimate relationship between language, people, and society, language is eminently social.

Language as a social phenomenon highlights the importance of the context of language because context is necessary for determining the meaning of the utterance. Three distinct types of context that determine the meaning are the linguistic context, the context of a situation, and the context of culture. First, the Concise Oxford English Dictionary defines the linguistic context as "the parts that immediately precede and follow a word or passage and clarify its meaning."[214] To demonstrate this, consider the following sentences:

> I read a book.
> I read a book yesterday.

The first sentence is construed as an event in present or past. In the second sentence, however, by adding the word "yesterday," which provides the linguistic context, the reader suddenly identifies that the action took place in the past. Second, the context of a situation takes into account the extra-linguistic factors, such as the physical or social circumstance in which the sentence is uttered.[215] For instance, the utterance "Who wrote this?" can express a pleasant surprise in a situation where a girl finds a note without a name. But in a case where a mom sees a scribble on a white wall, the same utterance can convey shock, anger, and annoyance. The third type of context is the context of culture. Even broader than the context of a situation, the context of culture involves the meanings and assumptions shared by a community of people.

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[213] Roman Jakobson, "Linguistics and Poetics," in *Style in Language* (Boston, MA: MIT Press, 1960); Michael. A. K. Halliday, *Language and Society*, ed. Jonathan J. Webster (London: Continuum, 2007).
[214] *Concise Oxford English Dictionary*, ed. Angus Stevenson and Maurice Waite, 12th ed. (Oxford: Oxford University Press, 2011), s.v."Context."
[215] Fasold and Connor-Linton, "Introduction," 7.

For instance, “I am wearing blue pants” can mean “I am wearing blue trousers” in the US, but “I am wearing blue underpants” in the UK. Considering that language is always in the form of discourse, the context of a situation and culture play an imperative role, just as much, if not more, than the linguistic context in discerning the meaning of the utterances.

The importance of context in the language is especially pronounced in the works of Ludwig Wittgenstein. As mentioned above, Wittgenstein, in *Philosophical Investigations,* compares linguistic activity to playing games. Just as one who understands the specific rules of a game and how it is different from other games can appreciate the meaning of the game, one must understand the words in their particular context to understand the meaning. Noting the highly rule-governed and conventional characters of language, Wittgenstein asserts that every utterance is a social activity that people do in what he calls a “language-game.” Some examples of language-games include reporting an event, forming and testing a hypothesis, making a story, play-acting, guessing riddles, and making a joke.[216]

Wittgenstein uses the term “language-game” to underscore “the fact that speaking of language is part of an activity or of a form of life,” which gives language its meaning.[217] According to Anat Biletzki and Anat Matar, “forms of life can be understood as changing and contingent, dependent on culture, context, history, etc.”[218] When there is an agreement in the form of life, there is also shared insight into the use of language, which gives rise to meaningful language. Consequently, he insists, “the meaning of a word is its use in the language.”[219]

The concept of grammar is also intimately connected to the meaning and use of language. Grammar typically refers to the rules of correct syntactic and semantic usage.

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[216] Ludwig Wittgenstein, *Philosophische Untersuchungen = Philosophical Investigations*, Rev. 4th ed., ed. P. M. S. Hacker and Joachim Schulte (Chichester, West Sussex, UK; Malden, MA: Wiley-Blackwell, [1953] 2009), par. 23.
[217] Ibid.
[218] Anat Biletzki and Anat Matar, "Ludwig Wittgenstein," in *Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta (Summer, 2018). https://plato.stanford.edu/archives/sum2018/entries/wittgenstein/.
[219] Wittgenstein, *Philosophical Investigations*, par. 43.

However, for Wittgenstein, it is a broader network of regulations—including customs, institutions, and conventional formations of concepts—that determine the correct linguistic moves for making sense. He remarks, "Essence is expressed by grammar... Grammar tells what kind of object anything is. (Theology as grammar)."[220] Addressing "essence" as the meaning of words, he states that grammar describes the use of words, and the use of words completes the meaning in essential ways. Therefore, grammar expresses the sociocultural norms of the linguistic community for meaningful language use.

The "language metaphor" focusing on the social nature of language directs attention to Saussure and Wittgenstein's understanding of language. For Saussure, language is social because of its arbitrariness. For Wittgenstein, the social character of language is reflected in the impossibility of separating the linguistic community's sociocultural practice from their linguistic activity. Although they have different ideas about what 'social' means, they understand that shared knowledge of the language and its use allows people to communicate. A language only known to an individual fails to convey any meaning. Hence, language is a social tool and a social product. It is a social phenomenon.

2.1 Science is a social phenomenon

When mapping the social aspect of language onto the domain of "language," the social nature of science surfaces in the discussion. Far from being an objective, value-free creation, science is continually changing with society and culture. Scientists bring their perspectives about the world and influence their scientific practices. Hugh Gauch claims, "Science cannot be implemented simply as a robotic method of gathering facts and reading infallible conclusions,

[220] Ibid., par. 371.

with complete disregard for the powers and limits of the humans who are the scientists."[221] This section explores the idea that science is a social activity.

Challenging the logical positivists who see science as an objective, self-regulated system in search of timeless, universal, irrefutable facts, Thomas Kuhn proposes a new image of science: science is a social institution grounded in its history and scientific practices by which a community of practitioners produce scientific knowledge.[222] In his ground-breaking *The Structure of Scientific Revolutions,* first published in 1962*,* Kuhn argues that science develops by undergoing the following phases:

Pre-science – normal science – crisis – revolution – new normal science – new crisis[223]

From the *pre-science* period full of disorganised and diverse activities emerges a paradigm that produces a set of general theoretical assumptions, laws, and techniques endorsed by a given scientific community. Although Kuhn occasionally uses "paradigm" to mean an exemplar, "paradigm" here refers to "the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community."[224] With the rise of a paradigm, the period of *normal science* begins, and the scientific community solves problems that their paradigm defines. But when scientists encounter some anomalies that persist in the current paradigm, they experience a *crisis.* After some time, the crisis gets resolved with a rise of an entirely new paradigm; this process is called a *scientific revolution.* After this revolution, scientists live in a different world where the new paradigm guides the new normal scientific activity.

Through his theory of paradigm shift, Kuhn underscores the role of the scientific community. For Kuhn, the scientific community is capable of discovering, sharing, and maintaining a paradigm.[225] Moreover, it plays a vital role in evaluating and accepting a new

[221] Hugh G. Gauch, *Scientific Method in Practice* (Cambridge: Cambridge University Press, 2002), 37.
[222] Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 4th ed.; 50th anniversary ed. (Chicago; London: University of Chicago Press, [1962] 2012).
[223] Chalmers, *What Is This Thing Called Science?*, 108.
[224] Kuhn, *The Structure of Scientific Revolutions*, 174.
[225] Kuhn explains further about a scientific community in the Postscript. Ibid., 175-81.

paradigm since the selection process involves non-scientific factors, such as the vested interests of individuals and power groups.[226] He also argues that the practitioners of the scientific community are the ones producing, disseminating, scrutinising, and certifying scientific knowledge. Just as the scientific community give rise to the governing paradigm, the paradigm equally exerts pressure on the scientific community by setting the boundaries of proper scientific activities. According to Kuhn, the dominant paradigm not only determines the assumptions, methods, problems, concepts, laws, and techniques used by a given community but also creates the abstract grounds in which the members of the paradigm community exchange ideas, solve problems, criticise, and validate each other's work.[227] Since the community shapes and is shaped by the scientific paradigm, Kuhn argues that science is deeply embedded in the social realm.

Influenced by Kuhn's theory deemphasising the role of rational thought while underscoring social, cultural, and psychological factors in science, a new generation of scholars, particularly in sociology, investigated the social dimensions of the establishment of scientific knowledge. From the 1930s through the 1960s, Robert K Merton, one of the pioneers of the sociology of science, examined how the socially constructed ethos and norms inform science and help further the institutional goals of accumulating reliable knowledge.[228] Merton proposed that there are four sets of institutional imperatives that comprise the ethos of modern science: universalism, communalism, disinterestedness, and organised scepticism. Universalism is the notion that the acceptance or rejection of a scientific claim is not dependent on the personal or social attributes such as race, nationality, religion, class, and gender of the scientist;[229] communalism refers to the idea that all scientists should have joint ownership of

[226] McGrath, *The Foundations of Dialogue*, 162.
[227] Kuhn, *The Structure of Scientific Revolutions*, 178.
[228] David Bloor, "Sociology of Scientific Knowledge," in *Handbook of Epistemology*, ed. Ilkka Niiniluoto, Matti Sintonen, and Jan Woleński (Dordrecht; London: Kluwer Academic, 2004), 920.
[229] Robert King Merton, *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago, IL: University of Chicago Press, 1973), 270-73.

the intellectual property to promote social collaboration;[230] disinterestedness means "a passion for knowledge, idle curiosity, altruistic concern with the benefit to humanity," rather than for the personal gain of individual scientists;[231] and organised scepticism means that scientific claims must be exposed to critical scrutiny before being accepted.[232] Merton claimed that these norms or institutional values are internalised by the scientists, thus shaping their scientific conscience and promoting their work to extend reliable scientific knowledge.[233]

Beginning in the 1970s, some scholars have asserted that Merton's analysis of the social character of science fails to draw out the full impact of the sociocultural forces in science. They insist that sociology should not settle on asking how and to what extent social factors might influence the products of the mind but instead show that scientific knowledge is constitutively social. This school of thought is called the sociology of scientific knowledge (SSK) or the strong programme.

David Bloor, one of the founders of SSK, criticises Merton's approach to the sociology of science for correlating social factors only with transformations in the institutional structures of scientific communities.[234] He writes, "Merton largely took for granted that, in the proper functioning of the institution, the rational appraisal of evidence and the testing of theories were autonomous process. The inner, rational core of scientific thinking was not itself social."[235] For Bloor, sociology affects the inner core of scientific thinking, the very content of scientific discovery. He argues that sociology is fundamental to understanding how scientists behave "rationally," recognise something as a "fact," gather "evidence" for or against some theory,

[230] Ibid., 273-75.
[231] Ibid., 276.
[232] Ibid., 277-78.
[233] Ibid., 269.
[234] Stephen P. Weldon, "The Social Construction of Science," in *Science and Religion: A Historical Introduction*, ed. Gary B. Ferngren (Baltimore, MD; London: Johns Hopkins University Press, 2002), 375.
[235] Bloor, "Sociology of Scientific Knowledge," 920.

and produce the scientific knowledge.[236] Since SSK views scientific judgment and content as dependent on social relations, one can mistake SSK as an attempt to explain nature in terms of society and reject science's authority to represent the external world successfully. However, SSK practitioners argue that SSK focuses on explaining shared beliefs about nature and reinterpreting the scientific authority in sociological and naturalistic terms.[237]

Just as the social character of language is highlighted in the tight connectedness of meaning, language form, and language users, the supporters of the Actor-Network Theory (ANT) attribute the social nature of science to the networks formed by various actors in the system of science. In ANT, the term "actor" denotes any human or non-human entity that "acts or to which activity is granted by others."[238] Actors include not only scientists, engineers, and technicians but also animals, objects, microscopes, x-rays, and even scientific symbols that accomplish a certain act. Human and material agents transform and are transformed by building and maintaining networks. A particular network can expand to influence other scientific networks over time, but it can also become less durable and eventually fall apart.

Although both ANT and SSK endorse the social constructivist approaches to scientific knowledge, what ANT considers social is different from that of SSK. According to Helen Longino, SSK treats social relations as an external, independent factor, but ANT "abjure the implied separation of social context and scientific practice and focuses on the social relations within scientific research program and communities and on those that bind research-productive and research-receptive communities together."[239] Thus, Bruno Latour, one of the primary

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[236] Steven Shapin, "Here and Everywhere: Sociology of Scientific Knowledge," *Annual Review of Sociology* 21, no. 1 (1995): 297.
[237] David Bloor, "Anti-Latour," *Studies in History and Philosophy of Science* 30, no. 1 (1999): 87, https://doi.org/10.1016/S0039-3681(98)00038-7; Jeff Kochan, *Science as Social Existence: Heidegger and the Sociology of Scientific Knowledge* (Cambridge: Open Book Publishers, 2017), 21.
[238] Bruno Latour, "On Actor-Network Theory: A Few Clarifications," *Soziale welt* (1996): 375.
[239] Helen Longino, "The Social Dimensions of Scientific Knowledge," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta (Metaphysics Research Lab, Stanford University, 2016). https://plato.stanford.edu/archives/spr2016/entries/scientific-knowledge-social/.

developers of ANT, claims that science is social in the sense that science in action forms associations, connections, or networks between actors.[240]

The "language" metaphor framework noting the social, communal aspect turns attention to Kuhn's scientific revolution, Merton's norms of science, SSK and ANT and expands the conceptualisation of science from a static system of scientific constructs and tools guided by the scientific method to dynamic networks and interfaces between the community of scientists and their environment. Science is constantly influenced by personal, cultural, and political factors and, ultimately, by its context. Borrowing James Smith's words, "science is a network of material practices, built environments (including laboratories, instrumentation, etc.), traditions of apprenticeship, and learned rituals that emerged over time, in particular configurations, in different places"[241] Therefore, science is a social enterprise.

The discussion so far indicates that science is an active, flexible, dynamic system of networks and connections between scientific constructs, scientific tools, the scientific method, and the scientific community and rapidly interacting with its environment. However, it has not revealed why people engage in science. Like language performs communicative functions, science also carries out various roles in society. This aspect will be explored in the next section.

2.2 Religion is a social phenomenon

Just as the social aspect of language is essential for grasping what language is, the social nature is an indispensable part of religion, like Christianity. Three attributes of Christianity make the social, communal nature prominent: (1) the importance of the community of believers; (2) the focus on relationships; and (3) the sensitivity to the sociocultural context.

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[240] Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory*, Clarendon Lectures in Management Studies, (Oxford; New York: Oxford University Press, 2005).
[241] Jamese K. A. Smith, "Science as Cultural Performace: Leveling the Playing Field in the Theology and Science Conversation," in *Scientism: The New Orthodoxy*, ed. Richard N. Williams and Daniel N. Robinson (London: Bloomsbury, 2015), 181.

First, Christianity is social because it always revolves around the life of the community of believers. This faith community, rooted in the story of Israel, brought anew with Jesus of Nazareth, is continuing to participate in the narrative of God's salvation and merciful love. The followers of Jesus in the first century shared their stories about Jesus, and those who heard came to believe in Jesus as their Messiah. This unique faith tradition has been handed down from generation to generation as Christians communicated their interpretations of life and the teachings of Jesus. As a tradition, Christianity could not have emerged without the community of believers.

The importance of the Christian community is embodied in the two keywords of the New Testament: *ecclesia* (cf. Acts 11:26, 1 Cor 15:9) and *koinonia* (cf. Acts 2:42, Phil 2:1-2). As stated in the previous section, the term *ecclesia* deals with the assembly of Christians as the body of Christ—that is, the church. It describes Christians meeting regularly in homes or public places for worship, prayer, learning about the word of God, and friendship. In the Bible, the community of believers is also related to the word *koinonia,* which roughly translates to fellowship or communion. It denotes a deep, intimate connection among the believers bound in the covenantal relationship with God. *Koinonia* signifies that Christians who share the new life in Christ become united and strengthen the bond among them. Therefore, the words *ecclesia* and *koinonia* highlight the communal dimension of Christianity.

The second aspect of Christianity revealing the social nature is the emphasis on relationship. It is no understatement to say that the grace-based relationship between God and humanity is the foundation of Christianity. Both in the Old and the New Testament, God is described as a personal God who continues to demonstrate love for the people and fulfils the promises. Sometimes, God is a loving parent who cares for the children and provides everything they need. As a parent, God not only rebukes the children for their wrongdoings but also forgives and comforts them. At other times, God is a bridegroom who longs for an intimate,

faithful, and loving relationship with the church. For example, in Ephesians 5:25-27, Paul explains salvation through faith in Jesus Christ using the reconciled relationship between an alienated husband and wife.[242] Throughout the Bible, God is depicted as constantly desiring to form a loving relationship with human beings.

The relational character of Christianity is also demonstrated in God's triune nature: one God revealed as Father, Son, and Holy Spirit. The Trinity often takes the formula "one substance (*ousia*), three persons (*hypostases*)," demonstrating the fundamentally personal God who exists in perfect communion in a relationship. Richard of St. Victor, one of the most influential trinitarian thinkers of the Middle Ages, describes the Trinity as a community of love. In *On the Trinity,* he argues that three is the minimum number required for sharing love:

> On the basis of these considerations, it is clearly impossible that any one person in the Godhead could lack the fellowship of association. If he were to have only one partner, he would not be without anyone with whom he could share the riches of his greatness. However, he would not have anyone with whom he could share the delights of love. There is nothing which gives more pleasure or which delights the soul more than the sweetness of loving. Only someone who has a partner and a loved one in that love that has been shown to him possesses the sweetness of such delights. So it follows that such a sharing of love cannot exist among fewer than three persons.[243]

In this passage, rather than adopting a more individualist approach to the Trinity, Richard views the Trinity as a social partnership between three persons within the Godhead. He acknowledges that the act of giving and receiving love is what forms this unique social relationship. Since the three persons of the Trinity unite through self-giving, empathy, and adoration, God is an inherently social being.

For many theologians, the social trinitarian view of God serves as a model for human beings to participate in a loving relationship with God and with other human beings. According

[242] The Book of Hosea also illustrates a similar relationship. God, the faithful husband, yearns for the return of the adulterous wife, the people of Israel.
[243] Alister E. McGrath, *Theology: The Basic Readings*, 3rd ed. (Newark: John Wiley & Sons, Inc., 2017), 148-49.

to Jürgen Moltmann, the doctrine of the Trinity communicates the true theological doctrine of freedom:

> The triune God reveals himself as love in the fellowship of the Father, the Son, and the Holy Spirit. His freedom therefore lies in the *friendship* which he offers men and women, and through which he makes them his friends…God demonstrates his eternal freedom through his suffering and his sacrifice, through his self-giving and his patience… Through his freedom he waits for man's love, for his compassion, for his own deliverance to his glory through man. Through his freedom he does not only speak as Lord, but listens to men and women as their Father.[244]

For Moltmann, the relationship of love and solidarity is not limited to the fellowship of the three persons but instead offered to men and women. Consequently, those who accept God's invitation can enter into a loving relationship and become God's children. Additionally, Moltmann argues that the doctrine of the Trinity has a social purpose—to be the exemplar of true human community in both the church and society. He claims that the people must emulate the self-giving, patient, humble, loving nature of the Trinity and form a society without domination, subjection, class rule, or dictatorial oppression.[245]

Another theologian Paul S. Fiddes takes a radical social account of the Trinity. He argues that the three persons should be understood "as movements of relationship, rather than as individual subjects who *have* relationship."[246] To illustrate this dynamic form of relations, Fiddes uses the image of a dance with the focus not on the dancers but the patterns of the ecstatic movements. He writes, "In *this* dance the partners not only encircle each other and weave in and out between each other as in human dancing; in the divine dance, so intimate is the communion that they move in and through each other so that the pattern is all-inclusive."[247] Emphasising the intimate, dynamic movement between the Father, the Son, and the Holy Spirit,

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[244] Jürgen Moltmann, *The Trinity and the Kingdom: The Doctrine of God*, trans. Margaret Kohl, Twentieth Century Religious Thought, (Minneapolis, MN: Fortress Press, [1981] 1993). For a critique of this approach to the Trinity, see Karen Kilby, "Perichoresis and Projection: Problems with Social Doctrines of the Trinity," *New Blackfriars* 81, no. 956 (2000), http://www.jstor.org/stable/43250486.
[245] Moltmann, *The Trinity and the Kingdom*, 191-93.
[246] Paul Fiddes, *Participating in God: A Pastoral Doctrine of the Trinity* (London: Darton, Longman and Todd, 2000), 72.
[247] Ibid.

Fiddes argues that the Christian community is drawn into the divine dance with the Trinitarian community. He also asserts that the participants of the dance come to realise that they are supported by the love that already exists in the relations of the Trinity and begin to share that love with others. This is what Fiddes calls a healthy sense of dependence that is neither submission nor domination.[248] Hence, the self-giving, humbling, loving relationship of the Father, Son, and Holy Spirit models the life of the church.

Finally, Christianity is a social phenomenon because sociocultural situations influence its beliefs and practices. Revisiting Wittgenstein's philosophy of language, Wittgenstein asserts that language must appear as a part of a "form of life" rather than a part of theoretical knowledge. He states, "what *we* do is to bring words back from their metaphysical use to everyday use."[249] Similar to language, Wittgenstein asserts that religion, such as Christianity, takes its shape, form, and meaning in the life of the community of believers. The religious community members are playing their own "language game" of conversing and forming a relationship with God.

In *Philosophical Investigations,* he explicitly makes parallels between theology and linguistic concepts. First, he relates grammar to theology, saying, "Grammar tells what kind of object anything is. (Theology as Grammar)."[250] For Wittgenstein, grammar is not mere rules that govern syntactic and semantic usage; it describes how words are used and underscore the social embeddedness of meaning. By juxtaposing theology and grammar, he is contending that theology brings out what religious terms, concepts, and statements mean in ordinary life situations, such as attending church, praying, singing, being baptised, and going on pilgrimages. Another reference to theology appears in another parenthetical remark when Wittgenstein explains how words gain meaning. He writes, "how words are understood is not told by words

[248] Paul Fiddes, "Relational Trinity: Radical Perspective," in *Two Views on the Doctrine of the Trinity*, ed. Jason S. Sexton (Grand Rapids, MI: Zondervan, 2014), 183.
[249] Wittgenstein, *Philosophical Investigations*, par. 117.
[250] Ibid., par. 371.

alone (theology)."[251] Here, he underscores that theological language is meaningful only in its pragmatic context. On the whole, Wittgenstein highlights that the true meaning of faith is found in the context of the day-to-day lives of Christians.

Adopting Wittgenstein's view on linguistic meaning, George Lindbeck argues for a "cultural-linguistic" approach to religion. Opposing the "cognitive-propositionalist" or "experiential-expressivist" views, he claims that Christianity does not aim to make truth claims about spiritual reality or to characterise religious experiences in symbolic expressions.[252] Instead, he construes Christianity as "a kind of cultural and/or linguistic framework or medium that shapes the entirety of life and thought."[253] Comparing religion to a language and its correlative form of life, Lindbeck insists that the expression of Christian faith requires interiorising a set of skills developed and shared by the community through practice and training. He holds that the culture, which posits the system of conceptual vocabulary and grammar established communally, shapes Christianity.

In the past three decades, there has been a rise in fresh expressions of faith by attending to the worshipping community's context. This movement, which attempts to understand and express the Christian gospel in the richness of culture, is called *contextual theology.* Following Paul the Apostle, who urged his fellow Christians to be Jews to the Jews and ones under the law to those under the law for the sake of the gospel (cf. 1 Cor 9:20-23), Christians try to bring the gospel into their ordinary lives by identifying the local culture's needs and addressing them amid Christ in hopes of a transformation.[254] Lesslie Newbigin, in *The Gospel in a Pluralist Society*, states:

> True contextualisation happens when there is a community which lives faithfully by the gospel and in that same costly identification with people in their real situations as

[251] Ludwig Wittgenstein, *Zettel*, ed. G. E. M. Anscombe and G. H. von Wright, trans. G. E. M. Anscombe, The Collected Works of Ludwig Wittgenstein, (Oxford, UK: Blackwell Publishers, [1967] 1998), par. 144.
[252] Lindbeck, *The Nature of Doctrine*, 16-17.
[253] Ibid., 33.
[254] Robert J. Schreiter, *Constructing Local Theologies* (London: SCM, 1985), 18.

> we see in the earthly ministry of Jesus. When these conditions are met, the sovereign Spirit of God does his own surprising work.[255]

The proponents of contextualisation believe that contextualisation does not alter or lose the essence of the gospel. They see that the contextualised expression of faith is the husk of the unchanging kernel: faith in Jesus Christ.

The gospel has various shapes and forms. In Latin America, people contextualise the gospel to address the problem of the economic gap between the rich and the poor and the concern for the liberation of the oppressed. Some feminist theologians respond to the problem of discrimination linked to a person's sex and gender by vocalising a more inclusive view of the gospel. For the people in the Third World who struggle for physical survival, Jesus becomes the healer and the sustainer. The Christian message then focuses on the just distribution of resources and the quality of life.[256] Given that the meaning of the gospel takes its meaning in one's particular sociocultural context, Christianity is a "form of life" and a social activity that is dependent on culture and context.

The "language" metaphor honing the social aspect proposes that Christianity, which focuses on the figure of Jesus Christ, is more than a system of religious beliefs; it is active participation in the life of the faith community that seeks to restore and maintain an intimate relationship with God and share the contextualised gospel. Treating Christianity as a social activity stresses how Christians participate in the living tradition of faith handed down from generation to generation and practice fellowship. Therefore, the social dimension offers a broader perception of Christianity.

One point of caution when exploring the social nature of Christianity is considering Christianity only as a social phenomenon. For the sociologist Émile Durkheim, sociality is not

[255] Lesslie Newbigin, *The Gospel in a Pluralist Society* (Grand Rapids, MI: Geneva: Eerdmans; WCC Publications, 1989), 154.
[256] For other examples of contextual Christology, see Migliore, *Faith Seeking Understanding*, 205-31.

just a crucial part of religion. He claims that religion, like Christianity, is a *sui generis* social product. Recalling Durkheim's definition of religion, Durkheim does not mention the supernatural or God. He only states that beliefs and practices unite into a Church and promote social solidarity.[257] Durkheim's intention to explain the social origin of religion is very evident in *The Elementary Forms of the Religious Life.* Consider the following statements:

> The god of the clan…can therefore be nothing else than the clan itself [258]
>
> religious force is nothing other than the collective and anonymous force of the clan[259]
>
> the sacred principle is nothing more nor less than society transfigured and personified[260]

In these three quotes, Durkheim uses phrases such as "nothing else than," "nothing other than," and "nothing more nor less than" to forcefully argue that the social reality wholly explains religion. Although Durkheim's work on religion is widely praised for its theoretical insights, his approach to religion reduces the depth and richness of the religious form of life by excluding the ascetic traditions and the role of individual religious leaders. Furthermore, Christianity under the Durkheimian framework denies the existence of all metaphysical components, including God, revelation, conversion experience, the gifts of the Holy Spirit, and many other essential characteristics of the Christian life. Therefore, Durkheim's theory of religion may highlight the inseparable relationship between religion and society but treating Christianity merely as the result of social interactions is erroneous. This point once again justifies the need for a balanced outlook of Christianity provided by the "language" metaphor.

[257] Durkheim, *The Elementary Forms of the Religious Life*, 66.
[258] Ibid., 259.
[259] Ibid., 279.
[260] Ibid., 439.

3. Language performs communicative functions

From the analysis undertaken so far, language is described as both a system of words and grammar and a social activity dependent on the participants and the context. However, there is another principal aspect of language: communicative function. Language is the means by which people exchange information, ideas, and emotions. Language allows people to build relationships. Ultimately, without language, communication is not possible. This section discusses the different uses of language and their implications for apprehending science and religion.

The purpose of language is to accomplish specific communicative jobs. Until the first half of the twentieth century, language was often thought to have a single communicative objective: to make indicative sentences or statements of fact which are either true or false.[261] In *How to Do Things with Words,* J. L. Austin opposes this simplistic, one-sided account of the function of language. Heavily influenced by Wittgenstein, Austin observes that the function of language is not simply descriptive and fact-stating. He claims that during communication, the participants attune not primarily to a sentence or other expressions but to the performance of certain kinds of acts, such as making statements, asking questions, giving orders, explaining, thanking, and so on. He also notes that certain verbs like "apologise," "promise," and "request" used in sentence-size expressions serve the special purpose of performing a specific action while issuing the utterance."[262] Austin calls this type of utterance a *performative sentence* or, for short, *performative* and the action observed when uttering a performative *speech-act*. Austin asserts that speech-acts do not state or describe anything nor have a truth value but allow the speaker to perform specified acts by speaking them in the proper context.[263]

[261] J. L. Austin, *How to Do Things with Words*, 2nd ed., ed. J. O. Urmson and Marina Sbisà (Oxford: Clarendon, [1962] 1975), 1-2.
[262] Ibid., 61.
[263] Ibid., 4-7.

A more detailed, systematic analysis of the linguistic functions is found in the works of Karl Bühler and Roman Jakobson. To analyse the communication taking place in discourse, Bühler studied the structures or patterns across sentences and identified the three loci of communication: *speaker, listener,* and *context*. For him, there are three distinct objectives—*emotive, conative,* and *referential*—that correspond respectively to the three elements of communication.[264] Influenced by Karl Bühler's model of communicative functions, Roman Jakobson, another influential figure in the functional description of a language, adds three more loci of communication—namely, *message, contact,* and *code*—that correspond respectively to the *poetic, phatic,* and *metalinguistic* communicative functions.[265] The description of each function is outlined in the following **Table 1**.[266]

Table 1: Jakobson's functions of language

Function	Locus of communication	Purpose	Sentence/ Text types	Examples
Emotive	Addresser	Express the addresser's emotions, attitudes, opinions	Interjections	Oh! Ouch! Aww, I am tired.
Conative	Addressee	Elicit a response from the recipient (persuading, addressing)	Vocatives Imperatives Questions	Give it to me!
Referential	Context	Inform, describe, narrate	Indicatives with descriptive content	The car is blue.
Poetic	Message	Highlight the material and aesthetic aspects of communication	Word play, alliteration, pun, rhyme, poetry	She sells sea shells by the sea shore.
Phatic	Relationship/ contact	Establish, sustain, or discontinue relationship Attract attention	Greetings	Hi! Nice to meet you
Metalinguistic	Code	Checking and repairing communication	Questions confirming what is being said, language teaching and learning	Are you saying "flower" or "flour"?

[264] Karl Bühler, *Theory of Language: The Representational Function of Language*, trans. Donald Fraser Goodwin and Achim Eschbach (Amsterdam; Philadelphia, PA: John Benjamins Publishing Company, [1934] 2011), 110-19.
[265] Jakobson, "Linguistics and Poetics," 353-57.
[266] Ibid., 356; José Medina, *Language*, Key Concepts in Philosophy, (London; New York, NY: Continuum, 2005), 2-10.

In his scheme, Jakobson underscores the role of context in communication, which always entails an addresser directing a message to an addressee. He argues that in order for the communication to be successful, the addresser and addressee must share an understanding of both context and language.[267]

Although it was first suggested more than fifty years ago, Jakobson's model of communicative functions continues to be extremely important in the field of linguistics because it stresses that language in discourse is multifunctional. Through his model, he demonstrates that the different components of communication and their corresponding roles are always related to one another (see **Figure 12**). For instance, context can influence the addresser,

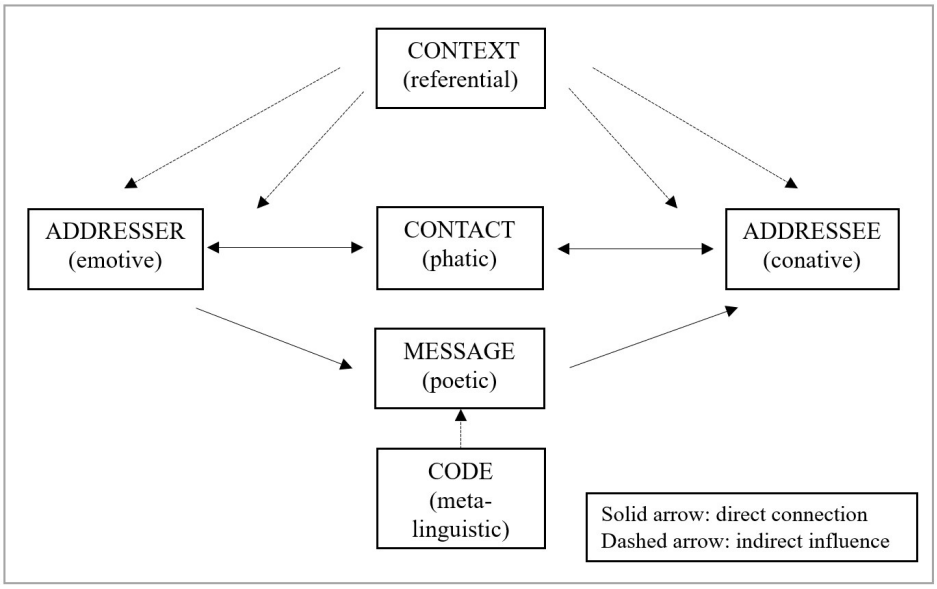

Figure 12: Six elements of communicative components and their corresponding functions. The relationship is either reciprocal or unidirectional[268]

addressee, and the type of relationship between them and, consequently, alter the emotive, conative and phatic functions. Consider the question: "What time is it?" This question is directed to the addressee for an answer, so it primarily has a conative function. Asking time

[267] Jakobson, "Linguistics and Poetics," 353.
[268] Modified from Deborah Schiffrin, "Discourse," in *An Introduction to Language and Linguistics*, ed. Ralph W. Fasold and Jeff Connor-Linton (Cambridge: Cambridge University Press, 2014), Figure 5.1, 205.

can also serve a referential function of informing time and a phatic function allowing the addresser and addressee to begin a conversation. Therefore, a communicative act can serve multiple functions at the same time.

The definition of "language," with emphasis on function, discloses that language is not only used for expressing information and emotions but also for performing an act, eliciting a response from the recipient, building a relationship, and forming a culture. When greeting someone, giving directions, showing gratitude, arguing, or making a presentation, language serves different purposes. The functional aspect of language presents a valuable angle of observation for the domains of "science" and "religion."

3.1 Science performs certain functions

Just as language has various communicative roles, science performs a variety of functions. At the empirical and theoretical level, science primarily works to form an organised body of specialised knowledge of natural phenomena. For Albert Einstein, organised understanding is developed by discovering theories and simplifying the connections between conceptual elements.[269] For Carl G. Hempel, scientific knowledge accumulates through the process of confirmation—in the sense that empirical observations confirm the hypothesis and that new, more credible theories replace old theories.[270] For Karl Popper, organised knowledge is achieved by testing theories for anomalous results rather than seeking data for further verification.[271] For Thomas Kuhn, the body of knowledge forms by undergoing a scientific revolution where a new paradigm with higher problem-solving capacity replaces the old one.

[269] Albert Einstein, "Science and Religion Are Reconcilable," in *The Faith of Scientists in Their Own Words*, ed. Nancy Frankenberry (Princeton, NJ; Oxford: Princeton University Press, 2008), 163.
[270] Carl G. Hempel, *Aspects of Scientific Explanation, and Other Essays in the Philosophy of Science* (New York, NY; London: Free Press; Collier-Macmillan, 1965).
[271] Karl R. Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge* (London; New York, NY: Routledge Classics, 1963).

Despite various opinions on how science promotes the formation of an organised body of knowledge, all agree that science operates to produce scientific knowledge.

On a personal level, science allows scientists to engage in various scientific activities, including making predictions, testing hypotheses, explaining phenomena, gathering evidence, interpreting data, formulating general rules, and pointing out patterns. In addition, since forms a scientific community and directs the members' behaviours. As a community, scientists share their findings, train new members, evaluate the contributions of other members, and promote their paradigm-based culture. Science also serves to endow scientists with a sense of professionalism and pride. If some members make outstanding contributions in their field, science becomes a source of self-esteem, high social status, and prestige.

Science also performs an essential objective at the level of society. In his 1939 treatise *The Social Function of Science,* John D. Bernal talks about science and its social role.[272] Objecting to the 'pure science' ideal of remaining independent from social and economic needs, Bernal argues that scientists must focus on the 'applied science' and consider usefulness in society as the central objective of the scientific enterprise.[273] Moreover, he urges that science must fulfil its social function by supporting a centrally planned society. He writes,

> In its endeavour, science is communism. In science, men have learned consciously to subordinate themselves to a common purpose without losing the individuality of their achievements. Each one knows that his work depends on that of his predecessors and colleagues, and that it can only reach its fruition through the work of his successors... Each man knows that only by advice, honestly and disinterestedly given, can his work succeed, because such advice expresses as near as may be the inexorable logic of the material world, stubborn fact. Facts cannot be forced to our desires, and freedom comes by admitting this necessity and not by pretending to ignore it.[274]

Committed to socialism, Bernal's plan of supporting society is through the formation of an endowment from the government and industries for scientific research. He argues that allowing

[272] J. D. Bernal, *The Social Function of Science* (London: George Routledge & Sons ltd, 1939).
[273] Ibid.
[274] Ibid., 415-16.

the social need to direct scientific research is not relinquishing an individual scientist's freedom to pursue the truth; instead, he sees freedom as the understanding of necessity. Unfortunately, Bernal's fundamental notions of social responsibility of scientists, central planning of scientific research, and freedom as the understanding of necessity were not received well by his capitalist contemporaries such as Michael Polanyi. As Roger Pielke Jr. states, "Bernal lost the intellectual battle over cold-war politics."[275] However, his ideas about science serving society and the nexus of science and policy are timeless insights that are ever so relevant today.

In 2009, Barack Obama stated in his address to the US National Academy of Sciences, "Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been before."[276] Throughout his speech, Obama reflects on Bernal's legacy of the tight science-policy-society relationship. He calls for the commitment of the government and the scientific community to drive scientific and technological innovations, invest in education, make breakthroughs in medicine and healthcare, and develop new technologies for energy. Obama also highlights the importance of the need for the scientific community to engage directly in the work of public policy—especially in the areas of biomedicine and environmental science.[277] Finally, he concludes his speech with social responsibility and stewardship: "We are reminded that with each discovery and the new power it brings comes new responsibility; that the fragility, the sheer specialness of life requires us to move past our differences and to address our common problems, to endure and continue humanity's strivings for a better world."[278] Although Obama's speech reflects the American attitude towards the role of science in society, many countries worldwide share a similar view that science must serve the community.

[275] Pielke Roger, Jr., "In Retrospect: The Social Function of Science," *Nature* 507, no. 7493 (2014): 428, https://doi.org/10.1038/507427a.
[276] Barack Obama, "What Science Can Do," *Issues in Science and Technology* 25, no. 4 (2009): 23.
[277] Ibid., 27.
[278] Ibid., 30.

Today, many world leaders see the social function of science as a global phenomenon. Everywhere in the world, science influences society by providing information to guide policymaking, developing science education, driving technology innovation, improving people's health and quality of life, contributing to economic development, and respecting the environment. According to a report by the US National Academies on the fundamental role of science and technology in international development, science and technology can help many developing countries to overcome challenges related to child survival, safe water, agricultural research, microeconomic reform, and prevention of and response to natural disasters.[279] For instance, research shows that two cents worth of vitamin A given to children every six months could reduce child mortality in many countries by over one-third, rice-wheat rotation techniques can enhance food production in South Asia, and scientifically based natural resource management in Central America can boost its economy.[280] Given the importance of science in relation to the global economy, international politics, and welfare, applicability and usefulness are essential functions and goals of today's science.

3.2 Religion performs certain functions

The view of Christianity as a language sheds light on the different roles of Christianity. First, Christianity functions as a source of transformation of attitudes, relationships, and worldviews. Speaking from the Christian tradition, Ian Barbour depicts religion as a language "to recommend a way of life, to elicit a set of attitudes, and to encourage allegiance to particular moral principles." [281] In his article about science and religion, Bruno Latour argues that Christianity behaves like a speech-act or a "love talk" that alters both the listener and the

[279] National Research Council of the National Academies, *The Fundamental Role of Science and Technology in International Development: An Imperative for the U.S. Agency for International Development*, National Academy of Sciences (Washington, D.C.: The National Academies Press, 2006), 2, https://www.nap.edu/read/11583/chapter/1#ii.
[280] Ibid., 1.
[281] Barbour, *Religion and Science*, 87.

speaker.[282] He claims that the performative utterances of Christianity reorient attention away from indifference and ignorance to the relationship with the personal God and with other people. For Alister McGrath, Christianity alters one's vision of reality by revealing a hidden web of meaning and providing coherence.[283]

Christianity also acts as the provider of meaning. In a secularised society, not all people attempt to find the meaning of life through religion. Rather than resorting to something that comes from beyond human life, they rely on things from within human life to find meaning or fullness. [284] For others, however, religion such as Christianity offers a framework for understanding the meaning of life. Hood et al. attribute religion's success as a meaning maker to four factors: (1) religion is the most comprehensive of all meaning systems; (2) it is easily accessible; (3) it involves a sense of transcendence; and (4) it boldly proclaims the ability to provide an understanding of significance.[285] The meaning of life in the Christian context is to glorify God, accomplish God's will, and enjoy God forever through Jesus Christ. Instead of seeking other sources of meaning, such as family or friends, Christians turn to God and the Christian community to find answers to many complex issues, such as the origin of life, identity, death, destiny, purpose, values, and ideals. Thus, Christians believe that their religion offers meaning for virtually every life situation.

Another function of Christianity is promoting individual well-being. Empirical studies in the field of psychology of religion reveal that religion and spirituality are positively linked to physical health. In their review, Hood et al. observe some broad areas where religion may provide health benefits. The first area is healthy behaviour. They note that religion may

[282] Latour, "Thou Shall Not Freeze-Frame," 29.
[283] Alister E. McGrath, *Enriching Our Vision of Reality: Theology and the Natural Sciences in Dialogue* (London: SPCK, 2016).
[284] See Charles Taylor, *A Secular Age* (Cambridge, MA; London: Belknap Press of Harvard University Press, 2007).
[285] Ralph W. Hood, Peter C. Hill, and Bernard Spilka, *The Psychology of Religion: An Empirical Approach*, Fifth ed. (New York, NY: The Guilford Press, 2018), 20-22.

encourage healthy practices, including exercise and dietary health, and discourage unhealthy activities, such as smoking, drinking, drug use, and risky sexual behaviour.[286] The second category promotes positive psychological states, such as joy, hope, love, and composure. Hood et al. indicate that religion may protect against negative psychological states, including fear, sadness, anger, and loneliness.[287] Another area is coping. They state that religion may provide comfort and solace to cope with difficulties in life by aiding self-regulation, self-control, and meaning-making process.[288] In consideration of the potential positive effect of religion in general, Christianity can be considered to promote one's physical, emotional, and spiritual well-being.

Besides its role at a personal level, Christianity also operates at the level of society to instil a sense of social responsibility. Guided by the notion of loving your neighbour and servanthood, Christians serve their local community by running various social services, which provide food, shelter, home and other necessities to those in need. One of the most well-known Protestant social service organisations is the Salvation Army, with over 1.6 million members worldwide offering help to the elderly, the young, offenders, drug addicts, and the disabled. Christian charities also promote a fair society by challenging injustice. They petition to ensure that everyone's basic needs and rights are met and work to provide the same access to equal opportunities and education. For example, Tearfund is a Christian charity that raises awareness of social issues, campaigns against poverty, encourages self-help, and provides emergency aid for natural disasters. Some Christians choose to demonstrate their love for their neighbours by practising charitable giving rather than directly participating in social service groups. For instance, Arthur Brooks' study analysing people's spending patterns indicates that religious

[286] Ibid., "Religion, Health, Psychopathology, and Coping," in *The Psychology of Religion: An Empirical Approach*, ed. Ralph W. Hood, Peter C. Hill, and Bernard Spilka (New York, NY: The Guilford Press, 2018), 463.
[287] Ibid.
[288] Ibid.

people, including Christians, donate more money to charities and are more likely to give to the homeless.[289] Thus, Christianity advocates social responsibility.

Christianity also promotes the formation of social identity, solidarity, and support network. Christians of a particular ecclesial community share similar beliefs and values by participating in communal activities, such as worship services, Bible studies, and missional work. Christians strengthen their social bond and build an extensive support network in the church.[290] They also experience stronger feelings of belonging and form social solidarity through upholding virtues of love, unity, and peace. In addition, Christians strive to follow the way of life exemplified by Jesus Christ. They not only actively pursue adherence to the instructions outlined in the Bible but also suppress or inhibit what is considered deviant and unacceptable behaviour.[291] Moreover, Christians try to maintain tradition and ensure that the same values are passed down to future generations. Given that Christianity binds people together and enforces religion-based norms and values, Christianity functions as both a force for social solidarity and social control.

To summarise, the definition of "language," with emphasis on function, provides a valuable understanding of the role of Christianity for individuals and society. To an individual, Christianity can be a source of powerful transformation and meaning-making. It may also promote one's health by encouraging happiness, stress-management, and self-control. At the societal level, Christianity can act as a social agency of responsibility, solidarity, and control. It can promote a sense of belonging to a community of believers and a sense of identity. Since the "language" metaphor permits a discussion regarding the function of Christianity, it is an effective tool for comprehending the complex "religion" concept.

[289] Arthur C. Brooks, *Who Really Cares: The Surprising Truth About Compassionate Conservatism* (New York, NY: Basic Books, 2006).
[290] Hood, Hill, and Spilka, *The Psychology of Religion: An Empirical Approach*, 24.
[291] Ibid., 476.

4. Language is complex

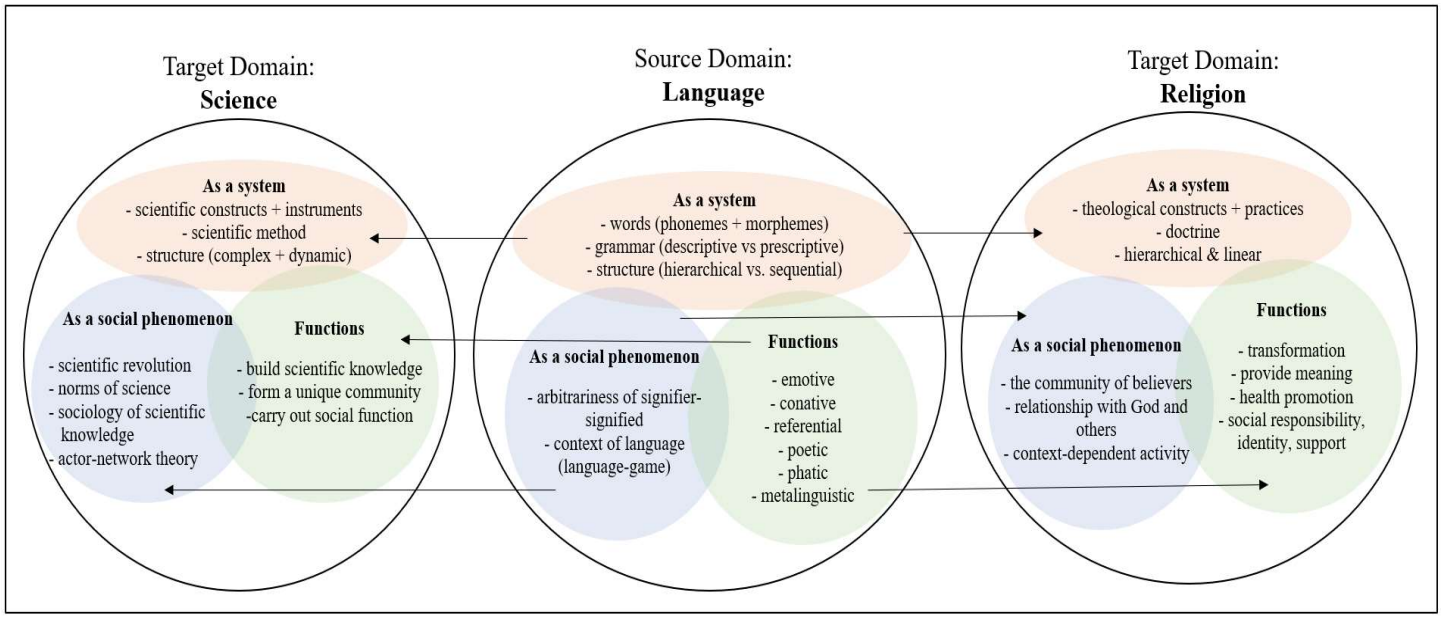

Figure 13: Cross-domain mapping of the definition of language mapped onto science and religion

This chapter has proposed a working definition of "language"—*a system of symbols and rules used in a social context to carry out communicative functions*—to depict fundamental linguistic features that provide compelling, multifaceted views of science and religion. The three focal points of *system*, *social context,* and *function* guide the exploration into the vast territories of science and religion in a manageable manner (see **Figure 13**).

Language is first and foremost seen as an intricate system of elements, such as words and grammar. Far from being a static system, language is also a dynamic social activity influenced continuously by its context of utterance and the participants. Moreover, language is designed to execute a particular communicative job. It allows people to express emotions, participate in relationships, share information, elicit a response from the addressee, and outline the aesthetic beauty of language. The working definition of "language" warrants a thorough, holistic apprehension of language that is useful for highlighting the representative aspects of science and religion.

Science seen through the three focal lenses of language is as follows. First, it is a system of scientific constructs and instrument tools guided by the scientific method of inquiry. Second, science is a social activity of the scientific community, which determines the governing paradigm, norms, and values. When accounting for the social factors in scientific practice, science is far from a pristine deliverer of objective truth but a network of theories, concepts, laboratory equipment, measurement tools, and scientists producing socially constructed knowledge. The social view of science acknowledges scientists being vulnerable to biases, mistakes, and accidents and influenced by their sociocultural context. Finally, the emphasis on functionality depicts science as performing a crucial function, such as building technology, improving health, solving environmental problems, changing policies, and fighting social injustice. Thus, science as a language is employed by scientists working with scientific constructs and instruments to represent the physical world.

The definition of language with three keywords also sheds light on the essential properties of Christianity, the most widely practised religion in the world. Focusing on the systematic nature, Christianity is comprised of theological constructs and rituals guided by the doctrine that safeguard meaningful beliefs and practices. Also, Christianity as a social phenomenon underscores the foundational relations with God and others and the culture-sensitive expression of the good news. Similar to language and science, religion fulfils many functions, including transforming one's worldview, ensuring individuals' well-being, creating a sense of identity, strengthening social solidarity, and promoting social responsibility. Christianity, seen as a language, is a religion that allows its adherents to participate in the creative act of expressing faith through networks and connections between theological constructs, practices, God, and other people.

Although language is complex, it is ultimately about communication. To put simply, language is what language does: saying, doing, being, meaning, relating, and sharing. Under

the “language” metaphor, science and religion are seen as modes of communication. Science communicates the knowledge of the physical world; religion, like Christianity, conveys faith, meaning, and life orientation. Both are always influenced by a particular sociocultural context and a community of participants who share the same rules, norms, and values. As a result, science is not merely a system of facts; religion is not simply a set of beliefs. They are *discourses* that say, do, and mean something to their participants.

Chapter 2: Language Change

One of the most common pitfalls in classifying the science and religion relationship with typologies is neglecting the aspect of time and change. While these typologies provide simple categories to conceptualise the complex interaction promptly and efficiently, they can misrepresent the science and religion relationship as static, trans-historic, and trans-contextual. But when seeing science and religion as languages, their ever-changing nature becomes all the more important.

Every language, without exception, changes with time. Language transforms incrementally and continuously to meet the needs of its linguistic community. For an individual, specific linguistic changes, like learning a new word or changing the tone of speech, occur very quickly; for the community as a whole, however, any shift in language takes a long time.

In this chapter, I examine whether the "language" metaphor is an effective model for the field of science and religion by focusing on the issue of language change over time. I start by providing a brief overview of diachronic linguistics, demonstrating that all parts of a language, including phonology, morphology, syntax, semantics, and lexicon, evolve. Then, I map these ideas onto the domains of science and religion, particularly Christianity. In science, even the most fundamental theories that found scientific paradigms are subject to change. Also, change is often associated with progress and viewed in a positive light. The emphasis on change enables the discussion of how science transforms, what aspects are altered, and what factors instigate change. In the case of Christianity, I demonstrate that all aspects of Christianity, including theology, doctrine, and practice, develop over time. Unlike science, religion does not always welcome the discussion of change. Some religious adherents even consider change a threat to the permanence of faith and tradition. Yet, religious beliefs and practices undergo development and reform to remain meaningful to the worshipping community. Seen as a

discourse about faith, Christianity is responsive to the changing needs of the church and society. Considering the paramount role of time in shaping science and religion, I argue that the historical analysis facilitated by the "language" metaphor is essential for understanding the complex science-religion relationship.

1. Language changes over time

While it is difficult to know precisely how and why languages change, linguists can identify some natural and social influences that drive linguistic change. According to Victoria Fromkin, Robert Rodman, and Nina Hyams, language transforms when transmitted from one generation to the next.[292] When children learn a language, they can overgeneralise or simplify specific rules, invent new vocabularies, and generate new meanings of words. These changes slowly get incorporated into their language and eventually get passed on to the next generation of language users. This transmission of modified features leads to changes in the entire language.

Language contact is another vital social force that promotes language change. As people move from place to place, they interact with different cultures and find their languages shifting to accommodate new environmental changes. Dieter Wanner claims, "contact exposure to a different value remains the fundamental condition for change" because the interaction with speakers of another language can often lead the speech community to borrow the name for new things and ideas from another language.[293] Contact also serves as a catalyst for phonological changes by incorporating new phonemes into the original language. For example, during the three hundred years of French political dominance after the Norman

[292] Victoria Fromkin, Robert Rodman, and Nina M. Hyams, *An Introduction to Language*, 9th ed. (Boston, MA: Cengage Wadsworth, 2011), 528.
[293] Dieter Wanner, *The Power of Analogy: An Essay on Historical Linguistics*, Trends in Linguistics. Studies and Monographs, 170, (Berlin; New York: Mouton de Gruyter, 2006), 139.

Conquest of 1066, English speakers began adopting words for meat, such as *pork* and *mutton,* from French speakers and included the /v/ sound in their speech.[294]

There are also other internal factors at play. An element that changes language's phonology is an *articulatory simplification* or *ease of articulation*. If a sequence of sounds is difficult to pronounce or unnecessarily complicated, it is likely to be simplified for more natural pronunciation.[295] Alternatively, if two sounds are too similar, one sound can change to maintain contrast and avoid potential confusion. *Regularisation* or *generalisation of rules*, which reduces the number of exceptional or irregular patterns, elicits language change too. For any second language learner or children acquiring their native language, regular rules are much easier to learn than ones with many exceptions. It is no surprise to see a novice English speaker saying, "*It falled from a tree"* or "*I waked up late*." Over time, languages tend to lose irregularities. For example, the exceptional plural forms *media* and *data* are now regarded as singular nouns that do not have plural forms. Also, many irregular past-tense forms are now being used with regular past-tense markers -*ed.*

Among various features of language that change, the lexicon is probably the most dynamic subsystem that quickly adapts to the changing environment and is undoubtedly the easiest to observe. Lexical changes occur in many different ways. First, there can be changes in the words' parts of speech. Consider the word *email.* As a noun, it refers to "a message sent over the internet," but as a verb, it means "to communicate by email message." Some proper nouns, such as *Google, Skype,* or *Hoover,* are also used as verbs. Another way to alter a language is by adding or losing words. New words are coined daily: from company or product names such as *Kleenex*, *Microsoft*, and *Instagram* to scientific or technical terms such as *genome* and *blockchain*. Abbreviated words (e.g. *NASA, MRI, g*ym) and blends or compound

[294] Shaligram Shukla and Jeff Connor-Linton, "Language Change," in *An Introduction to Language and Linguistics*, ed. Ralph W. Fasold and Jeff Connor-Linton (Cambridge: Cambridge University Press, 2014), 290; Fromkin, Rodman, and Hyams, *An Introduction to Language*, 530.
[295] Shukla and Connor-Linton, "Language Change," 289.

words (e.g. *brunch, smog*) regularly add new words to the lexicon. Borrowing words from other languages is another vital source of new words. For example, *tsunami, yoga, salsa,* and *croissant* come from other languages. Besides adding new words, some words become obsolete and eventually fade away.

The discussion indicates that language change is natural, inevitable, continual, and influenced by psycholinguistic and sociocultural factors. Then, is it possible to say that language change is progress? The term "progress" is the movement toward a goal or an improved state. Darwin, citing the German philologist Max Müller, claimed that the better, the shorter, the easier forms of languages are the ones that survive and succeed over time.[296] Also, scholars such as Otto Jespersen argue that simplicity is the measure of linguistic excellence. However, historical linguistics demonstrates that the expansion and decline of languages are dictated by political and social situations more so than by the intrinsic merit or decadence of a language.[297] Also, since the simple and regular forms of language can often lead to confusion and ambiguity, language continually strikes a balance between simplification and elaboration.[298] For instance, in English, the case endings are simplified to maintain integrity and regularity, while the syntax rules become more sophisticated to reduce the risk of ambiguity. Neologisms are added to the lexicon, but at the same time, some words go out of fashion and get lost. As a result, it is impossible to claim that the current form of language is superior or inferior to the previous state. The French linguist Joseph Vendryes rightly notes, "It is quite wrong to think of language as an ideal entity evolving independently of men and pursuing its own ends. Language does not exist apart from the people who think and speak

[296] Charles Darwin, *The Descent of Man, and Selection in Relation to Sex*, vol. 1 (Princeton, N.J.: Princeton University Press, [1971] 1981), 60.
[297] Jean Aitchison, "Progress or Decay?," in *Language Change: Progress or Decay?* (Cambridge; New York, NY: Cambridge University Press, 2001), 251.
[298] Ibid., 252.

it."[299] Any psychological or sociocultural factors that affect the people will directly or indirectly alter their language. Hence, language, in the absolute sense, does not progress, decay, or move towards some desired endpoint; it merely conforms to the needs of the community of users as it matures over time.

2. Science changes over time

Like all living languages, science has been and still is undergoing many transformations. For instance, the composition and structure of an atom underwent significant revision. As John Dalton argued, it is not an indivisible solid mass; it has a small, positive-charged nucleus and atomic orbitals where electrons are likely to be found. In astronomy, Earth is no longer the centre of the Universe, Pluto is no longer considered to be a planet, and the static Universe view is a relic of a past age. Scientists today are finding evidence for the existence of dark matter and observing black holes, albeit indirectly. Overall, every scientific knowledge has a history of development and transformation.

There is no doubt about science changing over time, but how and why does science change? What is evolving, and by what processes do changes take place? Is the shift in science sporadic or continuous? Does science move towards a particular goal? A significant number of philosophers and historians of science have attempted to address these questions. In the diachronic analysis of scientific change, it is crucial to recognise the full context of science, which includes the personal, institutional, communal, and cultural relations scientists are a part of. The "language" metaphor presents a comprehensive view of scientific change, examining not only the developments in the methods, theories, concepts, predictions, and findings of science but also its values and social impact.

[299] Joseph Vendryes, *Language: A Linguistic Introduction to History* (Abingdon; New York, NY: Routledge, [1931] 2013), 359.

2.1 Theories of change

From the classical empiricists and rationalists of the 17th century, like John Locke and David Hume, to the logical positivists in the early 20th century, such as Carl Hempel and Rudolf Carnap, many philosophers of this period describe scientific change as the increase in the production of empirically verifiable scientific truths or knowledge. According to this approach, each generation corrects what is false, adds new truths, and passes them on to the next generation.[300] The empiricists and rationalists claim that the scientific method developed in the 17th century is the only way new facts are discovered and organised into a rational system. They deliberately ignore the social or historical aspects of scientific theory development and focus on understanding the context within which a theory was formulated and founded rationally.[301]

In the second half of the 20th century, scholars like Karl Popper, Thomas Kuhn, Paul Feyerabend, Imre Lakatos, and Larry Laudan challenge the prevailing conceptions of logical empiricism. Opposing the notion of science as a simple, continuous build-up of scientific truth, they urge that scientific activity is dynamic and historical by nature and undergoes some discontinuity or break.

2.1.1 Karl Popper's theory

Karl Popper is one of the most influential figures criticising the cumulative view of science. Noticing that all observations are theory-laden, Popper argues that scientists begin with a problem, propose a theory construed as speculative and tentative hypotheses, infer a conclusion through deductive logic, test the conclusion by observation and experiment, and finally determine whether the tests falsify or corroborate the theories. If the theory is falsified, it is eliminated and replaced by another theory with higher explanatory power. Championing

[300] Anouk Barberousse, "Scientific Change," in *The Philosophy of Science*, ed. Anouk Barberousse, Denis Bonnay, and Mikael Cozic (New York, NY: Oxford University Press, 2018), 228.
[301] Ibid.

deductive logic as the guiding principle for science, Popper asserts that science develops by testing conjectures and refuting falsified theories.[302]

2.1.2 Thomas S. Kuhn's theory

Unlike Popper, Thomas S. Kuhn does not believe deduction is the method through which science progresses.[303] In his seminal monograph, *The Structure of Scientific Revolutions,* Kuhn argues that science develops through alternating periods of tradition-bound normal science and tradition-shattering revolution. An overview of the stages of the scientific revolution is addressed in Chapter 2.

Normal science is a period when the scientific community engages in puzzle-solving activities, which determines the questions to be solved, the methods for resolving them, and the standards of rationality.[304] It is marked by the scientists' strong commitment to their shared theoretical beliefs, values, instruments, models, and techniques. The constellation of shared commitments is called a "disciplinary matrix" or "paradigm."

During normal science, the scientific community neither conducts tests to confirm nor tries to falsify the guiding theories of the paradigm. There is a growth in the stock of puzzle-solutions, but no growth in novelties of fact or theory. The image of science provided by the guiding paradigm framework prevails. As normal science period continues, some anomalies emerge and pose a problem for the existing paradigm. At first, scientists try to ignore or explain away through ad hoc modifications of their theory. However, suppose the anomalies continue to question and undermine the foundation of the paradigm. In that case, scientists are forced to adopt another framework that provides a new outlook and suggests different problems, methods, values, and rules with which the community should engage. A scientific revolution

[302] Karl R. Popper, *The Logic of Scientific Discovery*, Routledge Classics, (London; New York: Routledge, [1959] 2002).
[303] Another crucial difference between Popper and Kuhn that for Popper, scientific change is a matter of personal rationality, but for Kuhn, it occurs at the level of scientific communities.
[304] Barberousse, "Scientific Change," 232.

occurs when the older paradigm is replaced entirely or partially by an incompatible new one.[305] In Kuhn's model, scientific change is essentially a paradigm shift or revolution.

Kuhn insists that revolutionary science is noncumulative because the scientific community revises the existing scientific belief and practice, relegates some achievements of the preceding period of normal science, and finds problems previously non-existent or trivial very significant.[306] He also affirms that the transition from the former to the alternative paradigm occurs promptly. Using the visual gestalt-switch images, Kuhn suspects that a scientist instantly converts to a completely different way of conceptualising the world through the new paradigm. Since two successive paradigms present different worldviews of scientific research, Kuhn argues that they are not only incompatible but also incommensurable, meaning there is no common standard of comparison.[307] Overall, Kuhn's scientific paradigm thesis endorses that scientific change is a discontinuous transformation rather than a gradual cumulation.

2.1.3 Imre Lakatos' theory

Imre Lakatos's theory attempts to resolve the tension between Popper's falsification and Kuhn's revolutionary structure of science by proposing what he called the "research programme."[308] Around the mid-1960s, Popper's falsification was criticised for being a weak criterion that demarcates science and pseudo-science, and Kuhn's paradigm structure was denounced for being too relativistic. What Lakatos introduces is a new methodology of scientific change that overcomes the problems of the two previous approaches. Lakatos

[305] Kuhn, *The Structure of Scientific Revolutions*, 92.
[306] Ibid.
[307] In response to many criticisms regarding the notion of incommensurability, Kuhn suggests partial incommensurability, admitting that some aspects of the paradigm incompatible with the current paradigm can be understood and measured to a certain extent. Thomas S. Kuhn, "Commensurability, Comparability, Communicability," *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, no. 2 (1982), https://doi.org/10.1086/psaprocbienmeetp.1982.2.192452.
[308] Imre Lakatos, "Falsification and the Methodology of Scientific Research Programmes," in *Criticism and the Growth of Knowledge*, ed. Imre Lakatos and Alan Musgrave (Cambridge, UK: Cambridge University Press, 1970).

proposes that a research programme consists of a *hard core* of a sequence of theories that form the foundation of the program and a "protective belt" of *auxiliary hypotheses* that can be modified or replaced and protect the hard core from falsification (see **Figure 14**). The two parts of the research program yield empirical predictions compared with the results of observation and experiment. If there is a mismatch between the hypothesis and observation, the assumptions in the protective belt are modified.

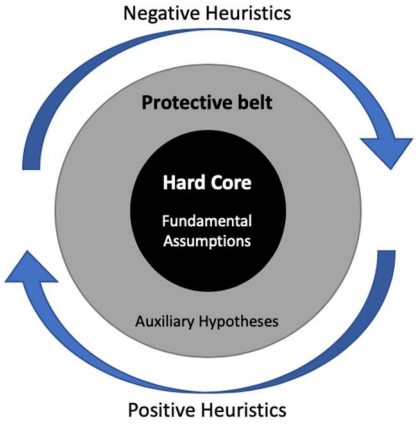

Figure 14: Lakatos' research programme

Lakatos stresses that the modification strictly follows the *negative* and *positive* heuristic principles implicit in the hard core of the programme. The *negative heuristic* of a program specifies what scientists should not do—that is, not change the hard core but modify the auxiliary hypotheses. On the other hand, the *positive heuristic* advises what scientists should do: "how to change, develop the "refutable variants" of the research programme, how to modify, sophisticate, the "refutable protective belt."[309]

Lakatos also asserts that research programmes are progressive if new theories corroborate the fundamental assumptions of the hard core and make novel predictions. His notion of progress does not require a research programme to explain everything in its domain; simply presenting new problems and hypotheses within a research programme is sufficient. If

[309] Ibid., 135.

a new programme is unsuccessful in offering new theoretical or empirical content, then the change in science is degenerative. Therefore, Lakatos presents scientific change as the alteration in the protective belt of auxiliary assumptions by new theories offered to the research programme.

While Lakatos tries to offer a midway between Popper and Kuhn's approaches, his methodology faces criticism. First, there are some doubts about whether Lakatos' description accurately depicts what happens in the history of science. According to Alan Chalmer, there are some occasions, such as the Copernican Revolution, when the problems are solved by adjusting what Lakatos regards as the 'irrefutable' hard core of the programs.[310] Another problem with Lakatos' methodology is his lack of development of the concept of scientific rationality. Lakatos criticises Kuhn for resorting to "mob psychology" to reason how and why scientists choose a theory. However, Lakatos himself fails to provide a remedy for this problem. While he stresses that scientists *rationally* make methodological decisions, he does not clearly explain why the decisions should be regarded as rational rather than social.[311] Despite these shortcomings, Lakatos's methodology suggests a model that science can be continuous and progressive while dealing with troublesome problems or anomalies.

2.1.4 Larry Laudan's theory

Another philosopher of science, Larry Laudan, presents an alternative to Lakatos' research programs. His theory of change involves the "research tradition" or a set of general assumptions from theories that share a common ontology and methodology (see **Figure 15**). According to Laudan, science aims to solve intellectual problems of two types: "empirical questions concerning the objects in some domain; and conceptual difficulties concerning

[310] Chalmers, *What Is This Thing Called Science?*, 144-45.
[311] Ibid., 144.

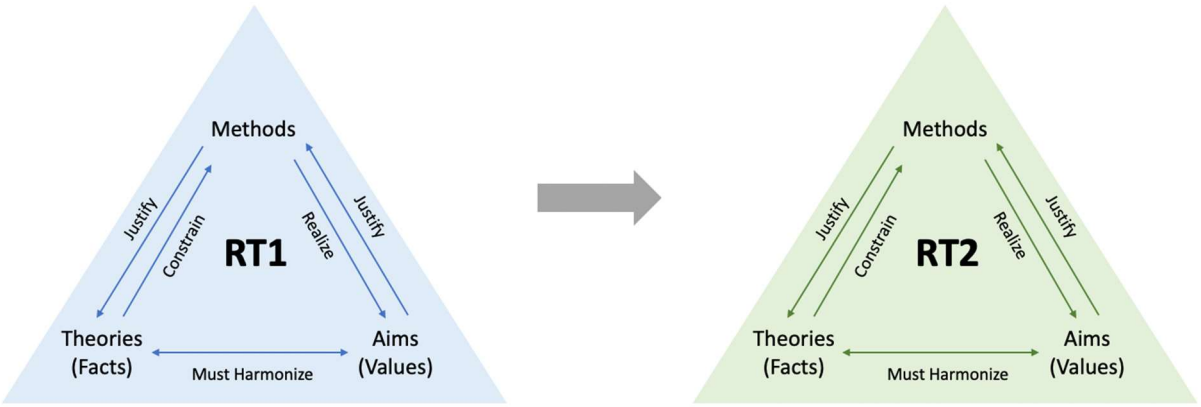

Figure 15: Scientific change as the development of research traditions [312]

contradictions internal to a theory, or between it and other scientific, methodological, or even metaphysical principles."[313] Sometimes, these problems lead to minor modifications within the research tradition, but other more severe anomalies may require changes in its basic core elements. Thus, contrary to Lakatos' research programs, Laudan's research tradition experiences changes in its deep-level foundations.[314]

Laudan attests that science progresses by increasing problem-solving effectiveness. In "Scientific Change," he points out that "the overall problem-solving effectiveness of a theory is determined by estimating the number and importance of the empirical problems which the theory solves and subtracting the number and importance of the anomalies and conceptual problems which the theory generates."[315] From this reasoning, a scientific change from an empirically well-supported theory to a less well-supported one can be progressive, provided that the latter resolves significant anomalies confronting the former.

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[312] Modified from Larry Laudan, *Science and Values: The Aims of Science and Their Role in Scientific Debate*, vol. 11, Pittsburgh Series in Philosophy and History of Science, (Berkeley, CA: University of California Press, 1984), 64.
[313] Larry Laudan et al., "Scientific Change: Philosophical Models and Historical Research," *An International Journal for Epistemology, Methodology and Philosophy of Science* 69, no. 2 (1986): 207-8, https://doi.org/10.1007/BF00413981.
[314] Larry Laudan, *Progress and Its Problems: Towards a Theory of Scientific Growth* (London: Routledge & Kegan Paul, 1977), 98.
[315] Laudan et al., "Scientific Change," 208.

In *Science and Values,* Laudan introduces the "reticulated model" of rationality, which shows how scientific justification and consensus formation are possible. He propounds that justification and consensus are processes in which scientists assess their commitments to theories, methods, and aims or values. Under this model, Laudan shows that all three elements change with time, but he also underlines that they rarely, if not at all, change altogether.[316] In other words, even if there is a dramatic change in one place, there is rarely a severe disturbance in another. Interestingly, this claim directly rejects a Kuhnian revolution where all aspects of science change. Moreover, Laudan advocates that the interdependent elements of a reticulated model experience a continual process of mutual adjustment, constraint, and justification during problem-solving activities. For example, advancing methodological expertise can welcome new standards or goals; the present or foreseeable knowledge and methods can make some aims unrealisable. In the reticulated model, as Thomas Nickles declares, "no element takes absolute precedence over the other."[317] While Laudan tries to demonstrate a historically contingent fixity in the research tradition, he fails to defeat the problem of relativism.

2.1.4 The evolutionary models

Several philosophers and historians of science compare the dynamic of scientific change to an evolutionary process. For example, Kuhn adopts an evolutionary model to reject a teleological view of scientific progress. He advances that just as an organism does not evolve towards a particular ideal form, science does not progress towards a true, perfect theory. Stephen Toulmin is another philosopher espousing the evolutionary model of scientific development.[318] In contrast to Kuhn's scientific revolution, Toulmin suggests that conceptual change requires variation in concepts, selection for the soundest one, and transmission.

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[316] Laudan, *Science and Values*, 11.
[317] Thomas Nickles, "Historicist Theories of Scientific Rationality," in *The Stanford Encyclopedia and Philosophy*, ed. Edward N. Zalta (Summer ed., 2017). https://plato.stanford.edu/archives/sum2017/entries/rationality-historicist/.
[318] Stephen Toulmin, *Human Understanding*, vol. 1 (Oxford: Clarendon Press, 1972).

Compared to Kuhn or Toulmin, David Hull offers a more detailed evolutionary account of scientific change in *Science as a Process*.[319] According to Hull's theory, science is a real-life activity involving fallible scientists who compete or cooperate with each other for recognition and credit. Scientists try to maximise their "conceptual inclusive fitness" by promoting their ideas in various academic arenas such as academic journals, conferences, review panels, and university departments.[320] One method of gaining support from others is to show that the research is a continuation of traditions. This approach can generate immediate approval from those in the same research group, but as a trade-off, it can decrease the originality of the idea. Another method is to suggest a novel, innovative approach. It can attract scientists who are looking for fresh insights, but at the same time, it can face severe criticisms and fail to pass on the idea to the next generation.

His evolutionary model of scientific change highlights the selection mechanism in the form of positive citation, forcing ideas to undergo modifications, become extinct, or merge with other ideas. It also pronounces that a variety of social and political factors, such as personality, the use of metaphors and analogies, the ability to secure research funds, and institutional support, affect the transmission of one's work. Although these factors exert much influence over one's activity, Hull's approach admits that these forces are only internal rather than external to scientific practice.

Like many other theories about scientific change, Hull's model also has some drawbacks. First, according to Garland E. Allen, Hull's model focuses only on upper-class actors or professional scientists who are strongly motivated by personal ambition and careerism. Allen urges that the process of science must include not only elite practitioners of science but

[319] David L. Hull, *Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science*, Science and Its Conceptual Foundations, (Chicago: University of Chicago Press, 1988).
[320] Ibid., 23.

also other actors, such as novice researchers and students.[321] Another problem that Allen raises is Hull's implication that the process of science is eternal, universal, and unchanging. For Hull, only the products of science, like ideas or theories, changed, but not the practice of doing science. However, the history of science shows that not only the products but also the social relationships and processes change. The social relations between teachers, students, and research institutions in the 17th and 21st centuries are very different; modern scientific practice has been transformed dramatically by advances in communication and technology. Additionally, Hull's attribution of professional recognition and credit to the principal driving force of scientific change is more or less a modern phenomenon and forsakes the presence of other motivating reasons. The 17th-century pioneer of chemistry, Robert Boyle, for example, considered studying nature as a religious duty, illuminating God's omnipresence and goodness. Despite these challenges, Hull's evolutionary account illustrates how modern scientific change occurs via theory succession.

2.1.5 Hakob Barseghyan's theory

Although much of the discussion about scientific change takes place from the 1960s to the 1980s, there has been a resurgence of interest in this question in recent years. The leading scholar in this movement is Hakob Barseghyan. In *The Laws of Scientific Change,* Barseghyan makes a bold claim of offering a general descriptive theory of scientific change, which explains scientific change as a law-governed process.[322] Before describing his theory, he summarises the problems of past models. He notes that many traditional models, like those of logical positivists and Popper, advocate a universal, transhistorical scientific method or the set of requirements for theory assessment. However, the history of science reveals that both theories

[321] Garland Allen, "Reviewed Works: "Science as a Process: An Evolutionary Account of the Social and Conceptual Development of Science" and "the Metaphysics of Evolution"," *Isis* 82, no. 4 (1991): 701.
[322] Hakob Barseghyan, *The Laws of Scientific Change* (Cham, Switzerland: Springer International Publishing, 2015).

and methods of science change over time. As a result, there are other strands of argument accommodating the dynamic scientific method (see **Figure 16**). One argument is that only the surface-level methods change, while the foundational method remains fixed. Another approach claims that there is a logical mechanism to account for the changes in both theories and methods, but this often runs the risk of being too relativistic. An alternative option is that there is no general logic but only sociological, anthropological, or psychological factors that guide the scientific change of theories and methods.

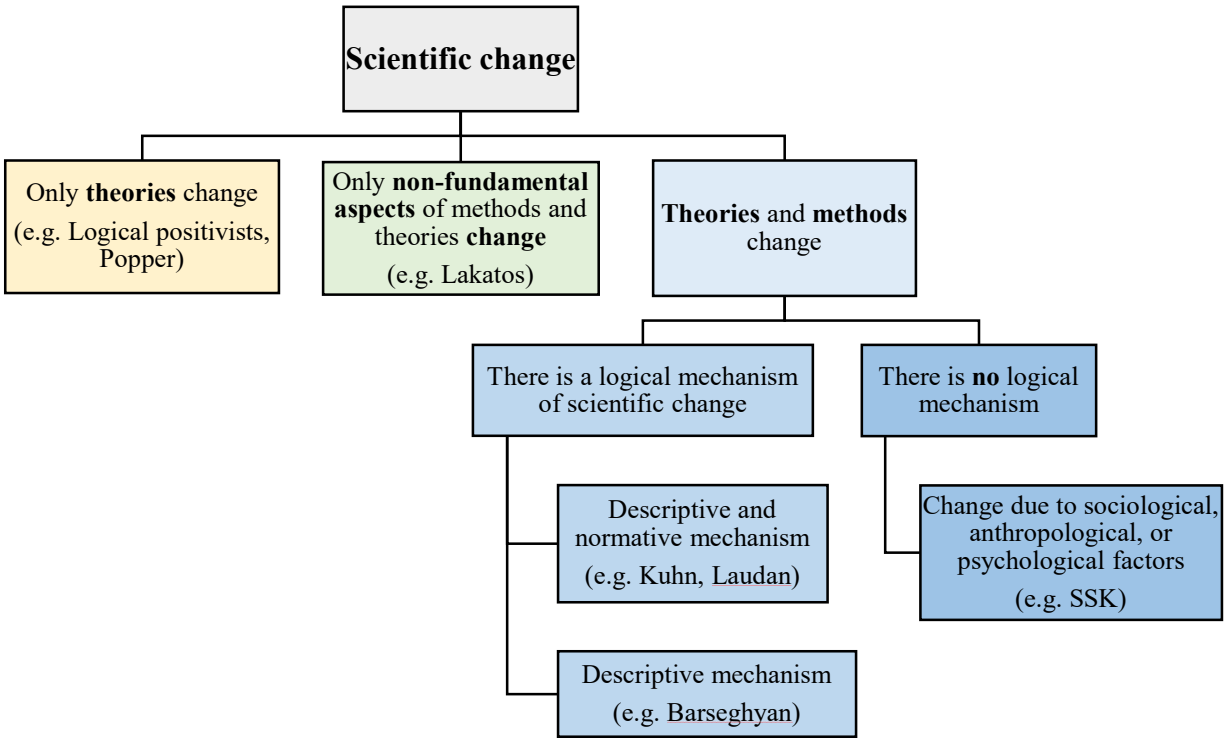

Figure 16: A summary of the different views on scientific change

Barseghyan insists that his attempt is of the second strand of models. Many models in this category—such as Kuhn's scientific revolution or Laudan's reticulated model—have been both descriptive (uncover how or why science does change) and normative (explain how those changes ought to take place). Consequently, these models saw the method used in theory assessment as the best available method at the time. However, the history of science tells a different story. Many scientists who adopted induction were aware of the serious logical flaws,

such as the problem of induction or the paradox of confirmation.[323] The hypothetico-deductive method, despite the tacking by disjunction paradox, was still employed by many Bayesian authors.[324] Barseghyan's solution to overcoming this error is to limit the scope of his theory to attend to the descriptive question regarding methods. In other words, his argument only attempts to describe the general mechanism instead of suggesting which rules should be involved in theory assessment.[325]

According to Barseghyan's theory, scientific changes occur at the level of what he calls a "scientific mosaic," which means a set of accepted theories and adopted methods of a scientific community at some particular time in history.[326] By examining the changes in the scientific mosaic, Barseghyan addresses changes in both theories and methods. He argues that the guiding mechanism of change in the scientific mosaic is as follows: the scientific community continues to accept theories until they are replaced by some new approaches that satisfy the requirement of the community's employed method, which are, in turn, changed by the acceptance of new theories. To explain this principle, he identifies four fundamental regularities or axioms which constitute the foundation of scientific change:

> 1st Law: Scientific Inertia – An element of the mosaic maintains its state in the mosaic unless replaced by some other elements.[327]
>
> 2nd Law: Theory Acceptance – In order to become accepted into the mosaic, a theory is assessed by the method actually employed at the time.[328]
>
> 3rd Law: Method Employment – A method becomes employed only when it is deducible from some subset of other applied methods and accepted theories of the time.[329]
>
> 0th Law: Compatibility – At any moment, the elements of the scientific mosaic are compatible with each other.[330]

[323] Ibid., 19.
[324] Ibid.
[325] Ibid., 12-13.
[326] Ibid., xi, 6.
[327] Ibid., 123.
[328] Ibid., 129.
[329] Ibid., 132.
[330] Ibid., 152.

Then, using the four laws as the starting point, he deduces many theorems. For example, theory change is impossible in cases where a currently accepted theory is considered to reveal the final and absolute truth.[331] Also, a theory is rejected only when other incompatible theories become accepted, and a method ceases to be employed only when other methods that are incompatible with it are utilised.[332] Another theorem derived from the laws is that sociocultural factors can affect the process of theory acceptance insofar as the theory is permitted by the method applied at the time.[333] With over 20 deduced theorems, Barseghyan expounds his general theory of scientific change that finds overall patterns in history without distorting the actual historical episodes.

While Barseghyan's ambitious project bridges the history of science and philosophy of science, it fails to offer clear answers to problems such as the ontology of theories, methods, and axioms or the demarcating criteria of science and non-science and thus requires some significant modifications.[334] Nevertheless, it clarifies some of the terms used in previous philosophical and historical accounts of scientific change and organises past theories according to various meta-theoretical issues.

In summary, the study of scientific change has been challenging because it draws on numerous ideas from various domains, including history, philosophy of science, philosophy of language, and sociology, and involves many key philosophical issues, such as realism, rationality, relativism, and progress. In addition, philosophers and historians of science use different terms to describe scientific change, so there is no coherency in language and meaning. Despite these impediments, the historically-informed philosophical views since the 1960s

[331] Ibid., 165.
[332] Ibid., 168, 73.
[333] Ibid., 235.
[334] To read more about how Barseghyan's theory integrates history and philosophy of science, see Gregory Rupik, "Scientonomy: A Bold New Vision for an Integrated History and Philosophy of Science," in *The Past, Present, and Future of Integrated History and Philosophy of Science*, ed. Emily Herring et al. (London: Routledge, 2019).

explain that scientific change is a dynamic, complex process that alters not only theories but also methods, values, goals, scientists' culture, and social impact (see **Table 2** for a full summary of the approaches mentioned in this chapter). All these approaches underscore that

Table 2: Summary of the theories on scientific change

	Is there a fixed, universal method?	What is changing over time?	What is the driving force behind scientific change?	At the individual or community level?
Logical Positivists	Yes, the scientific method	Theories	Scientific rationality	Individual
Popper	Yes, falsifiability	Theories	Falsificationism	Individual
Kuhn	No	Paradigm	The essential tension between tradition and innovation	Community
Lakatos	Somewhat; the fundamental aspects remain unchanged	Research program	Positive and negative heuristics	Community
Laudan	No	Research tradition	Reticulated model, problem-solving	Community
Hull	No	Theories, methods, goals, scientific community	Professional recognition and credit	Community
Barseghyan	No	Scientific mosaic	Barseghyan's axioms and theorems of scientific change	Community

the units of analysis of scientific change are relatively stable, large-scale structures whose internal structure plays only a minor role.[335] Also, they pinpoint that the guiding conceptual framework is rarely abandoned when faced with anomalies. In regard to theory choice, the amount of empirical data is not the only determining factor, and the potential successes of sets of theories are just as important as their proven successes.[336] Finally, they emphasise the theory-ladenness of observation. Even with these points of consent, there are many aspects yet to be disclosed—whether a change is continuous or discontinuous, the exact cause of change, cognitive basis of change, to name a few—to fully comprehend the nature of scientific change.

[335] Barberousse, "Scientific Change," 226.
[336] Ibid.

2.2 Technology that changes science

So far, the discussion about scientific change has been within the domain of science. However, there is another major domain closely associated with science that affects how science changes over time: technology.[337] Like the term "science," the term "technology" is hard to define. It can be a branch of knowledge, the application of science, the study of techniques, or even the source of power for both developing and developed countries. According to W. Brian Arthur, technology has a trifold definition: (1) a means to fulfil a human purpose (technology-singular); (2) an assemblage of practices and components (technology-plural); and (3) the entire collection of devices and engineering practices available to a culture (technology-general) .[338] Arthur argues that this trifold understanding of technology sheds light on the concept of technology as a device, method, and process. For Richard Li-Hua, technology is a combination of technique (covers the instruments of labour, materials, and the way they are brought into function by labour in the working process), knowledge (includes applied science, skills, and intuition), and the organisation of production used to produce a meaningful product.[339] In other words, technology is "a combination of "hardware" (buildings, plants, equipment) and "software" (knowledge, skills, experience, together with suitable organisational and institutional arrangement) to create things that benefit human beings.[340]

So, what is its relationship with science? Traditionally, technology is considered applied science. According to this perspective, technological capabilities grow out of scientific knowledge. Technologists make practical applications of scientific knowledge and address

[337] Although many proponents of Science, Technology, and Society (STS) such as Bruno Latour, Donna Haraway, and Karl Rogers see science and technology as substantially or even essentially similar, I do not endorse the reductionist view of science as technology. My position is that while science and technology are closely related, they are separate domains with many crucial differences. Hans Radder discusses the dissimilarities between science and technology in detail. Hans Radder, "Science, Technology and the Science-Technology Relationship," in *Philosophy of Technology and Engineering Sciences*, ed. Anthonie Meijers (Amsterdam; Boston, MA: Elsevier, North Holland, 2009).
[338] W. Brian Arthur, *The Nature of Technology: What It Is and How It Evolves* (London: Allen Lane, 2009), 28.
[339] Richard Li-Hua, "Definitions of Technology," in *A Companion to the Philosophy of Technology*, ed. Jan Kyrre Berg Olsen Friis, Stig Andur Pedersen, and Vincent F. Hendricks (Oxford: Wiley-Blackwell, 2013).
[340] Ibid.

human needs. Consequently, science always precedes technological developments, and science is epistemologically superior to technology.[341] Mario Bunge presents that the distinction between technology as applied science and pure science is the different aims of the practitioners. He states, "If the goal is purely cognitive, pure science is obtained; if primarily practical, applied science."[342] However, this approach is too simplistic and historically inaccurate. In reality, some technological advances came about independently from science. Some examples include steam engines, water power devices, and mechanical clocks.[343] Also, there are instances when the inappropriate application of scientific knowledge leads to futile or even disastrous results like weaponised pathogens. Therefore, technological practice is autonomous from science rather than developing unidirectionally from science.

A better picture of the relationship between science and technology is a two-way symbiotic relationship, where scientists and technologists learn from each other in mutually beneficial ways. Harvey Brooks notes that science contributes to technology by providing a new source of ideas, tools, and techniques and offering research instrumentations, laboratory techniques, analytical methods, and research practice for developing practical technology. In addition, he argues that science creates a knowledge base that enables more efficient strategies of applied research, development, refinement, and assessment of technologies.

Conversely, Brooks argues that technology impacts science in two ways. First, technology provides a source of new scientific questions. For example, in 1964, two scientists, Arno Penzias and Robert Wilson of the Bell Telephone Laboratories, Holmdel, N.J. were working with a large microwave horn antenna. Originally designed as a satellite communications antenna, this device was also the most sensitive radio telescope in existence. While using this antenna, the two researchers encountered a low, steady microwave noise

[341] Radder, "Science, Technology," 70.
[342] Mario Bunge, "Technology as Applied Science," *Technology and Culture* 7, no. 3 (1966): 329, https://doi.org/10.2307/3101932.
[343] Radder, "Science, Technology," 71.

which they could not explain. At first, they thought this interference was coming from a terrestrial source. Sure enough, they found a pigeon's nest inside the horn, and the horn was covered in pigeon droppings. But cleaning the antenna did not eliminate the persistent radio noise. Having removed all possible natural and human-made sources of interference, they concluded that the noise was the cosmic microwave background radiation (CMB) or residual thermal energy throughout the universe after the Bing Bang. In conjunction with the relative abundance of light elements, this observation lent strong support to the Big Bang model and led Penzias and Wilson to become the 1978 Nobel Prize winners.[344] Besides the CMB in space, there are numerous examples where technology offers new avenues of scientific research.

Second, technology plays a vital role "as a source of otherwise unavailable instrumentation and techniques needed to address novel and more difficult scientific questions more efficiently."[345] To illustrate this point, consider the field of cognitive neuroscience. To examine the neural connections involved in mental processes, scientists needed the experimental method to observe brain activity and function. Brain mapping technology, such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), enabled scientists to achieve such a goal. These devices not only revolutionised the ability to image molecular processes in the brain but also opened up new opportunities to conduct pioneering research on higher brain functions such as literacy, motivated behaviour, social cognition, and memory. Therefore, new technology can provide an experimental methodology to investigate novel or complex problems.

Brooks notes that technology changes science by suggesting new problems and supplying apparatus to access the objects of study. However, there is another crucial way technology transforms everyday scientific activity: by revolutionising the mode of scientific

[344] Stephen Webb, *Measuring the Universe: The Cosmological Distance Ladder*, Springer-Praxis Series in Astronomy and Astrophysics, (London: Springer, 1999), 270.
[345] Brooks, *Who Really Cares: The Surprising Truth About Compassionate Conservatism*, 476.

communication. Science is a community enterprise involving many researchers who work together to solve a particular scientific problem. In the past, geographical and temporal synchronisation was necessary for forming a research group. Telecommunication technologies like email, video conferencing, and instant messaging enable researchers in multiple institutions, disciplines, and geographical locations to collaborate on a research project. In fact, according to *Science and Engineering Indicators 2016,* published by the US National Science Foundation, more than 60% of global science and engineering publications in 2013 had multiple authors, and 19.2% of these publications had authors from numerous countries.[346] Furthermore, social networks, blogs, and even Wikipedia increase networking opportunities within the research communities. For example, a social networking site called ResearchGate connects scientists and researchers to exchange ideas, meet experts, and discuss research challenges.

The Internet also allows researchers to transmit scientific information efficiently and rapidly. Today, many, if not all, journal articles are published online and made available to any internet user. Researchers have convenient access to the methods, results, and conclusions they wish to scrutinise, replicate, or build upon. Many readers easily submit comments, and the authors make post-publication amendments or write another article in response to the feedback. Such interactive science publishing not only improves the accuracy, transparency, and usefulness of the scientific literature but also fosters a healthy peer-review culture.[347] Besides, online data sharing provides large data sets that fuel future discoveries and open new doors of research. [348] For instance, the Human Connectome Project (HCP) website permits any researcher to download the extensive fMRI, structural MRI, and behavioural data from 1200

[346] National Science Board, *Science and Engineering Indicators 2016*, National Science Foundation (Arlington, VA, 2016).
[347] Theodora Bloom, "Systems: Online Frontiers of the Peer-Reviewed Literature," *Nature* (2006), https://doi.org/10.1038/nature05030.
[348] "Data Sharing and the Future of Science," *Nature Communications* 9, no. 1 (July 19, 2018), https://doi.org/10.1038/s41467-018-05227-z.

healthy young adult volunteers. Sharing data online also speeds up the process of innovative research findings replacing or disproving previous scientific knowledge. With an explosion of online data, science is becoming heavily data-driven and computational.

Technological advancement over the last few decades has revolutionised science by offering new scientific questions and sourcing instrumentations and techniques to investigate them. In addition, technological changes are transforming how scientists communicate and share information. Considering various influences of technology on science, any technological development over time can alter scientific activity.

2.3 Science as language changing over time

The "language" metaphor of science serves as a model of scientific change that contrasts the previously mentioned theories. It differs from Kuhn's paradigm thesis because the notion of incommensurability does not exist in a language. Language, as a system of communication, preserves its identity by ensuring the same or similar use of a set of symbols and rules among its users. Without such an agreement, the users will not be able to communicate with each other. Given the emphasis on continuity and conformity to the general system, a language transforms not by undergoing revolutions which abandon the operating paradigm altogether but by accumulating changes over generations.

The "language" metaphor of change in science also contrasts with Lakatos' research programme because there is no "hard core" or fundamental component impervious to change in language. One linguistic concept potentially analogous to Lakatos' understanding of the "hard core" is what Noam Chomsky calls universal grammar, the innate "blueprint" in the brain for all human languages. However, despite its explanatory value, Chomsky's theory was

criticised for its lack of adequate research methods and scarce empirical support.[349] Given the difficulty in pinpointing a universal, fundamental core for language, Lakatos' research programme does not fit with the "language" metaphor.

Laudan's reticulate model of rationality, unlike Kuhn's theory of paradigm shift, describes scientific change as a gradual and continuous process because the mutual dependency of theories, methodological rules, and values impedes a radical change in one particular component. He also offers a framework to discuss the role of cognitive values, such as the scope, generality, range of application, coherence, and social values in scientific rationality.[350] These emphases on the historical contingency and social nature of scientific activity align with the image of science presented by the "language" metaphor. However, science is not a purely cognitive project driven by the intentional rationality of its practitioners. The "language" metaphor, in contrast to Laudan's model, treats science as a holistic human undertaking in a particular context influenced by both internal and external factors. It is worth noting that while the "language" metaphor underscores the role of sociocultural context in shaping the direction of scientific activities, it does not go as far as to endorse the strong programme which claims that scientific beliefs are socially generated. Language change is attributed to external causes, such as contact with other cultures, and internal linguistic considerations, like articulatory simplification and generalisation of rules. Likewise, science is influenced by scientific rationality, personal values, and the environment.

Compared to Hull's evolutionary metaphor of change in science, which stresses the highly social structure of the scientific community struggling to increase their conceptual fitness, the "language" metaphor explains not only the sociocultural circumstances affecting

[349] See N. Evans and S. C. Levinson, "The Myth of Language Universals: Language Diversity and Its Importance for Cognitive Science," *Behavioral and Brain Sciences* 32, no. 5 (Oct 2009), https://doi.org/10.1017/s0140525x0999094x.
[350] Larry Laudan, "The Epistemic, the Cognitive, and the Social," in *Science, Values, and Objectivity*, ed. Peter Machamer and Gereon Wolters (Pittsburgh, PA: University of Pittsburgh Press, 2004).

the scientific community but also the inner structure of scientific practice composed of scientific knowledge, methods, values, and norms. Moreover, in contrast to the overly abstract theoretical approach of Barseghyan, the "language" metaphor proposes a vivid, explanatory framework of change in science.

Then what does the "language" metaphor reveal about how science changes? First, just like all parts of language are subject to change, the entire enterprise of science, including theories, methods, epistemologies, disciplinary boundaries, and work styles, can be altered. Even the most tenable scientific theory can change in the face of refuting evidence.

Second, science undergoes non-linear, dynamic changes. Consider how English has changed in the past century. With the rise of online communication, new internet slang such as "YOLO" (You Only Live Once) and "FOMO" (Fear of Missing Out) have emerged rapidly. On the other hand, the progressive form of the verb has slowly and steadily increased in use. Similarly, the invention of brain imaging techniques such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) have enabled the rapid growth and changes in the field of cognitive neuroscience in the last 20 years, whereas the status of Pluto changing from "planet" to "dwarf planet" took more than 70 years. Most scientific advancements come from long-term, persistent, methodological research that builds on past findings. Still, some unexpected discoveries or technological innovations can dramatically alter the course of scientific study. The rate of change in science is never constant, and the path of change is never a straight line. Scientific change, just like linguistic change, is unpredictable and non-linear.

Third, the "language" metaphor informs that there are intentional and unintentional changes in science. The replacement of generic *he* with *he or she, s/he,* or sometimes *they* with a singular referent reflects a deliberate change in modern English to account for gender neutrality; the emergence and obsolescence of words are instances of unconscious linguistic

change. In science, many changes are driven by scientists with specific intents and goals. Scientists deliberately alter the methods or adjust the experimental design to make improvements. The research funding opportunities determine the direction of research. However, there are instances of accidental changes, such as Alexander Fleming's discovery of penicillin or Wilhelm Rontgen's discovery of x-ray, that made lasting marks in the history of science. Thus, the transformations in science are sometimes planned and sometimes unplanned.

Fourth, the role of conceptual, sociocultural, and technological context in scientific change is accentuated by the "language" metaphor. Language is refined due to internal and external factors, including ease of articulation, generalisation, and contact with different cultures and languages. In the case of science, not only the cognitive, epistemological, and psychological drives but also the personal, institutional, and cultural relations prompt scientific reform. In addition, the technological environment plays a vital role in facilitating and mitigating scientific change. Therefore, scientific change is contingent on the variations in its context.

The "language" metaphor of scientific change also affirms the importance of human participants. Language doesn't change in a vacuum; it varies when it is used in the personal and social world in the form of discourse. In science, the community of scientists are at the heart of generating change. The scientists choose a problem to investigate, conduct research, develop theories, check others' work, and offer criticism and support. Their personal or institutional goals can also alter the course of research. Similar to a shared understanding of grammar enabling communication, common research standards and ethics provide a trusted form of scientific communication. Scientific change begins with human agents.

Finally, the view of scientific change as language change highlights the intricate balance between change and continuity. As language transforms over time, some elements are preserved to allow its users to communicate. In other words, language evolves with some

continuity. In the past, the discussion on scientific change has focused either on continuity or break in continuity, and the two perspectives have often been thought mutually incompatible. On the one hand, scholars such as Thomas Kuhn perceive science as transforming via revolutions or radical innovations. Kuhn insisted that communication between the two paradigms is impossible because there are no common concepts and standards of comparison. On the other hand, those advocating continuity assert that science develops by elaborating on past findings and improving pre-existing theories. They insist that even discoveries rely on the existing scientific tradition. While various theories of scientific change have presented a one-sided focus on either discontinuity or continuity, the "language" metaphor offers a concrete model that portrays science innovating while maintaining continuity. Science develops as the participants actively revise existing concepts, discard outdated or falsified theories, revisit past models, make breakthroughs, replicate previous findings, adopt new methods, and attend training sessions and conferences. During these activities, scientists are transforming science and carrying on its unique tradition. The language model presenting a balanced view of change and continuity does not imply that there are some "essential" elements impervious to change. Instead, it indicates that while all aspects of science are subject to change, the complex system or framework that the scientific community adopts to produce scientific knowledge is stable.

Despite its advantages in outlining key features of scientific change, the "language" metaphor is inapt for discussing the progress in science. There is no directionality or goal in the life of a language. The language that survives today is not necessarily better or linguistically more advanced than the past language, which died out. The durability of a language merely reflects particular cultural, social, and political situations.[351] Science, on the other hand, is progressive. Indeed, there is a disagreement on what scientists articulate as progress—increasing explanatory power, approximating to the truth, accumulating knowledge, increasing

[351] Aitchison, "Progress or Decay?," 251.

competing alternatives, increasing problem-solving effectiveness, increasing understanding, enhancing the development of technologies or useful interventions, and so on.[352] However, there is a sense of improvement as science changes over time. In evolutionary terms, only the "fit" theories, methods, or knowledge—whatever they may be—survive and prosper. While the "language" metaphor fails to accommodate the progressive nature of science, it offers a comprehensive picture of the dynamics of scientific change.

3. Religion changes over time

3.1 What is changing?

While the notion of change is often recognised as an intrinsic part of science, this concept is sometimes overlooked in Christianity because of the emphasis on the timeless character of God and the unchanging truth of the gospel. The authority of the Bible and the Church for those claiming apostolic succession is indisputable and enduring. Christians strive to preserve the good news as experienced by the first disciples. Any deviation from traditional practices and beliefs can be considered unacceptable or even heretical. Notwithstanding the importance of the continuity of tradition, Christianity is far from being a static, fixed religion. Seeing Christianity as a language sheds light on how the key elements of Christianity, namely theology, doctrine, and practice, are going through dynamic changes.

3.1.1 Christian theology

Christian theology is one area of tremendous change over time. For Saint Anselm of Canterbury, theology is referred to faith seeking understanding. It is the active process of reflecting, asking questions, and aiming for a deeper understanding of faith in God as revealed in Jesus Christ. It is about knowing and building trust in the living God and forming tools to

[352] National Research Council, "Progress in Science," in *A Strategy for Assessing Science: Behavioral and Social Research on Aging*, ed. Irwin Feller and Paul C. Stern (Washington, DC: National Academies Press, 2007), 70.

make sense of reality. But this quest of faith for understanding occurs in a particular historical and cultural context, and this background is incorporated into theological reflection. The questions relevant at one point in time may not apply in other situations. Conversely, many answers that once resolved puzzles can become inadequate or obsolete in the present. The local circumstances of life affect the development of theology by generating new problems and influencing one's worldview.

One example of Christian theology changing in response to its cultural backdrop is the theology of divine suffering. The supposition that God cannot suffer, also known as divine impassibility, comes from the early Greek philosophers who saw God as a perfect, self-sufficient, and changeless being. The patristic writers such as Irenaeus and Athanasius inherited and incorporated the Hellenistic view of God as impassible into their theology. In his criticisms against the Gnostics, Irenaeus argued that affections and passions only operate among men. The transcendent and immanent God is ontologically different from the finite, visible, and passible creatures.[353] Athanasius affirmed the divine impassibility of the Son by attributing his sufferings and death exclusively to his human nature.[354] In the medieval period, Anselm of Canterbury and Thomas Aquinas characterised God without passions or emotions. In *Cur Deus Homo*, Anselm advocated divine impassibility: "When we say that God suffered any humiliation or weakness, we do not understand this of the loftiness of His impassible nature, but of the infirmity of the human substance which He took."[355] Aquinas stated that God's love and compassion should not be understood in the human sense of arousing affectionate feelings but as attributes of God actualised in the act.[356]

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[353] Irenaeus, *Five Books of S. Irenaeus, Bishop of Lyons: Against Heresies*, trans. John Keble, Library of Fathers of the Holy Catholic Church, (Oxford: James Parker & Co., 1872), 2.13, §3: 123.
[354] Rob Lister, "Patristic Models of Divine Impassibility," in *God Is Impassible and Impassioned: Toward a Theology of Divine Emotion* (Wheaton, IL: Crossway, 2012), 83-84.
[355] Anselm, *Cur Deus Homo, or Why God Was Made Man* (Oxford; London: John Henry and James Parker, 1865), 15.
[356] Aquinas Thomas, *Summa Contra Gentiles*, trans. Anton C. Pegis (Notre Dame, IN; London: University of Notre Dame Press, 1975), 1.89-91; Ibid., *Summa Theologica*, 1a.20.1-2.

While divine impassibility was accepted virtually as axiomatic by the patristic and medieval theologians, Christian theologians from the end of the nineteenth century voiced that this theology is unsuitable for addressing the modern-day issues of pain and suffering from wars, poverty, diseases, natural disasters, and injustice. They saw that God is not an insensible, indifferent, and aloof bystander who turns his face away from the people in pain. The theologians in the twentieth century, such as Bertrand Brasnett, Karl Barth, Dietrich Bonhoeffer, Kazoh Kitamori, and Jürgen Moltmann, expounded a theology of divine suffering from their own experiences of war and hardships.[357] They proclaimed that God is a personal, compassionate, and loving deity who knows and empathises with human suffering. Moreover, they recognised that the theology of divine impassibility was compromised by Greek philosophy and tried to restore the authentic Christian perception of the suffering God in Christ. In *The Crucified God* and *The Trinity and the Kingdom*, Moltmann advocated that the concept of the suffering Trinity—the Son who suffers on the cross and the Father who grieves the loss of the Son—ultimately points to resurrection, new creation, and victory.[358] Today, the view of God suffering in solidarity with the oppressed offers a sense of consolation, support, love, hope, and liberation to Christians.

Questions such as who is God or what is God like are axiomatic in Christianity because how one understands the nature and character of God determines their interaction with God. The attribute of impassibility endorsed by the patristic and medieval theologians has conjured awe of the utmost perfect and holy God in the past. Still, too much emphasis on the impassible

[357] Bertrand Rippington Brasnett, *The Suffering of the Impassible God* (London; New York; Toronto: Society for Promoting Christian Knowledge; The Macmillan Co., 1928); Karl Barth, "The Perfections of the Divine Loving," in *Church Dogmatics*, ed. Geoffrey William Bromiley and Thomas Forsyth Torrance (Edinburgh: T&T Clark, 1957), II/1, §30.2: 370; Dietrich Bonhoeffer, *Letters and Papers from Prison*, ed. John W. De Gruchy, trans. Isabel Best et al., Dietrich Bonhoeffer Works, (Minneapolis, MN: Fortress Press, [1953] 2010); Kazō Kitamori, *Theology of the Pain of God*, 1st British ed. (London: S.C.M. Press, 1966); Moltmann, *The Trinity and the Kingdom*; Ibid., *The Crucified God*, 40th anniversary ed. (Minneapolis: Fortress Press, [1973] 2015).

[358] Ibid., *The Trinity and the Kingdom*; Ibid., *The Crucified God*.

nature poses a challenge in the contemporary context because it can lead to a misunderstanding of God without compassion and empathy. Therefore, any changes in the prevailing social and cultural milieu promote a revision or reconception of Christian theology because religion, similar to a language, adapts to the people's needs that vary over time.

3.1.2 Christian doctrine

Does doctrine change over time or remain the same? Doctrine denotes a communally recognised authoritative teaching about Christian beliefs and practices. It safeguards the understanding of God in Christ and regulates the church's performance of the gospel by delineating the acceptable interpretations of its foundational traditions. Moreover, doctrine exercises restraint over the individual's perception of truth.[359]

Despite its quintessential function in preserving the Christian identity and overseeing all beliefs and practices to be truthful witnesses to Jesus Christ, the Christian doctrine is still a human construction. Since it was formed through social interactions between various theologians attempting to discern the "correct" understanding of the Christian narrative, it is responsive to any changes in its sociocultural context and subsequently revisable. But if the Christian doctrine is provisional, how does it transmit the eternal, timeless truth of the gospel and carry out its normative role? To answer this question, I examine how past theologians dealt with the issue of change regarding doctrine.

One of the first theologians to discuss doctrinal change was Vincent of Lérins, a fifth-century Gallic monk. Around the time of the Council of Ephesus, there were questions on how to determine true doctrine from heresy. Why are Nicene Christology using the Greek philosophical categories, such as *ousia* and *hypostasis,* and the honorific title *Theotokos* for Mary legitimate developments of the apostolic faith even though they have no scriptural basis? Why are Arianism, Donatism, and Pelagianism pernicious false teachings? How should the

[359] McGrath, *The Genesis of Doctrine: A Study in the Foundation of Doctrinal Criticism*, 11.

Church separate sound doctrine from error? Vincent addressed these questions in *Commonitorium,* published in AD 434.

In his treatise, Vincent argued that while the final authority of Christian truth is the Holy Scripture, the Tradition of the Catholic Church must be invoked to ascertain the proper interpretation of Scripture. Vincent's criterion of true faith, also known as the Vincentian Canon, is what has been believed "*everywhere, always,* and *by all* (*quod ubique, quod semper, quod ab omnibus creditum est).*"[360] If a teaching does not pass the threefold test of universality, antiquity, and consent, it is a heretical innovation. Although Vincent underscored the antiquity and tradition of the Church, he did not presume that doctrines remain at a standstill. Instead, he defended that Christian doctrine develops and progresses, and such development is always in continuity with what has preceded it. For him, protecting and preserving the faith delivered once and for all to the saints did not mean maintaining the status quo or repeating the traditional formula but continuing to grow in understanding and knowledge without changing its fundamental character.[361] He attested, "The intelligence, then, the knowledge, the wisdom, as well of individuals as of all, as well of one man as of the whole Church, ought, in the course of ages and centuries, to increase and make much and vigorous progress; but yet only in its own kind; that is to say, in the same doctrine, in the same sense, and in the same meaning."[362] Comparing doctrinal change to an infant becoming an adult and a seed growing to be a plant over the years, Vincent manifested that the doctrines may change shape, form, and clarity, but their nature remains the same.[363]

[360] Vincent of Lérins, "The Commonitory," in *Sulpitius Severus, Vincent of Lerins, John Cassian*, ed. Philip Schaff, A Select Library of the Nicene and Post-Nicene Fathers of the Christian Church. Second Series (Edinburgh; Grand Rapids, MI: T&T Clark; Wm. B. Eerdmans Publishing Company, 1988), 2.6: 132.
[361] Thomas G. Guarino, "St. Vincent of Lerins and the Development of Christian Doctrine," *Logos: A Journal of Catholic Thought and Culture* 17, no. 3 (2014): 106, https://doi.org/10.1353/log.2014.0029.
[362] Lérins, "The Commonitory," 23.54: 147-48.
[363] Ibid., 23.55: 148.

Although most medieval theologians did not give much attention to the issue of doctrinal development, it became an important subject during the Protestant and Catholic Reformation. Martin Luther, a seminal figure in the Protestant Reformation, criticised the Catholic view of doctrinal development for endorsing teachings that do not have a scriptural basis. He posed the question: if true doctrine is apostolic, is it necessary to go beyond the apostolic writings in the Bible?[364] In his 1539 pamphlet "On the Councils and Church," Luther assessed the first four ecumenical councils and argued that Christian understandings of faith have remained fixed since the apostolic era. He declared:

> No council ever did it or can do it; the articles of faith must not grow on earth through the councils, as from a new, secret inspiration, but must be issued from heaven through the Holy Spirit and revealed openly; otherwise, as we shall hear later, they are not articles of faith.… It remained unchanged since the days of the apostles until this council, and so on until our own day—it will remain until the end of the world, as he says, "Lo, I am with you always, to the close of the age" [Matt. 28:20].[365]

In this statement, Luther claimed that the councils are not establishing new or different articles of faith but merely restating belief in the face of heretical opposition.[366] Regarding any new changes concerning faith or good works, Luther said, "You may rest assured that the Holy Spirit had no hand in it, but only the unholy spirit with his angels."[367] Championing *sola scriptura,* Luther also professed that the Bible, not the council or papacy, is the binding norm of true doctrine. For Luther, any post-canonical doctrinal change was a distortion of the apostolic depository; true doctrine is immutable and warranted by Scripture.

The 17th-century French Roman Catholic apologist Jacques-Bénigne Bossuet also held that there was no change in the Christian doctrine but for a different reason than Luther. While Luther condoned doctrinal immutability on the basis that all teachings come from the unchanging word of God in Scripture, Bossuet's conservative perspective emerged out of his

[364] Malcolm B. Yarnell, *The Formation of Christian Doctrine* (Nashville, TN: B & H Academic, 2007), 111.
[365] Martin Luther, "On the Councils and the Church," in *Church and Ministry, Vol. 3*, ed. Eric W. Gritsch, The Works of Martin Luther (Charlottesville, VA: InteLex Corporation, 1966), Ch. 1.1.1: 58.
[366] Ibid., 105.
[367] Ibid., 122.

denouncement of Protestants who are, according to Bossuet, transforming and corrupting the articles of faith. For instance, in *The History of the Variations of the Protestant Churches,* Bossuet advanced that Luther's doctrine of justification by faith alone is unknown to the Christian church throughout the first 1500 years of her existence and, therefore, a heretical innovation.[368] Bossuet believed that the teachings of the Catholic Church eternally remained unchanged and intact. He wrote, "The Church's doctrine is always the same (*semper eadem*)… The Gospel is never different from what it was before. Hence, if at any time someone says that the faith includes something which yesterday was not said to be of the faith, it is always *heterodoxy,* which is any doctrine different from *orthodoxy.*"[369] Bossuet accepted that there was doctrinal progress in terms of finding more appropriate words to communicate and expound knowledge and spreading to different places, but not in terms of gaining new insight or understanding.[370] Although Bossuet's maxim *semper eadem* emerged as a highly significant element of Catholic polemic against Protestantism, Bossuet's rigid position of doctrinal immutability became untenable in the face of improved historical understanding revealing apparent changes in Christian teachings.

The 19th-century English theologian John Henry Newman placed the topic of doctrinal change on the stage of the theological debate. In the 1843 sermon 'The Theory of Developments in Religious Doctrine' and *An Essay on the Development of the Christian Doctrine*,[371] Newman introduced the notion of the development of doctrine as his reasoning for overcoming personal struggles as a believer and scholar of Christian history. In these writings, Newman accounted for the discrepancy between the faith of the early church and that

[368] Bossuet's anti-Protestant attitude is described in Jacques Bénigne Bossuet, *The History of the Variations of the Protestant Churches* (Dublin: Richard Coyne, [1742] 1829).
[369] Ibid., "Premiere Instruction Pastorale sur les Promesses de L'église," in *Oeuvres De Bossuet* (Versailles: De L'imprimerie de J.A. Lebel, 1815), 418-9.
[370] Owen Chadwick, *From Bossuet to Newman*, 2nd ed. (Cambridge: Cambridge University Press, 1987), 17-20.
[371] John Henry Newman, *An Essay on the Development of Christian Doctrine* (London: James Toovey, 1845), 117; Ibid., "The Theory of Developments in Religious Doctrine," in *Fifteen Sermons Preached before the University of Oxford between A.D. 1826 and 1843* (Notre Dame, IN: University of Notre Dame Press, 1997).

of the 19th-century Church by propounding that Christian doctrine develops to gain a deeper understanding of the Christian faith. Newman used the term "development" more often than "change" to describe the maturation process of doctrine because "development" implied that something is growing or becoming more mature or advanced, whereas "change" could denote something becoming entirely different in nature. When referring to doctrine as "changing," Newman alluded to the minor alterations or expansions without blatant distortions of the apostolic message. Alternatively, when using "change" to describe corruption or heresy, he stressed the substantial modification or deviation from the original.[372]

Newman's central argument in the *Essay* was that Christian doctrines are living ideas that develop over time while remaining self-identical. He contended that the truths of the gospel, similar to any great ideas that demand a considerable amount of time for full comprehension and perfection, are not revealed all at once to the recipients and, therefore, require time and deep thought for their complete elucidation.[373] Newman called this maturation process a development only if "the assemblage of aspects, which constitute its ultimate shape, really belongs to the idea from which they start."[374] Influenced by Vincent of Lérins, Newman adopted organic metaphors to explain the development. He said that just as a mustard seed germinates and grows into a tree, the living idea of the Christian faith expands and manifests different aspects of itself throughout history while remaining self-identical.[375]

Regarding how one discerns a legitimate development from corruption, Newman did not adopt the Vincentian rule of "*everywhere, always,* and *by all"* because terms like "everywhere" and "always" were ambiguous and imprecise.[376] Instead, he suggested seven

[372] Ibid., *Essay*, 338.
[373] Ibid., 27.
[374] Ibid., 37.
[375] C. Michael Shea, "Doctrinal Development," in *The Oxford Handbook of John Henry Newman*, ed. Frederick D. Aquino and Benjamin John King (Oxford: Oxford University Press, 2018), 288; Newman, *Essay*, 112.
[376] Rhyne R. Putman, *In Defense of Doctrine: Evangelicalism, Theology, and Scripture* (Minneapolis, MN: Fortress Press, 2015), 92.

tests or "notes" for determining the authenticity of the developments. The first test was the *preservation of type*. Newman asserted that just like young birds growing into birds, not fish, doctrine preserves its type.[377] The second test was the *continuity of principles*, denoting that abstract underlying principles of the doctrine do not change over time. The third test was the *power of assimilation*. According to this test, the Church interacts with the cultural context and appropriates elements which are compatible with the gospel but rejects those that are novel and corrupted. The fourth note was *early anticipation*. Newman explained, "Supposing then the so-called Catholic doctrines and practices are true and legitimate developments, and not corruptions, we may expect to find traces of them in the first centuries."[378] The fifth test was the *logical sequence* or *elaboration*, which indicated that any authentic development must be a logical consequence of its antecedent and not a logical contradiction. The sixth note, the *conservation action upon its past*, proposed that development not only clarifies and expands the past but also conserves what was revealed before. Newman considered actual development in doctrine to be "an addition which illustrates not obscures, corroborates not corrects, the body of thought from which it proceeds."[379] On the contrary, Newman argued that corruption "ceases to illustrate, and begins to disturb, the acquisitions gained in its previous history."[380] Finally, the seventh test of *chronic continuance* or *duration* appealed to the persistence of the vitality of truth. In other words, any faithful development, by its nature, survives the test of time, whereas heresy eventually dies out. Using the seven tests, Newman probed into some Roman Catholic Church's teachings, such as Purgatory, the invocation of saints, the papacy, and the veneration of the Virgin Mary, and declared that they are not corruptions but legitimate explications of the implicit teachings from the early church. Consequently, he posited that the

[377] Newman, *Essay*, 58.
[378] Ibid., 369.
[379] Ibid., 87-88.
[380] Ibid., 86.

Roman Catholic Church best embodies authentic development and therefore represents the true Church of Christ.

Overall, Newman underscored that Christian doctrine develops over time. For Newman, the truth was communicated once and for all by inspired teachers, but the complete elucidation by the recipients required time and more profound thought. Of course, Newman was not the first to assert the existence of doctrinal development. However, as Owen Chadwick rightly notes, Newman made the theory of doctrinal development "wider and vaguer, and thereby far more fertile in conception, and more useful to anyone who cared about intellectual honesty."[381]

Since modernity, theologians have been more historically conscious and acknowledged that people have a part in determining the trajectories of Christianity, including doctrines. While the reception of development in the recent era is far from conclusive, there are some salient patterns among Christian denominations.

For the Roman Catholic Church, the evolution of church teaching has become an officially endorsed view since the Second Vatican Council. However, the road to accepting development was not a smooth one. In the 1840s and 1850s, Newman's contemporaries reacted with both sympathetic responses and criticisms. For example, after hearing Newman's university sermons in 1843, Bishop Nicholas Wiseman described the theory of development as "a high service to the Catholic Church" and commended by saying, "We cannot conceive an abler vindication of the whole Catholic system."[382] Giovanni Perrone, the doyen of Catholic dogmatic theologians, praised and incorporated Newman's ideas into his works on the infallible authority of the Church in matters of doctrine.[383] On the other hand, the Swiss-born Reformed church historian Philip Schaff doubted whether Roman Catholics could "give up the

[381] Owen Chadwick, *Newman*, Past Masters, (Oxford: Oxford University Press, 1983), 48.
[382] Nicholas P. S. Wiseman, "Art. V.-the British Critic and Quarterly Theological Review," *The Dublin Review* 15, no. 49 (1843): 114.
[383] Kenneth L. Parker and C. Michael Shea, "The Roman Catholic Reception of the Essay on Development," in *Receptions of Newman*, ed. Frederick D. Aquino and Benjamin John King (Oxford: Oxford University Press, 2015), 43.

principle of stability, without unsettling its own foundation."[384] Orestes Brownson, a Catholic convert, condemned Newman's theory as "essentially anticatholic and Protestant" and "utterly repugnant to [the Church's] claims to be the authoritative and infallible Church of God."[385] Around the time of the First Vatican Council, Henry Edward Manning, a stern critic of Newman, described the doctrine of papal infallibility as "the triumph of dogma over history." In contrast, others, such as Bishop David Moriarty of Kerry, treated the development theory as foundational for affirming the papal authority.[386] From the 1880s to the 1950s, Modernist writers and Ressourcement theologians tried to advance the notion of development as a Catholic understanding of Tradition. Yet, the Roman School committed to neo-scholastic Thomism dismissed and sometimes actively shunned the developmental metanarrative.[387]

Around the time of the Second Vatican Council in 1962, the Catholic Church began to sway away from neo-scholasticism toward a historical understanding of theology. Facing various problems posed by the modern world, Catholic theologians at the council discussed how to undergo reform that is in continuity with the past. The Dominican ecclesiologist Yves Congar was a peritus at the council. As one of the most prominent ressourcement theologians, Congar argued that the absolutisation of the historically and culturally conditioned doctrines and forms of worship in the past has made the assimilation of new Catholics difficult, if not impossible.[388] To overcome this challenge, he echoed Newman's understanding of the development and insisted that the church must continue to change.

> The church has to develop, then, and to make progress in the world along with the world…. The church is obliged to follow the ceaseless development and variety of the

[384] Philip Schaff, *What Is Church History?: A Vindication of the Idea of Historical Development* (Philadelphia, PA: J. B. Lippincott and Co., 1846), 47.
[385] Orestes Brownson, "Art. Iii - an Essay on the Development of Christian Doctrine," *Brownson's Quarterly Review* 3, no. 3 (1846): 346.
[386] Parker and Shea, "The Roman Catholic Reception," 47.
[387] Ibid., 49.
[388] Yves Congar, *True and False Reform in the Church*, trans. Paul J. Philibert, Twentieth Century Religious Thought, Volume I: Christianity, (Collegeville, MN: Liturgical Press, [1950] 2011), 44.

> ever-growing innovation and new situations of humanity. The church has to move forward on the human journey.[389]

While Newman intended to highlight the fact of development in Catholic doctrine, Congar asserted the necessity of continual reform that responds to the current political, social, technological, and economic changes. With the growing awareness of the role of history in the life of the Catholic Church, the Council instantiated doctrinal development in the Dogmatic Constitution on Divine Revelation, *Dei Verbum,* Article 8:

> The Tradition that comes from the apostle makes progress in the Church, with the help of the Holy Spirit. There is a growth in insight into the realities and words that are being passed on.…Thus, as the centuries go by, the Church is always advancing towards the plenitude of divine truth, until eventually the words of God are fulfilled in her.[390]

The theology that triumphed at Vatican II continues in the present. The Roman Catholic Church recognises that historical context influences Christian teachings and practices and endorses the historicised understanding of tradition. It also describes doctrinal development as a part of its essential nature. Just as Andrew Meszaros holds, doctrinal development is seen as "thoroughly historical and thoroughly divine."[391]

Although the notion of doctrinal development has been discussed mainly in Catholic circles over the past century, theologians from other denominations, such as Eastern Orthodoxy and Protestantism, have investigated this subject in the light of their own traditions. In the case of Eastern Orthodoxy, theologians have diverse views on the topic of doctrinal development. For theologians like Andrew Louth and Vladimir Lossky, the notion of doctrinal development is incompatible with an Orthodox understanding. Louth argues, "If development means that there is a historical advance in Christian doctrine, making our understanding of the faith deeper

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[389] Ibid., 148.
[390] Second Vatican Council, "Dogmatic Constitution on Divine Revelation, Dei Verbum, 18 November, 1965," in *Vatican Council Ii: The Conciliar and Post Conciliar Documents*, ed. Austin Flannery (Dublin; Clonskeagh: Dominican Publications; Talbot Press, 1975), 754.
[391] Andrew Meszaros, *The Prophetic Church: History and Doctrinal Development in John Henry Newman and Yves Congar*, First ed. (Oxford: Oxford University Press, 2016), 13.

or more profound than that of the Fathers, at least in principle, then such a notion of development cannot be accepted as a category of Orthodox theology."[392] Louth contends that there is nothing that surpasses the understanding of the mystery of Christ offered by the Fathers of the Orthodox church. He fears that the theory of development promotes a kind of hubris, implying that later centuries "had a deeper grasp of the Holy Spirit than the first."[393]

Similar to Louth, Lossky denies that the development of doctrine contributes to a greater understanding of revelation. He states, "'To renew' does not mean to replace ancient expressions of the Truth by new ones, more explicit and theologically better elaborated." Unlike many Catholic theologians who treat development as making the fullness of truth delivered to the saints more explicit, Louth and Lossky reject that the development in doctrinal language results in a greater understanding of truth held implicitly through faith. They both assert that doctrines open access toward understanding the mystery of revelation but do not develop or make further progress in understanding.[394]

Despite Louth and Lossky's outright rejection of doctrinal development, some Orthodox theologians, such as George Florovsky and Dumitru Staniloae, consider the idea compatible with Orthodox theology. Florovsky, one of the most famous Orthodox theologians of the twentieth century, initially dismissed the development of doctrine under the impression that this idea undermines the truth communicated to the Orthodox Church through the indwelling of the Holy Spirit. In the 1931 article titled "Revelation, Philosophy, and Theology," Florovsky states that dogma, which denotes the fullness of truth or Tradition, cannot change.[395]

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[392] Andrew Louth, "Is Development of Doctrine a Valid Category for Orthodox Theology?," in *Orthodoxy & Western Culture: A Collection of Essays Honoring Jaroslav Pelikan on His Eightieth Birthday*, ed. Jaroslav Pelikan, Valerie R. Hotchkiss, and Patrick Henry (Crestwood, NY: St. Vladimir's Seminary Press, 2005), 55.
[393] Ibid., 58.
[394] Daniel J. Lattier, "The Orthodox Theological Reception of Newman," in *Receptions of Newman*, ed. Frederick D. Aquino and Benjamin John King (Oxford: Oxford University Press, 2015), 398.
[395] According to Daniel Lattier, Orthodox authors use the term "dogmatic" interchangeably with "doctrinal." He insists that there is no intension to distinguish dogma as more authoritative teaching than doctrine. See Ibid., "The Orthodox Rejection of Doctrinal Development," *Pro Ecclesia: A Journal of Catholic and Evangelical Theology* 20, no. 4 (2011): 393, https://doi.org/10.1177/106385121102000408; Georges Florovsky, "Revelation,

However, in later years, he employs the theory of the development of doctrine in support of his plea for a "neo-patristic synthesis," a common rediscovery of the works of the Greek fathers. During the process of returning to the Fathers, Florovsky recognises the need for historical understanding that leads to "a new synthesis" or a constructive vision that will enable contemporary Orthodox theologians to connect with what has happened in the past.[396] He claims, "What is really meant and required [by a neo-patristic synthesis] is not a blind or servile imitation and repetition, but rather a further *development* of this patristic teaching, but homogeneous and congenial."[397] Although it is not clear what led Florovsky to change his opinion, he supports that doctrinal change occurs as the theology of the Fathers is renewed, clarified, and exfoliated.[398]

Another influential Orthodox Christian theologian of the mid-20th century Dumitru Staniloae also treats doctrinal development congruent with the Orthodox understandings. Unlike Louth or Lossky, who criticise doctrinal development based on the notion that new language does not yield a greater understanding of truth, Staniloae defends that finite human language can develop and progress in the knowledge of God.

> I think one may say that it is not only the mission of these new expressions [doctrines] to be the means which by their novelty will awaken the human mind to see anew the amazing meaning and importance of the words and formulas of Scripture and Tradition. It is not only a question of an exterior renewal, or of an "aggiornamento" of language. It is impossible to separate language and content so clearly as that. If one uses new expressions, one throws new light onto the content expressed.[399]

By emphasising the ability of new language to throw "new light onto the content," Staniloae asserts that the development of doctrines improves the quality rather than the quantity of

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Philosophy and Theology," in *The Patristic Witness of Georges Florovsky: Essential Theological Writings*, ed. Brandon Gallaher and Paul Ladouceur (New York, NY: T&T Clark, 2019), 120.

[396] Paul L. Gavrilyuk, "Florovsky's Neopatristic Synthesis and the Future Ways of Orthodox Theology," in *Orthodox Constructions of the West*, ed. George E. Demacopoulos and Aristotle Papanikolaou (New York, NY: Fordham University Press, 2013), 118.

[397] Florovsky, "Patristics and Modern Theology," 155.

[398] Ibid., "The Patterns of Historical Interpretation," *Anglican Theological Review* 50, no. 2 (1968): 149.

[399] Dumitru Staniloae, "The Orthodox Conception of Tradition and the Development of Doctrine," *Sobornost* 5 (1969): 660.

understanding. While acknowledging the limitation of human language in expressing the mystery of faith, Staniloae argues that doctrine changes by offering clearer partial correspondences to this eternal truth. Although Louth, Lossky, Florovsky, and Staniloae had different views on the topic of doctrinal development, their common goal was to understand how the changeless truths are expressed in the vibrant life of the Church, which is liable to grow and change.

Although the development of doctrine has not been a significant issue among Protestant theologians because only Scripture is finally authoritative and infallible for Protestants, theologians like Peter Toon and Rhyne R. Putman examine doctrinal development in the Protestant context. In his monograph, Toon provides the recent Protestant view of the development with emphasis on the centrality of the Bible and the historical situations. He rejects the organic, continuous, cumulative model of doctrinal development. Instead, he argues that the development of doctrine can be understood as the *continuity of aims* and *question-answering exercises*. Toon explains that doctrines are the outcome of the efforts to state the Christian faith expressed in Scripture, the nature of worship, and the experience of salvation for each generation and each culture.[400] Since language, culture, and perspectives change unpredictably over time, the doctrines adjust accordingly to convey the same faith but in a way that is meaningful to the people in a particular context. Alternatively, doctrines can be thought of as the Church's response to questions posed by the world or to the erroneous teachings of some members.[401] The answers of one generation may not be relevant or meaningful to another because the questions and situations change. According to this approach, the development of doctrine is a complex path that leads to a radical restatement or a significant adjustment.[402]

[400] Peter Toon, *The Development of Doctrine in the Church* (Grand Rapids, MI: W. B. Eerdmans, 1979), 81.
[401] Ibid.
[402] Ibid., 83.

Toon compares the process of doctrinal development to Kuhn's normal science.[403] During normal science, scientists engage in puzzle-solving activities under the guiding paradigm, which presents a cluster of broad conceptual and methodological presuppositions and the questions to be solved. A particular research tradition emerges as scientists try to find explanations and solutions to the questions. In Christianity, the guiding paradigm is the apostolic interpretations of Christ written in the Bible. Under the paradigm, theologians throughout history read and study the Bible first to understand the apostolic message and then to teach it to others. New doctrines are formulated as people try to offer explanations of the faith tradition in different historical and cultural contexts. Toon describes, "Development of doctrine involves the Church in careful exegesis of the texts and then the choice of the best available concepts and words within a specific cultural situation as the means of conveying God's message for that time and place."[404] The doctrines may progress in understanding due to various factors, including the teaching of heretics, scientific discovery, theological controversy, or social change. However, the guiding biblical paradigm does not change.[405] Toon also stresses that only the theology generated within the guiding paradigm—the apostolic understanding of Christ—is acceptable. Moreover, he asserts that considering the limitations of human language, no ecclesiastical doctrine represents the best possible understanding of the paradigm. On the whole, Toon's view of doctrinal development as the ongoing reformulation of the historically and culturally conditioned doctrines according to the Word of God reflects the Protestant slogan *ecclesia semper reformanda est*.

Another Protestant theologian Rhyne P. Putnam claims that doctrines can develop while maintaining continuity with the revealed teachings of Scripture. Using insights from

[403] Edwin El-Mahassni offers a more detailed analogy between the development of Christian doctrine and Kuhn's structural revolutions. See Edwin El-Mahassni, "Kuhn's Structural Revolutions and the Development of Christian Doctrine: A Systematic Discussion," *Heythrop Journal* 59, no. 3 (2018), https://doi.org/10.1111/heyj.12488.
[404] Toon, *The Development of Doctrine*, 115-16.
[405] Ibid., 116.

contemporary hermeneutical theory and evangelical theology, Putman outlines three features of faithful doctrinal development. First, he advances that doctrinal development "begins with and ends in doxology, the praise and worship of God."[406] He contends that theologians begin the entire theological enterprise to glorify God, and doctrines direct the audience to the splendour of God.[407] Second, he affirms that faithful doctrinal development is a response to "what Scripture's divine and human authorship intends readers to do with the texts."[408] He highlights that only the Bible has the ultimate ruling authority in determining the acceptability of post-canonical development. Neither church nor extrabiblical tradition nor an ethical telos unforeseen by biblical authors supersedes the authority of the Bible.[409] Putman explains that a proper response to God's message in the Bible requires understanding the meaning of the text in an ancient setting as well as in a new contemporary situation. Finally, Putman argues that faithful doctrinal development is the work of the Holy Spirit through human understanding first to reveal the divine-human authorial meaning of the text and to guide Christians in responding appropriately to new circumstances.[410] For Putman, the development of doctrine is contextual, subject to biblical authority, and naturally occurring as the church fulfils its mission of transmitting the gospel cross-culturally and cross-generationally.

Today, many theologians accept some form of doctrinal development. They prefer to use the term "development" to avoid misunderstanding that doctrines change or distort the truth into something completely different. Theologians stress that even if some words or concepts are modified, there is a historical continuity of the apostolic message throughout the doctrinal development. Theologians from various traditions ascribe doctrinal stability and change to different sources. Roman Catholic theologians locate the authority of the doctrine to the

[406] Putman, *In Defense of Doctrine*, 382.
[407] Ibid., 382-83.
[408] Ibid., 383.
[409] Ibid.
[410] Ibid., 388.

magisterium of the church, Eastern Orthodox theologians rely on "Holy Tradition," and Protestant theologians bind to the authority of Scripture. However, regardless of the denomination, theologians acknowledge that doctrines are human constructs, limited by human language to describe or represent God adequately. They also agree that doctrine is always about faith lived in history rather than abstract truth fixed for all time. Therefore, no Christian doctrine is impervious to historical influences.

3.1.3 Christian practice

Another vital area of Christianity affected by time is how Christians practise their faith. The authentic and meaningful expressions of faith include a broad set of practices such as baptism, the Eucharist, Sabbath-keeping, testimony, forgiveness, healing, and many more. Dorothy Bass and Craig Dykstra denote Christian practices as "things Christian people do together over time in response to and in the light of God's active presence for the life of the world in Christ Jesus."[411] According to this definition, regardless of how mundane the activity is, as long as it is a response to God's love and active presence, it is considered a Christian practice.

The New Testament records the disciples and the first-century Christians living out their faith. Baptism, as witnessed in the New Testament accounts of Jesus' baptism, emerged as the means by which new converts became members of the Christian community. The apostolic visits and epistles reminded the worshipping communities that they are "all one in Christ Jesus" (cf. Gal. 3:28 RSV), notwithstanding their differences in race, culture, language, social status, and educational level. For many first-generation Christians, Sunday became the special day for remembering Jesus, who had been raised from the dead (cf. Acts 20:7; 1 Cor. 16:2). Held in private houses rather than in public buildings, Sunday worship included the elements of prayer, reading and studying the messages of sacred texts, singing psalms and

[411] Dorothy C. Bass and Craig Dykstra, "Times of Yearnings, Practices of Faith," in *Practicing Our Faith: A Way of Life for a Searching People*, ed. Dorothy C. Bass (Hoboken, NJ; Chichester: John Wiley & Sons, 2010), 5.

hymns, giving offerings, and sometimes making prophecies and speaking in tongues. Another central focus of Christian worship was the participation in the rite of breaking bread, which later came to be known as the "thanksgiving," the "Eucharist," the "Holy Communion," or the "Lord's Supper."[412] Christians shared food and drink as a part of a larger communal agape meal to commemorate the suffering, death, and resurrection of Jesus Christ and commune with the risen Lord (cf. 1 Cor. 11).

Although baptisms and the Lord's Supper, integral to the first Christians, have remained essential for Christian worship today, the structures and forms of these practices have altered drastically. If the first Christians had baptisms in lakes, seas, or any body of water, many Christians in the 21st century get baptised inside a church building. Depending on the denomination, the application of water can be in various forms, such as sprinkling water, pouring over the head, and fully immersing in the baptistry. During the baptism, the order of service most likely includes the profession of faith, Scripture readings related to baptism, affirmation, and prayers of intercession. The entire service is often filmed or photographed to capture the moments of spiritual rebirth, and friends and families are invited to witness this special event.

The modern practices of the Holy Communion also vary from those of the early Christian communities. The Eucharist in the first century was a meal comprising bread and wine and additional elements such as cheese, milk, honey, salt, oil, fruits, or fish.[413] In some communities, the prayer over the cup preceded the prayer over bread, and water replaced wine.[414] In contrast, the modern Eucharist is a rite of sharing small portions of bread and wine.

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[412] Ivor J. Davidson, *The Birth of the Church: From Jesus to Constantine, A.D. 30-312*, vol. 1, Monarch History of the Church, (Oxford: Monarch, 2005), 120.
[413] Maxwell E. Johnson, "The Apostolic Tradition," in *The Oxford History of Christian Worship*, ed. Geoffrey Wainwright and Karen B. Westerfield Tucker (Oxford: Oxford University Press, 2006), 48; Andrew Brian McGowan, *Ascetic Eucharists: Food and Drink in Early Christian Ritual Meals*, Oxford Early Christian Studies, (Oxford: Clarendon Press, 1999).
[414] Johnson, "The Apostolic Tradition," 48.

Catholic churches have regarded the administration and reception under both kinds as preferable but not necessary; Orthodox and Protestant traditions have consistently practised communion that includes both bread and wine. Some churches use unleavened bread, while others use leavened bread; a few congregations use grape juice rather than wine. Moreover, some churches prepare individualised portions of bread and wine in advance, whereas other communities allow the members to take a piece of the broken loaf and drink from one cup.

In addition to the two sacraments, the Sunday liturgical tradition has changed through the centuries. The second-century Christian writer Justin Martyr describes the Sunday gathering of his Christian community in Rome as the following:

> On the day which is called Sunday we have a common assembly of all who live in the cities or in the outlying districts, and the memoirs of the Apostles or the writings of the Prophets are read, as long as there is time. Then, when the reader has finished, the president of the assembly verbally admonishes and invites all to imitate such examples of virtue. Then we all stand up together and offer up our prayers, and, as we said before, after we finish our prayers, bread and wine and water are presented. He who presides likewise offers up prayers and thanksgivings, to the best of his ability, and the people express their approval by saying 'Amen.' The Eucharistic elements are distributed and consumed by those present, and to those who are absent they are sent through the deacons... Sunday, indeed, is the day on which we all hold our common assembly because it is the first day on which God, transforming the darkness and [prime] matter, created the world; and our Savior Jesus Christ arose from the dead on the same day.[415]

In this description, the worship pattern appears similar to contemporary Sunday services. The passages for public readings are taken from both the Old and New Testaments. A pastor, or "president" in Justin Martyr's words, preaches a sermon. The congregation participates in communal prayer, shares bread and wine, and offers thanksgiving. Justin Martyr also attests to the observance of the Lord's Day on Sunday, supplanting the Sabbath commandment.[416]

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[415] Justin, "The First Apology," in *The First Apology, the Second Apology, Dialogue with Trypho, Exhortation to the Greeks, Discourse to the Greeks, the Monarchy or the Rule of God*, ed. and trans. Thomas B. Falls, The Fathers of the Church (Washington, D.C.: Catholic University of America Press, 1948), Ch. 67: 106-7.

[416] According to theologians like Samuele Bacchiocchi and Justo González, the sociocultural and political factors such as Contantine's decree of observing the "venerable day of the Sun" promoted the transition from the Saturday to Sunday as the day of rest and worship in the early Christian church. Samuele Bacchiocchi, *From Sabbath to Sunday: A Historical Investigation of the Rise of Sunday Observance in Early Christianity* (Rome: Pontifical Gregorian University, 1977); Justo L. González, *A Brief History of Sunday: From the New Testament to the New Creation* (Grand Rapids, MI: William B. Eerdmans Publishing Company, 2017).

Nonetheless, the second-century worship format has been altered over time. Johannes Quasten classifies the early Christian services as "a semirigid type of Liturgy because there are regular elements in it, but there is also still room for the personal composition of the consecrating priest."[417] In the 21st century, Catholic and Anglican churches have more standardised liturgical services with a set structure and pattern of prayers and readings. Some Protestant churches, such as Lutheran and Reformed, also are liturgical, conducting services with a fixed order of progression. In contrast, Baptist, Pentecostal, and Charismatic churches prefer to worship with more freedom and flexibility. Other informal worships focus on the personal adoration of God without any formality. For instance, Quakers hold meetings without ministers or creeds, and the attendees sit in silence, waiting for the Spirit.

The liturgical language also has transformed over time. In their study of Christian liturgy, Albert Gerhards and Benedikt Kranemann assert, "the various Christian liturgies made use of a great number of languages; they also changed languages and sometimes used more than one simultaneously."[418] For the first Christian communities in the Syro-Palestine region, the liturgical language was Aramaic and Greek.[419] Theologian Wendy Mayer points out that in the mid-second century, the "memoirs of the apostles" and the Old Testament prophets were circulated only in Greek, and the "instructions" or proto-sermons were most likely delivered in the koinē Greek.[420] She also emphasises that when Christianity was introduced to the Latin-dominant Roman empire, Christians did not immediately use Latin for worship. They continued to use Greek, the lingua franca in the whole of the eastern half of the Roman Empire, for preaching and worship.[421] In the second half of the fourth century, Pope Damasus

[417] Johannes Quasten and Angelo Di Berardino, *Patrology*, vol. 1 (Westminster, MD: Christian Classics, [1950] 1986), 215.
[418] Albert Gerhards and Benedikt Kranemann, *Introduction to the Study of Liturgy*, trans. Linda M. Maloney, Pueblo Book, (Collegeville, MN: Liturgical Press, 2017), 293.
[419] Ibid.
[420] Wendy Mayer, "Preaching and Listening in Latin?: Start Here," in *Preaching in the Patristic Era: Sermons, Preachers, and Audiences in the Latin West*, ed. Anthony Dupont et al. (Leiden: Brill, 2018), 11.
[421] Ibid., 12.

established Latin as the liturgical language of the West.[422] In the East, however, the language of worship became the vernacular language understood by the community. When missionaries from the East went to other countries, they adopted the style of the people they evangelised. Latin continued to be the liturgical language of the Roman Catholic Church at the Council of Trent in spite of the intense attacks from the Protestants claiming Latin as a cult-language. In the 20th century, Vatican Council II recognised the pastoral need for increasing understanding and encouraging greater participation of the people and approved the use of the vernacular in the liturgy. Throughout the history of the liturgy, the language of worship altered with the anthropological, cultural, liturgical-theological, and pastoral premises of the time.

Music is another integral part of Christian worship which has undergone many reforms. Everett Ferguson characterises early Christian music as vocal and monodic with some influences from Jewish psalmody and Greek music.[423] The common forms of singing were responsorial (the precentor or reader sings the body of the text, and the people respond with a refrain), antiphonal (the congregation, divided into two groups, sing alternatingly), or in unison.[424] The use of instruments was discouraged or even prohibited. In the 21st-century services, only a few denominations sing a cappella. Most congregations in the West use instruments such as an organ, piano, keyboard, guitar, and drums to accompany the singing. During the service, the whole congregation or specialised subgroups sing a wide range of worship songs including traditional hymns and contemporary worship music songs.

Another example of Christian practice changing over time is responding to God's "calling." While the liturgy is one of the most prominent forms of expressing one's faith, Christians try to live a life God has called them to live. In Christianity, "calling" is also referred

[422] Latin used in liturgy is an artificial language different from that in daily use. Gerhards and Kranemann, *The Study of Liturgy*, 293.
[423] Everett Ferguson, "Music," in *Encyclopedia of early Christianity*, ed. Everett Ferguson (Second, London: Routledge, 2016), 788.
[424] Ibid.

to as "vocation," which comes from the Latin word *vocare,* meaning to call or to summon. In the New Testament, Jesus says, "I have come to call not the righteous but sinners" (Mark 2:17b). The purpose of Jesus' call is to summon his followers to repent and become his disciples. In fact, as Gary Badcock states, "All discipleship is presented as the result of Jesus' personal calling; there is no instance of anyone volunteering successfully to become a disciple."[425]

For the first three centuries, the Christian "vocation" was about keeping one's faith despite potential atrocities such as severe persecution, torture, arrest, and social ostracisation. In the fourth century, after Emperor Constantine's conversion, Christians no longer risked their lives to follow Christ. Consequently, the notion of God's "calling" shifted focus from preserving Christian faith to demonstrating sacredness through radical self-denial and devotion to serving God. Around this time, Eusebius of Caesarea proposed that there were two ways of life: the "perfect" and the "permitted" life. The former was a special call reserved for priests, monks, and nuns who devoted their lives to the service of God, while the latter was secular, less dignified, mundane tasks such as soldiering, farming, governing, selling, drawing, and parenting.[426] Eusebius considered those who lived the "perfect" life to be first-rate Christians and treated work as demeaning and grading.[427] Such a hierarchical, two-tier view of "vocation" was crystalised in the Middle Ages. To answer the "call" almost exclusively meant to become a priest or nun or to join some monastic order and commit daily to prayer, worship, contemplation, and the service of God.

During the Protestant Reformation, Martin Luther and John Calvin began to debunk the dualistic understanding of the term "vocation." Luther rejected the sacred/secular, perfect/permitted, contemplative/active, higher/lower, first-rate/second-rate dichotomy

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[425] Gary D. Badcock, *The Way of Life: A Theology of Christian Vocation* (Grand Rapids, MI: W.B. Eerdmans, 1998), 5.
[426] Os Guinness, *The Call: Finding and Fulfilling the Central Purpose of Your Life* (Nashville, TN; London: W Publishing Group, 1998), 32.
[427] Alister E. McGrath, *Christianity's Dangerous Idea: The Protestant Revolution*, 1st ed. (New York, NY: Harper One, 2007), 336.

prevalent in the Middle Ages.[428] He claimed that God called each individual to faith through their occupation and turned every kind of work into a sacred vocation; hence, the notion of "the priesthood of all believers." In a similar line, John Calvin asserted that God "has assigned distinct duties to each in the different modes of life… he has distinguished the different modes of life by the name of callings."[429]

In the 21st century context, "calling" is no longer treated as becoming a monk or devoting to a religious occupation. Instead, it is understood as living out one's faith in Christ in specific tasks and professions in society. Contemporary Christians regard "calling" as participating in Christ's redemptive work in the world using individual talents and giftedness and making Christ every part of life. However, the term "vocation" has taken a different trajectory. It has been secularised and eclipsed by the notion of "job" and "career."

To summarise, many, if not all, Christian practices are subject to change because Christians throughout the age seek to find authentic and meaningful expressions of faith in their respective contexts of living. While valuing traditional elements, Christians feel less obliged to replicate the precise ways of the early Christians. Hence, Christian practices will continue to transform to fit the needs of the worshipping community.

3.2 Religion as language changing over time

The past studies of religion or Christianity have not paid much attention to developing a theoretical model to conceptualise the dynamic developments over the course of history. In the sociology of religion, there have been mainly two theories—the secularisation theory and the economic model of religion—to account for the religious changes occurring at the level of

[428] Martin Luther, "The Babylonian Captivity of the Church," in *Luther's Works*, ed. Abdel Ross Wentz (Philadelphia, PA: Fortress Press, 1959), 78.
[429] Jean Calvin, *Institutes of the Christian Religion*, trans. Henry Beveridge, vol. 2 (Edinburgh: T & T Clark, [1536] 1863), 3.10.6: 34.

society. The secularisation paradigm's central premise is that the processes of modernisation weakens the power and authority of the church as an institution and diminishes the stability and vitality of religious communities, practices, and beliefs.[430] This theory focuses on the relationship between religion and modernity and utilises demographic data and projections to support the thesis. However, it does not offer a thorough analysis of the nature of change in symbols, practices, or beliefs.

On the other hand, the economic model of religion provides a more complex model for explaining why and how religion changes in society. It integrates economic principles with the understanding of socio-political structures to explain religious beliefs and behaviours such as conversion, membership, commitment, and values. For example, competition prompts religious communities and members to provide customer-oriented services and to strive towards continual renewal to attract new people.[431] Although the economic model proposes a conceptual framework for investigating the interactions of various religious communities and ideologies, religious communities do not always behave according to the laws of supply and demand, nor are they driven by capitalistic motives of growing membership or religious capital.

To look at Christianity specifically, the existing models that discuss development focus only on Christian doctrines, not practices. One of the most well-known is the "organic" model of doctrinal development endorsed by Vincent of Lérins and Newman. According to this model, Christian doctrine grows and matures in the knowledge of divine truth while preserving continuity and retaining its essential identity. However, some theologians such as Vladimir Lossky and Georges Florovsky express concern about the organic metaphor for implying the inner necessity of the progressive increase of the knowledge of revealed truth or

[430] Detlef Pollack, "Religious Change in Europe: Theoretical Considerations and Empirical Findings," *Social Compass* 55, no. 2 (2008): 169, https://doi.org/10.1177/0037768607089737.
[431] Ibid., 170.

misrepresenting history as a process that necessarily unfolds according to an intrinsic principle.[432]

Alister McGrath also presents some models for change in Christianity, albeit confined to doctrinal development. In *Scientific Theology,* McGrath introduces the metaphor of "Neurath's ship" out to sea to describe how doctrinal paradigm shifts arise. First proposed by Otto Neurath and later popularised by W. V. Quine, this metaphor describes that doctrinal development is already constructed and under sail or that it occurs *in via* and not *de novo* or *ab initio*. Using this metaphor, McGrath argues that Christians who want to remain afloat learn to *unpack* and live within the confines of the boat, *reconstruct* the vessel when damaged by adverse conditions, and *incorporate driftwood* to strengthen the ship.[433] Although the metaphor of the boat presents a framework for identifying and revealing the fundamental pressures which lead to doctrinal development, critics such as Malcolm Yarnell claim that McGrath's analogy fails to consider the role of Scripture in development.[434]

In "The Evolution of Doctrine? A Critical Examination of the Theological Validity of Biological Models of Doctrinal Development," McGrath refers to Simon Conway Morris's concept of "islands of stability" as a promising analogy to depict doctrinal development. On the "islands of stability," evolution regularly appears to "converge" on specific favoured outcomes because, despite the infinitude of genetic possibilities, the destinations are limited.[435] McGrath insists that "the nature of the Christian faith is such that 'islands of theological stability' may be expected to emerge, nucleating around certain core themes or notions—such

[432] Vladimir Lossky, *In the Image and Likeness of God* (Crestwood, NY: St. Vladimir's Seminary Press, [1967] 2001), 162-63; Alister E. McGrath, *A Scientific Theology: Theory*, vol. 3 (London; New York: T&T Clark, [2003] 2006), 217, 19.
[433] Ibid., *A Scientific Theology: Theory*, 3, 219-22.
[434] Yarnell, *The Formation of Christian Doctrine*, 126-27.
[435] Simon Conway Morris, *Life's Solution: Inevitable Humans in a Lonely Universe* (Cambridge: Cambridge University Press, 2003), 297; Alister E. McGrath, "The Evolution of Doctrine? A Critical Examination of the Theological Validity of Biological Models of Doctrinal Development," in *The Order of Things: Explorations in Scientific Theology* (Oxford: Blackwell Publishing, 2006), 160.

as the identity of Jesus Christ." Using this model, he highlights that Christian doctrine would emerge inevitably, whatever the unpredictable contingencies of history.[436] Despite its strengths, the model exhibits the danger of emphasising the isolated, episodic nature of doctrinal development and downplaying the continuity through shared meanings and values.

George A. Lindbeck, who sets out the postliberal agenda, uses the cultural-linguistic model to explain doctrinal development. According to Lindbeck, doctrines are neither propositional truth claims nor symbolic expressions of inner experience but rather grammar or rules found in the story of Christ that guide the beliefs of the faith community.[437] Consequently, the development of doctrines does not mean the improvement in understanding or intensified feelings of religious experience. It denotes the redescription of reality within the scriptural framework.[438] For Lindbeck, doctrinal development is an expected outcome as the church tries to understand the implications of Scripture for their time and place in history.[439] Lindbeck's cultural-linguistic model lays the foundation for the "language" metaphor discussed here.

The "language" metaphor is a highly felicitous model for religion because it accounts for the concept of "change" in a vivid, workable manner. The metaphor asserts that just as all parts of language, including pronunciation, lexicon, semantics, and syntax, are subjected to change, the understanding of the Christian faith, the communally endorsed teachings, and practices that grow out of knowledge can change over time. God is unchanging in his character, and the revealed truth is immutable. However, the Christian discourses that transmit and perform the revealed truth are variable because they are human activities within a specific context.

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[436] Ibid., "The Evolution of Doctrine?," 162.
[437] Lindbeck, *The Nature of Doctrine*, 18.
[438] Ibid., 118.
[439] George A. Lindbeck, "The Problem of Doctrinal Development and Contemporary Protestant Theology," in *Man as Man and Believer*, ed. Edward Schillebeeckx and Boniface Willems (New York, NY: Paulist Press, 1967), 138-39.

Then, what causes Christianity to change? Christianity is neither a system of belief nor a *sui generis* social product; it is a way of life in faith. Consequently, any factors that modulate the life of the church influence Christian theology, doctrine, and practice. Consider the factors that reshape a language. The internal factors, such as the ease of pronunciation or generalisation, or the external factors, like contact with another language, result in linguistic modifications. Like a language, Christianity transforms due to internal and external influences. Some adjustments in theology are motivated by individual theologians seeking to gain knowledge of the truth revealed by God; several alterations in Christian practices come from the church responding to the fluctuations in the sociocultural context. Thus, any variation in personal, communal, and sociocultural circumstances affects the expressions of the Christian faith.

The "language" metaphor illustrates that changes in Christianity take various forms. In language, some developments are sporadic and affect only one or a few words, but others are systematic modifications that reorganise the entire system or subsystem. Also, certain refinements happen very quickly, whereas other alterations occur gradually. The type of language change often depends on non-linguistic factors relating to social cohesion, the facility of communication among different groups, etc.[440] Similarly, various shifts in Christianity can be irregular and present only in particular religious communities. Minjung theology, the Korean contextual theology, is an example of the sporadic change in liberation theology. On the other hand, some developments, such as the doctrine of the Trinity, are systematic, affecting the entire Christian community worldwide. In addition, whether theology, doctrine, or practice, the transformations may be abrupt or gradual. For example, the preaching and prayer styles of the American colonies changed rapidly in just a decade during the Great Awakening. The religious leaders began to preach energetically, and the listeners responded with great

[440] David W. Lightfoot, "Imperfect Transmission and Discontinuity," in *The Cambridge Handbook of Historical Syntax*, ed. Adam Ledgeway and Ian Roberts, Cambridge Handbooks in Language and Linguistics (Cambridge: Cambridge University Press, 2017), 529.

enthusiasm and emotion in prayer. On the other hand, the view on the ordination of women to ministerial or priestly office is a subject that has undergone lengthy debates. Today, the ordination of women is accepted in some Christian denominations, such as Anglicans, but contested in other groups, like Roman Catholics and Eastern Orthodox. Considering the turns in Christianity as linguistic change reveals that the developments in theology, doctrine, and practice are diverse and lively.

Treating religion as a language, the "language" metaphor spotlights the unpredictability of change. Just as it is impossible to predict the course of linguistic modifications, the direction of developments in Christianity cannot be anticipated in advance. The medieval theologians could not have foreseen the surge of criticisms against the Church and the papacy in later years. In 2019, Christians could not have conjectured that many churches in the world would transition from Sunday gatherings at church buildings to online worship services due to the COVID-19 pandemic. Life is full of unexpected circumstances, and Christian beliefs and practices always reflect and respond to these events. As Catholic theologian Andrew Meszaros comments, "History gives shape to Christian teaching, preaching, and life."[441] Thus, Christianity does not reform by following a track set out by theologians or church officials but by exploring the unknown terrains of life.

The "language" metaphor also underscores the necessity of group confirmation for a change in Christianity. Any alteration in a language requires a new linguistic form used by a subgroup within a speech community to be adopted by other community members and accepted as the norm. In parallel with language, Christianity also transforms when a new understanding, instruction, or practice is endorsed by community members as scriptural and in line with the church tradition. If the community of believers do not see the new variation as authentic to the

[441] Emphasis removed from the original; Meszaros, *The Prophetic Church*, 11.

Christian faith, then it is disregarded, and no development occurs. In this way, the community members safeguard orthodoxy.

Just as the evolution of language is unavoidable, the development of Christianity is inevitable. When the linguistic community uses their language, they make modifications to fit their needs. No matter how hard a linguistic community tries to preserve the language in a particular form, the language in discourse shifts over time. Similarly, changes in Christianity are inescapable. As Christians pursue a way of life immersed in the narrative of God's salvation, they respond and deal with various challenges from their surroundings. During this process, their understandings and faith practices naturally adjust to maintain a close relationship with Jesus Christ.

The "language" metaphor also provides a helpful explanation of religion changing without abandoning tradition. All languages change continually, but never to the degree that halts communication. For instance, the use of *have* with the support of the auxiliary verb *do* is a recent phenomenon. In the past, the verb *to have* was used alone, as in the case of *Have you any money?* or *I haven't any money.* Although English speakers nowadays prefer the do-support, as in *Do you have any money?* or *I don't have any money,* they would still understand the expressions without the do-support. Whether the changes are rapid or gradual, small-scale or large-scale, they seldom, if ever, lead to a communication breakdown. Since the language users share a vast amount of lexical and syntactic information and are immersed in a similar linguistic culture, they can overcome any inconvenience or functional disadvantage the linguistic change has incurred. Thus, language is constantly in flux while maintaining continuity.

Likewise, the changes in Christianity are not total departures from the past. Admittedly, Christianity emerges out of Judaism by way of a radical reorientation.[442] In Thomas Kuhn's terms, Jesus of Nazareth was the anomaly that instigated the reconceptualisation of the word "Messiah." Under the Jewish paradigm, the Messiah denoted a future political-military leader and liberator of the Jewish people. However, the disciples, who witnessed the life, death, and resurrection of Jesus, considered Jesus the Messiah. They broke away from the old paradigm and saw the world in a wholly different fashion. Although the beginning of Christianity was a decisive break from Judaism, the Christian paradigm, which the first Christians endorsed, has prevailed until today. Christians continue to grow and flourish under this paradigm.

Hans Küng, applying Kuhn's theory to Christian history, indicates that there are smaller-scale paradigm changes. In *Theology for the Third Millennium,* he identifies six paradigms: Early Christian – Apocalyptic Paradigm, Early Church – Hellenistic Paradigm, Medieval – Roman Catholic Paradigm, Reformation – Protestant Paradigm, Enlightenment – Modern Paradigm, and Contemporary – Post-modern Ecumenical Paradigm.[443] Küng argues that the Christian community's beliefs, values, needs, and practices transform during the paradigm shifts.[444] According to Küng, the paradigm change process in Christianity involves both continuity and discontinuity, conceptual stability and conceptual change.[445] But if small-scale paradigms, like Kuhn's paradigms, are incommensurable, how is the continuity of tradition still preserved?

The concept of language, once again, hints at the answer. Language presents a guiding paradigm or framework to the linguistic community for apprehending reality. Words and

[442] For a detailed discussion, see Dirk-Martin Grube, "Christian Theology Emerged by Way of a Kuhnian Paradigm Shift," *International Journal of Philosophy and Theology* 79, no. 1-2 (2018), https://doi.org/10.1080/21692327.2017.1422988.
[443] Hans Küng, *Theology for the Third Millennium: An Ecumenical View* (New York; London: Doubleday, 1988), 128.
[444] Ibid., *Christianity: Essence, History and Future* (New York: Continuum, 1995), 111.
[445] Ibid., *Theology for the Third Millennium*, 154.

grammar organise and structure thoughts and experiences of reality and represent them meaningfully. Language provides a particular perception of reality. Although the individual constituents of language may change over time, the unique worldview posited by the language continues for all generations of users.

Similarly, in Christianity, continuity is possible by emphasising the overarching Christian worldview characterised by the faith in Jesus Christ. Lindbeck insists that Christianity remains the same amid vast transformations by upholding the paradigm, which is "moulded by the set of biblical stories that stretches from creation to eschaton and culminates in Jesus' passion and resurrection."[446] He adds that Christianity is able to "retain continuity and unity down through the centuries" because it is a "framework within which Christians know and experience, rather than what they experience or think they know."[447] The changes in Christianity do not mean the introduction of novel teachings. Instead, they occur when the Christian good news is translated to be meaningful to the audience in a particular context and ultimately transform culture. Therefore, the worldview of Christianity, the way of life that Jesus Christ presents for his followers, safeguards theologies, doctrines, and practices from veering too far while undergoing reform.

Various changes in language signify that the language is alive and actively used by its linguistic community. If the language becomes extinct, there will be no transformation. Similarly, the shifts in Christianity are not threats to its identity but markers of the church's vitality. Lindbeck contends, "It is only in dead or imperfectly known languages and religions that no new words are used, truths uttered, or feelings expressed. Nor need this variety impair identity."[448] The alterations in Christianity naturally arise as Christians, who face various environmental challenges, try to keep their faith in Christ. Just as the living language changes,

[446] Lindbeck, *The Nature of Doctrine*, 83.
[447] Ibid.
[448] Ibid.

the living religion of Christianity changes in accordance with the needs of the believers and, at the same time, preserves continuity with its origin.

Notwithstanding the advantages outlined so far, there are some constraints to using the "language" metaphor to examine how Christianity changes over time. The language concept cannot address the notion of divine providence. Christians believe that God has been at work throughout all of human history. According to them, God cares, governs, protects, and preserves creation as a loving father, and everything unfolds according to God's plan. The Holy Spirit dwells in each believer and guides them to lead a life of Christ-like character and bear spiritual fruit. Under McGrath's "boat" metaphor, the Holy Spirit is the wind that enables the boat to sail through both calm and rough waters in life. Without the Holy Spirit, Christianity's authentic and faithful development is impossible. In language, however, there is no metaphysical supreme being in control of language development. Linguistics is limited to the scope of the physical world and focuses on the linguistic community. Therefore, the understanding of God directing the changes in Christianity has no correspondence in the language domain.

Another drawback of the "language" metaphor is its inability to accommodate the "organic" model of doctrinal development. Vincent of Lérins, Henry Newman, and other Catholic theologians use the organic metaphor to advance that the church's doctrines grow and progress in understanding the revealed truth. The organic metaphor, which compares the development to the ripening of fruit or the maturing of animals, suggests that the teachings of the church are clarified and amplified over time. While the organic metaphor portrays doctrines developing in a linear, cumulative, and almost automatic fashion, the "language" metaphor presents doctrines changing in a non-linear, unpredictable manner. Also, the organic model implies progress in understanding, but the "language" metaphor does not mean advancement in a particular direction. The language of the new generation is not necessarily better or more

complex than that of the older generation. The language change is not a matter of "growth" but acclimation to the changing historical situation and the fluctuating needs of the linguistic community.

As with all metaphors, the "language" metaphor cannot map all aspects of transformations in Christianity. Nevertheless, the metaphor is unmatched in its ability to pose thought-provoking questions related to the issue of diachronic change, offer tools for analysis and understanding, and present a rich picture of the Christian faith, authentically expressed and experienced in life, changing over time.

4. Implications for the relationship between science and religion

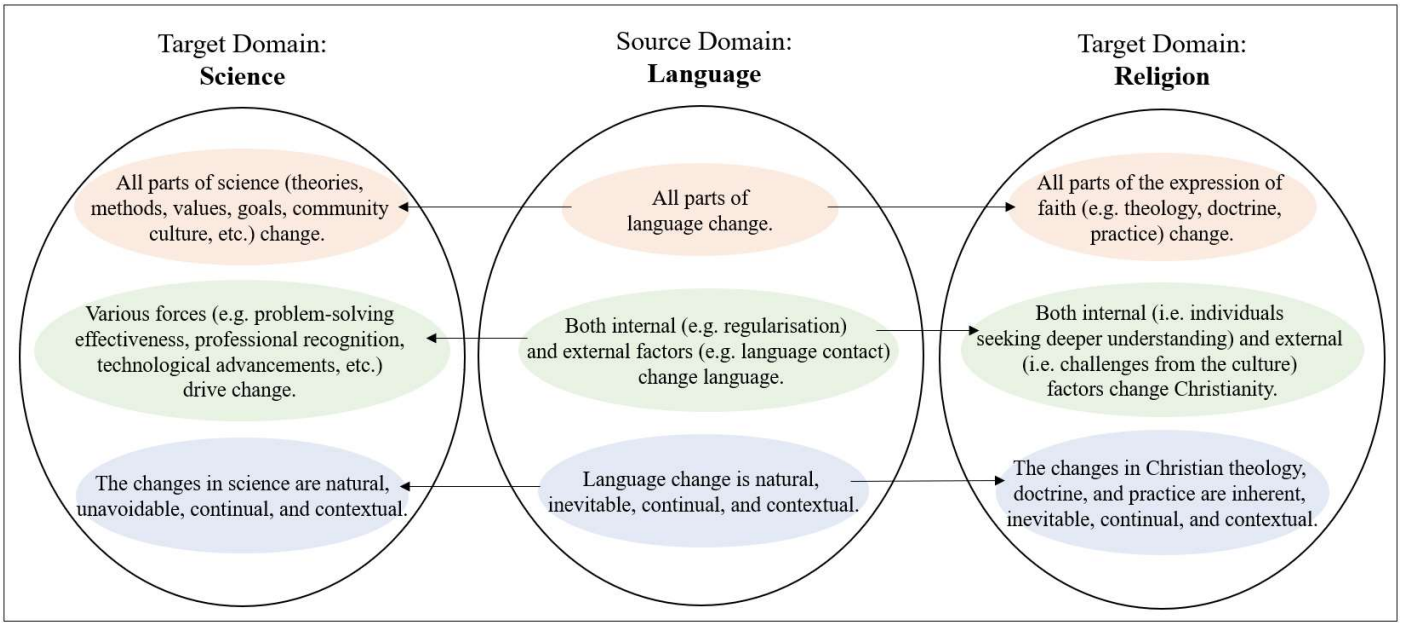

Figure 17: Cross-domain mapping of language change onto science and religion

In this chapter, the concept of language changing over time has served as the source domain for examining science and religion (see **Figure 17**). All areas of language structure, including phonology, syntax, discourse style, semantics, and lexicon, are subjected to change over time. Various internal and external factors shift language, but after all, language adapts to reflect the lives, experiences, and cultures of the linguistic community. The modifications in language are natural, inevitable, and continual because they enable language users to accommodate new

ideas, values, and needs. Without its adaptable nature, language will not be an effective communication system for different communities and generations.

Transferring these ideas to the domain of "science" yields a peculiar outlook on science. Scientific theories, methods, values, and goals of science change with the fluctuating context of the scientific community. Scientific change can stem from a wide range of factors, such as the accumulation of anomalies creating the tension between tradition and innovation, alteration in the empirical questions or hypotheses, the ability to secure research funds, institutional support, and technological advancement. Basically, any personal, sociocultural, political, or technological factor that shifts the scientific community transforms science. While the "language" metaphor is unsuitable for addressing the progress of science, it remains a practical device for highlighting that change is an intrinsic part of scientific activity.

The concept of language change mapped onto the domain of "religion" indicates that the human expression of faith in the unchanging God is always changing. Christian theology, the active process of seeking an understanding of faith, doctrine, the communally authoritative teachings about faith, and practice, the outward expression of faith, evolve. Various reforms can occur as believers try to strengthen their relationship with God or respond to the challenges in their current context of living. Just like a living language, Christianity naturally and continually changes per the needs of the church. Still, it preserves its identity by adhering to the metanarrative of God's love shown in Jesus Christ. Thus, the metaphor of language change explains how Christianity maintains the continuity of its tradition in the ever-changing world without resorting to essentialistic presuppositions.

In addition to the benefits of depicting change in science and religion, the notion of language change also offers valuable insight into the relationship between science and religion. Given that science and religion change through time, the historical context becomes a critical issue in analysing the interaction between the two. For instance, if someone asserts that science

and religion are in conflict, the argument may be valid for that particular period but may not be applicable in other situations. Moreover, the lack of historical sensitivity when exploring the science-religion relationship runs the risk of artificial abstractions of science and religion and anachronistic assumptions. Peter Harrison attests, "It is history…that shows the settings in which human actors are at work, and that can provide unique insights into the ways in which various aspects of their lives—including the "scientific" and "religious"—are related."[449] Therefore, the metaphor of language, focusing on the issue of change, underscores the historically conditioned nature of science and religion as well as their dynamic and complex relationship.

[449] Peter Harrison, ""Science" and "Religion": Constructing the Boundaries," *The Journal of Religion* 86, no. 1 (2006): 106, https://doi.org/10.1086/497085, http://www.jstor.org/stable/10.1086/497085.

Chapter 3: Language Variation

In the past theories of the science-religion relationship, such as Ian Barbour's four-fold model, Stephen J. Gould's Non-Overlapping Magisteria (NOMA), and Peter Harrison's map-territory model, science and religion are often depicted as homogeneous entities with distinct characteristics, activities, purpose, and history. Science is described as one unified, systematic enterprise of building knowledge about the physical world. Religion is also portrayed as a system of similar behaviours and practices that relate humanity to holy, sacred, divine, or spiritual elements. However, science and religion, in reality, are heterogeneous collections of extremely diverse concepts and practices of different communities.

The term "natural science" denotes a wide range of activities. It can mean the communication of factual knowledge or potential factual knowledge about nature. It also refers to explaining and sharing procedural knowledge integral to research. Some treat science as the exchange of ideas, opinions, or beliefs. As more and more people engage in what they consider as "natural science," scientists split into different groups like the guilds in the Middle Ages that maintained specialised skills and set the quality standard. Each group of scientists uses specialised tools and approaches to investigate specific phenomena and systems. As scientists develop expertise in a particular area, they generate a unique research culture, vocabulary, and communication habits. For instance, a group of geneticists working on breast cancer, astronomers calculating the orbits of asteroids, and environmental scientists studying air pollution in China use different sets of jargons to communicate their research findings.

The situation with the term "religion" is not so different. First, there are numerous faiths in the world. The traditions, such as Christianity, Islam, Hinduism, Buddhism, Judaism, and Jainism, as well as religions of modern origin, like Jehovah's Witnesses and Scientology, and even the satirical parody of Flying Spaghetti Monster can be classified under the category of

"religion." But there are also diverse expressions and understandings within one faith tradition. For example, Islam is divided into Sunni Islam and Shia Islam, which are further separated into different schools of jurisprudences, like Hanafi, Maliki, Abuhanifa, and Ahmad ibn Hanba. The term "religion" also covers an assortment of topics, including the meaning of life, purpose, supernatural beings, and morality. Moreover, the laden word "religion" signifies multifarious religious practices, such as prayers, sermons, meditations, public services, dances, music, and feasts. Therefore, if both "science" and "religion" are characterised as discrete, uniform enterprises, the multiform understandings within these two systems are overlooked, and any discussion about the science-religion relationship is subsequently skewed and abridged.

The "language" metaphor presents a contrasting view of "science" and "religion." Rather than regarding "science" and "religion" as homogeneous entities, the "language" metaphor turns attention to the variegated forms of science and religion.

There are around 5,000 to 8,000 languages and countless subvarieties in the world today. Languages differ from one place to another, from one situation to another, from one social group to another, and from an individual to another. Nobody has the same word choice, pronunciation, tone, sentence structure, and conventions of language use.

In linguistics, there are some categories to classify the varieties of language. The word *dialect* refers to a language variant associated with the characteristic or identity of the users of that language. A dialect can signal information such as age, ethnic group, or sociocultural group membership. Another major category for accounting linguistic variety is *register*. This term represents a use-based variant that points to the situation type where the language is used. The specific form of language used during a church sermon or business accounting are examples of registers. Another related word, *style*, is used primarily to discuss the differences in formality and reflects aesthetic preference, not function or context. The term "genre" refers to a language

variant associated with conventional, culturally recognised structures. It is affected by an external, non-linguistic factor such as intended audience and purpose.

Under the "language" metaphor, the varieties of science are treated as specialised discourses based on different disciplines. For example, biology is a technical discourse about life and living organisms, chemistry is a specialised discourse about elements and compounds, and physics is a specialised discourse about matter, motion, energy, and force. Since the diversification in science is associated with a particular area of subject matter, research, and training, each specialised discourse can be seen as a *register* of scientific language.

Different religions, through the lens of language, appear as distinct languages. Each religion comprises a separate community of believers and different sets of terms, beliefs, practices, and worldviews. As a result, people with divergent religious views face a language barrier to communication. In the case of one particular religion, individual denominations are considered *dialects* because each denominational community adheres to the general Christian language but also adopts specific terms and worship patterns that mark its distinct identity.

This chapter serves as another test for the tenacity of the "language" metaphor, which employs the concept of language variation to represent "science," "religion," and their relationship. I begin by identifying the notions of dialect and register as two points of correspondence in the domain of "language." Then, I map these concepts onto the fields of "science" and "religion." During the comparison process, I argue that the diverse specialised discourses of each scientific discipline are scientific registers that depend on the context of the study. In the case of "religion," I propose that the distinct discourses of Christian denominations are dialects reflecting the unique theology, practice, and identity of the ecclesiastical community. By accounting for the diversities of science and religion, the "language" metaphor also sheds light on the complex and multiform relationship between science and religion.

1. Varieties of Language

Any language used de facto by various linguistic communities has diverse varieties. Consider the English language used in the United Kingdom. It is erroneous to assert that the British people speak a single, unified "British English" because the patterns of pronunciation, vocabulary, grammar, and pragmatics that the different communities across the UK use vary greatly. Instead, it is more accurate to say that Britons speak a particular variety of English. For instance, many Scots speak Scottish English, the majority of Welsh people speak Welsh English, those who live in Birmingham speak Brummie, and announcers use Received Pronunciation. Like English, any language in the world is actually a family of related language varieties.

A language is diversified when speakers of the same language are separated and geographically or socially isolated over time. As the members of the isolated speech community talk to one another, their language naturally evolves to fit their needs and reflect their culture. The final product of the accumulation of linguistic innovations is a new language variant, often called either a "dialect" or a "register," depending on what factor leads to language diversification.

1.1 What is a dialect?

The term "dialect" refers to a subordinate variety of a language that is marked off from others by distinguishable linguistic features and used by a particular linguistic community. For example, American English, Australian English, African English, and Scottish English are various dialects of the English language. A *standard dialect* is an idealised variety supported by institutions. The variety is recognised by the government, taught in schools, and used in the mass media as the "correct" form of a language. The standard dialect is usually dominant and

given greater prestige than other varieties. A dialect shared among a group of people contrasts with the term *idiolect,* which refers to a unique variety of language of an individual speaker.

Since dialect is a specific form of language employed by a specific linguistic community, any variable that characterises the community—such as geographical area, social class, ethnicity, gender, and age—shapes a dialect. A distinct form of a language often associated with a particular geographical location is known as a regional dialect or *regiolect*. A variety related to an individual social group or social class is called *sociolect.* In the UK, around the 1920s, Standard British English or the Queen's English was the sociolect for the best educated and most prestigious members of English society, whereas the Cockney dialect was the variety of English associated with working-class Londoners.[450] The ethnicity-based language varieties, often called *ethnolect,* are formed by societal expectations regarding appropriate ways of speaking for different ethnic groups. Some examples of ethnolects are Māori English in New Zealand, Chicano English and African American Vernacular English in the United States. Gender and age are also variables of dialect. Studies in many English-speaking communities show that women tend to use Standard English more than men.[451] Furthermore, young children, teenagers, and the elderly tend to use non-standard or vernacular forms, whereas middle-aged people speak the standard form more frequently.[452]

When a language is diversified, the specific variant can be classified as either a dialect or another distinct language. The commonly cited criterion determining a variety as a dialect or another language is *mutual intelligibility,* where the speakers of different dialects understand each other to some degree because the two types are similar linguistically. However, there are some problems using mutual intelligibility as a yardstick. First, one's exposure to various ways

[450] Ronald Wardhaugh and Janet M. Fuller, *An Introduction to Sociolinguistics*, Seventh ed., Blackwell Textbooks in Linguistics, (West Sussex, England: John Wiley & Sons, 2015), 40-41.
[451] Fasold and Connor-Linton, "Introduction," 339.
[452] Janet Holmes and Nick Wilson, *An Introduction to Sociolinguistics*, 5th ed., Learning About Language, (London; New York, NY: Routledge, 2017), 186.

of speaking affects their understanding of another language or dialect.[453] Second, some dialects are not mutually intelligible, while some languages are mutually intelligible. For instance, Cantonese and Mandarin Chinese are linguistically different and are not mutually intelligible, but the speakers of these two varieties consider themselves to be speaking the same language, Chinese.[454] In contrast, Swedish, Danish, and Norwegian are different languages but are linguistically similar and mutually intelligible. Third, the relations between the varieties of language change over time. In other words, some dialects can become separate languages over time, and some languages can merge and become different dialects. For example, after the dissolution of the former Yugoslavia, the dialects of Serbo-Croatian became separate languages called Serbian, Croatian, Bosnian, and Montenegrin. Another difficulty is due to a *dialect continuum,* which is a spread of dialects and languages spoken across social and geographical space and time. Since neighbouring varieties share many similarities, it is difficult to draw a line demarcating the end of one language and the start of another one. Therefore, labelling a variant as a "dialect" or a "language" is an arbitrary process governed by various linguistic, historical, political, social, and geographical factors. As the facetious adage popularised by the sociolinguist Max Weinreich goes, a language is a dialect with an army and a navy.

1.2 What is a register?

The term *register* has both narrow and broad definitions. In a narrow sense, a register means the specific vocabulary associated with different occupational groups. The working definition of a register used throughout this chapter is a language variety typically used in a particular situation.[455] When people participate in recurrent communication situations, they tend to

[453] Wardhaugh and Fuller, *An Introduction to Sociolinguistics*, 29.
[454] Fasold and Connor-Linton, "Introduction," 323.
[455] Michael. A. K. Halliday, *Language as Social Semiotic: The Social Interpretation of Language and Meaning* (London: Edward Arnold, 1978), 111.

develop similar patterns of phonology, lexicon, syntax, and pragmatics. The set of language items, such as jargon and intonation, that becomes identified with a distinct context of utterance marks a register. The linguistic features of a register are functional, meaning they are well suited to meet the communicative purposes and demands of a specific situation of the register. Some examples of the register are the language of auctioneers, sports commentators, airline pilots, the language of the courtroom, baby-talk, and journalese.

According to the linguist Michael Halliday, a register features three variables—*field*, *tenor*, and *mode*.[456] "Field" refers to the content or subject matter of communication. It describes what is happening in a given situation. For example, the register required to explain the mitosis process will differ from the register for explaining the Second World War. "Tenor" depends on the participants' status, roles, and relationships. Doctor-patient, lawyer-client, parent-child, and teacher-student are examples of the tenor. "Mode" is about the channel or medium of communication used, such as a letter, academic article, short story, and friendly conversation. To summarise, the field describes *what* and *why* the communication takes place, the tenor is about *whom* the speaker is addressing, and the mode refers to *how* the communicative act occurs in a particular situation.[457] Halliday argues that any combination of these contextual variables creates the register of a situation.

In sociolinguistics, the notion of a register is distinguished from the notion of dialect. Registers are variations according to the context of *use,* but dialects are variations according to the *users.* A register is what a person is speaking, determined by what they are doing at the place/time, whereas a dialect is what a person speaks habitually, determined by who he or she is.[458] Registers depend on factors that change the situation, such as the topic of discussion and

[456] Ibid., 33.
[457] Richard A. Hudson, *Sociolinguistics*, 2nd ed., Cambridge Textbooks in Linguistics, (Cambridge: Cambridge University Press, 1996), 46.
[458] Norbert Dittmar, "Register," in *Variation and Change: Pragmatic Perspectives*, ed. Mirjam Fried, Jan-Ola Östman, and Jef Verschueren (Amsterdam; Philadelphia, PA: John Benjamins Pub. Company, 2010), 226-27.

the personal relationship between participants. In contrast, dialects are governed by variables affecting the speaker, like geography and social class.

In conclusion, a language has countless variations with unique linguistic features. One category of classifying linguistic variation is using the concept of dialect and analysing the speaker's characteristics. Another method is using the idea of register and identifying the specific situation of discourse. Regardless of how language varieties are organised or labelled, all varieties are equally correct, systematic in their use, and meaningful.

2. Varieties of Science

In the field of science, the 7.8 million full-time scientists explore a wide breadth and depth of subjects, including the Big Bang theory, black hole, supernova, organic farming, cloning, rainforest conservation, invasive species, virus, polymer, carbon dating, acid rain, and wave-particle duality. The research around these subjects involves unique sets of theories, hypotheses, models, instruments, laboratory settings, and goals. Markedly diverse conversations occur in different departments, discipline-specific journals, and subject-focused meetings. Thus, it is an oversight to regard "science" as a homogeneous system.

In the 21st century, the diversification and specialisation of science are inevitable phenomena. As natural science matures, the amount of information is too large for any scientist to master.[459] Consequently, scientists focus on a particular area of study and try to become an expert in a narrow field of research. As more scientists are recruited to work on a specific subject, they form a subject-specific community that shares information and sets a common standard while competing for recognition and resources. Sometimes, a group of scientists break

[459] Arturo Casadevall and Ferric C. Fang, "Specialized Science," *Infection and Immunity* 82, no. 4 (2014): 1355, https://doi.org/10.1128/IAI.01530-13.

away and pursue research on novel or unexplored subject matter, leading to the expansion of science.

The specialised intellectual areas that different research groups occupy are often referred to as the "scientific disciplines" or the "branches of science."[460] Some major scientific disciplines are physics, chemistry, biology, earth science, and astronomy. These branches can be further divided into narrower fields, such as nuclear physics, organic chemistry, microbiology, climatology, and astrogeology.

Traditionally, the term "scientific discipline" denotes a particular area of inquiry in science. For instance, physics deals with the basic principles and mathematical laws that explain matter and the interactions between the fundamental constituents of the universe, such as energy, force, motion, and time; astrophysics is the study of the physical nature of stars and other celestial objects using theories and methods from physics. These areas of inquiry consist of specific research problems, specialised procedures, solutions, and goals. For example, when biophysicists experiment on the cytoplasmic membrane, their goals and methods guided by their discipline contrast those of biochemists or molecular biologists. The biophysicists emphasise identifying and characterising the physical forces and energies that enable membrane transport, membrane fusion, protein clustering, and signal transduction.[461] They also use special instruments, such as electron microscopy and X-ray crystallography, to determine the energy of stabilisation of the phospholipid membrane, the surface tension, or the equilibrium potential.

[460] Scientific disciplines can be regarded as a type of academic disciplines characterised by Armin Krishnan as having a particular object of research, a body of accumulated specialist knowledge, theories and concepts, specific terminologies or technical language, specific research methods, and some institutional manifestation. Armin Krishnan, "What Are Academic Disciplines? Some Observations on the Disciplinarity Vs. Interdisciplinarity Debate," in *ESRC Working Paper* (Southampton: National Centre for Research Methods, University of Southampton, 2009).
[461] Joshua Zimmerberg, "Membrane Biophysics," *Current Biology* 16, no. 8 (2006), https://doi.org/10.1016/j.cub.2006.03.050.

The notion of scientific discipline represents the conceptual organisation of scientific knowledge and methods and alludes to the discipline community. According to Rudolf Stichweh, a discipline community exhibits the following characteristics: "the existence of common values, degrees of personal acquaintance, tacit knowledge of problem-solving techniques that can be transferred only interactionally from one person to another, and tacit divisions of labour or competitive relationships that are possible because each knows the problems being researched by others."[462] The members of the discipline community establish a common frame of reference in determining the significance of discoveries and theories in science. They evaluate the quality of research by examining the originality, generalisability, coherency, consistency, accessibility, communicability, conformity to research standards, and research implications.[463] The members also set up codes of ethics, guidelines, and standards of professional behaviour related to authorship practices, data acquisition and management, data sharing, reporting research findings, training and mentorship, peer review, research involving human subjects or animals, conflict of interest, treatment of confidential information, and misconduct.[464]

A concrete example of a discipline community is the university department. Most academic institutions are arranged around clusters of similar disciplines that share some intellectual goals, research methods, or other values. For example, chemistry, physics, and biology are grouped under the division of natural sciences, while philosophy and history are in the humanities division. The members of the academic department community include

[462] Rudolf Stichweh, "The Sociology of Scientific Disciplines: On the Genesis and Stability of the Disciplinary Structure of Modern Science," *Science in Context* 5, no. 1 (1992): 9, https://doi.org/10.1017/S0269889700001071.
[463] Pär Mårtensson et al., "Evaluating Research: A Multidisciplinary Approach to Assessing Research Practice and Quality," *Research Policy* 45, no. 3 (2016), http://www.sciencedirect.com/science/article/pii/S0048733315001845.
[464] Engineering National Academies of Sciences, Medicine, "Identifying and Promoting Best Practices for Research Integrity," in *Fostering Integrity in Research* (Washington, DC: The National Academies Press, 2017), 180.

academic staff, graduate students, and undergraduate students. The faculty members of a department are specialists in a particular area of study and have undergone rigorous training to earn such status. They perform a wide variety of roles, including conducting experiments, publishing research findings, giving lectures, planning the academic curriculum, and acting as a peer reviewer. Graduate students are channelled into narrow subject areas as they conduct research under the supervision of mentors, attend workshops and conferences, and publish journal articles. Undergraduate students learn discipline-specific research practices and procedures by reading textbooks and lab manuals, participating in discussions, attending lectures, and working in labs. The discipline communities organised around different university departments of natural sciences play an essential role in sustaining their unique principles and traditions.

Each scientific discipline also relates to a political structure. The scientists in each field are perceived to be experts producing specialised knowledge. They exercise organisational and bureaucratic forms of control and regulate the market relations between consumers and producers of knowledge.[465] Within each discipline, those that hold leadership positions, like the research directors or the department chairs, are usually assigned to allocate funding, set forth general policy, make administrative decisions, and review the outputs in publications. Moreover, the academic departments assume the power to make decisions on employment, tenure, and faculty promotion.

In addition, the term "scientific discipline" pertains to professionalism. According to Harald Mieg and Julia Evetts, each discipline shapes the scientists' professional identity "by means of shared educational backgrounds, professional training, and vocational experiences, and by the membership of professional associations (local, regional, national, and international)

[465] Timothy Lenoir, "The Discipline of Nature and the Nature of Disciplines," in *Knowledges: Historical and Critical Studies in Disciplinarity*, ed. Ellen Messer-Davidow, David R. Shumway, and David Sylvan (University Press of Virginia, 1993), 47.

and institutes where practitioners develop and maintain shared work cultures and common value."[466] Interestingly, the scientists feel more committed to the discipline than to the department or institution they are a part of. As autonomous, self-regulating systems, the scientific disciplines allocate privileges by setting up hierarchies of experts and amateurs and rewarding intellectual achievements.[467] Unfortunately, there are occasions of scientific misconduct due to the pressure to produce significant scientific research in order to gain fame and professional recognition.[468]

Overall, the different scientific disciplines, such as biology, physics, chemistry, and astronomy, represent the varieties of natural science. They denote not only the organisational units of specialised knowledge but also the social institutions that establish the discipline-specific paradigm, structure claims on resources, and allocate privileges and responsibilities of expertise.[469] They are the carriers of distinct scientific endeavours embodied in research groups, university departments, scientific journals, textbooks, lab manuals, research committees, and professional societies. Ultimately, disciplines define and are defined by their intellectual niche and associated practices.

2.1 Scientific disciplines as different registers

The sheer diversity of disciplines in science can correlate to the notion of "registers" in language. According to the "language" metaphor, science is the system of discourse by the scientific community to build and organise knowledge of the physical world. Then, the scientific disciplines are specialised discourses used to exchange information about a particular subject. While preserving the general traits of the scientific language, such as clarity,

[466] Harald A. Mieg and Julia Evetts, "Professionalism, Science, and Expert Roles: A Social Perspective," in *The Cambridge Handbook of Expertise and Expert Performance*, ed. A. Mark Williams et al., Cambridge Handbooks in Psychology (Cambridge: Cambridge University Press, 2018), 130.
[467] Lenoir, "The Discipline of Nature," 46-47.
[468] Mieg and Evetts, "Professionalism, Science, and Expert Roles," 137.
[469] Lenoir, "The Discipline of Nature," 58.

conciseness, accuracy, objectivity, and information-orientedness, the language of each scientific discipline is customised to address discipline-specific problem-solutions, concepts, and norms. The members of the scientific field devise jargon and phrases to point out the technical information within their areas of intellectual pursuit. For instance, biologists use terms such as epitope, extremophile, SNARE, flagellum, *Panthera leo*, selective breeding;[470] chemists often employ words like mole, exothermic, acid anhydride, alkaline, noble gas, oxidation, isomer; physicists' language includes specialised vocabularies like momentum, quark, quantum wave function, angular frequency, black body, and meson. They also exhibit different preferences for non-linguistic semiotic resources like images, photos, diagrams, charts, mathematical formulas, models, and graphs to transmit information. The abundance of formal and informal communication channels dedicated to a narrow research field further promotes the maturation of the scientific register. For instance, journals such as Neuron, Journal of Neuroscience, Annual Review of Neuroscience, and Nature Neuroscience act as a platform for neuroscientists to develop and advance the neuroscience-specific language variety.

The different scientific disciplines are regarded as registers instead of dialects because the language of a scientific discipline is associated with a particular context of scientific practice. The differential language patterns emerge due to the distinct intellectual territory rather than some characteristics of the disciplinary community, like gender, education, or class. The scientific disciplines are not offering different ways of saying the same thing about nature but providing approaches to discussing specific, limited aspects of the natural world. Given the "use-based" or functional variations of scientific language, the scientific disciplines are the registers of science.

[470] Jenna M. Zukswert, Megan K. Barker, and Lisa McDonnell, "Identifying Troublesome Jargon in Biology: Discrepancies between Student Performance and Perceived Understanding," *CBE—Life Sciences Education* 18, no. 1 (2019), https://doi.org/10.1187/cbe.17-07-0118.

There are many benefits to connoting science diversity using the linguistic concept of "registers." First, register depicts both conceptual and practical aspects of scientific disciplines. A register is not only an abstract system of communication but also the act of discourse in a situation type. By referring to scientific disciplines as registers of science, it is possible to highlight that they are collections of specialised scientific knowledge as well as the activities of identifying problems, doing research, and regulating the production and consumption of knowledge. Therefore, comparing scientific fields to registers enables a more holistic view of the scientific disciplines.

Second, the "register" concept underscores the role of the context in diversifying the language of science. A new register emerges when a speech community tailors its language to communicate in recurring situations. In science, a discipline is formed when a specific context gathers a group of scientists to engage in specialised knowledge-seeking activities. In the case of molecular biology, a shift in the intellectual, social, and technological context created the ground for the emergence of its register.

Around the 1940s, some geneticists and biochemists began to recognise the need for an in-depth study of the nature of genes, their mechanisms of action, and their role in protein and enzyme synthesis.[471] Consequently, small groups of researchers from diverse disciplines came together to explore the uncharted territory concerning the molecular basis of biological processes. For example, the Phage Group, a set of scientists coalesced around Max Delbrück, Salvador Luria, and Alfred Hershey, investigated the relationship between genes and proteins using bacteriophages of *E. coli*.[472] The early development of technologies, such as X-ray crystallography, electrophoresis, paper chromatography, and nucleic acid sequencing,

[471] Michel Morange, *A History of Molecular Biology*, Molecular Biology, (Cambridge, MA; London: Harvard University Press, 1998).
[472] Nicholas C. Mullins, "The Development of a Scientific Specialty: The Phage Group and the Origins of Molecular Biology," *Minerva* 10, no. 1 (Jan 1, 1972), https://doi.org/10.1007/BF01881390; Eric C. Keen, "A Century of Phage Research: Bacteriophages and the Shaping of Modern Biology," *BioEssays* 37, no. 1 (2015): 3, https://doi.org/10.1002/bies.201400152, https://pubmed.ncbi.nlm.nih.gov/25521633.

followed by the inventions of polymerase chain reaction, provided the tools to pursue research at the molecular level.[473]

A more recent example of green chemistry also illustrates how a new research context leads to the expansion of science. According to Jan Linthorst, the US Environmental Protection Agency (US EPA), founded in 1970, and the Pollution Prevention Act of 1990 introduced an original opportunity for scientists to work on the safe and sustainable design of chemical products and processes by encouraging networking between chemists, chemical industry representatives, and government officials, allocating funding for sustainable chemistry research, rewarding accomplishments in pollution prevention, and setting up journals and other communication networks specific to green chemistry.[474] As more scientists devoted themselves to research in this area, they customised the general scientific language to address their particular problem-solutions, complex concepts, norms, and research culture. Thus, the development of a specific research context focusing on engineering earth-friendly chemistry led to the formation of green chemistry as a stand-alone scientific discipline. As shown in the examples of molecular biology and green chemistry, the register analysis underscores the intellectual, social, political, and economic factors affecting the heterogeneity of science.

Third, "register" helps understand the borders and interactions of diverse disciplines. The register model presents each branch of science as a language variant superimposed on a particular reoccurring context (see **Figure 18**). Since the register of each scientific discipline responds to its environment, there is no permanent boundary demarcating what lies inside or outside the discipline. In other words, a scientific discipline can easily absorb new information

[473] Alexander Powell et al., "Disciplinary Baptisms: A Comparison of the Naming Stories of Genetics, Molecular Biology, Genomics, and Systems Biology," *History and Philosophy of the Life Sciences* 29, no. 1 (2007): 11, http://www.jstor.org/stable/23334194.
[474] J. A. Linthorst, "An Overview: Origins and Development of Green Chemistry," *Foundations of Chemistry* 12, no. 1 (Apr 2010), https://doi.org/10.1007/s10698-009-9079-4.

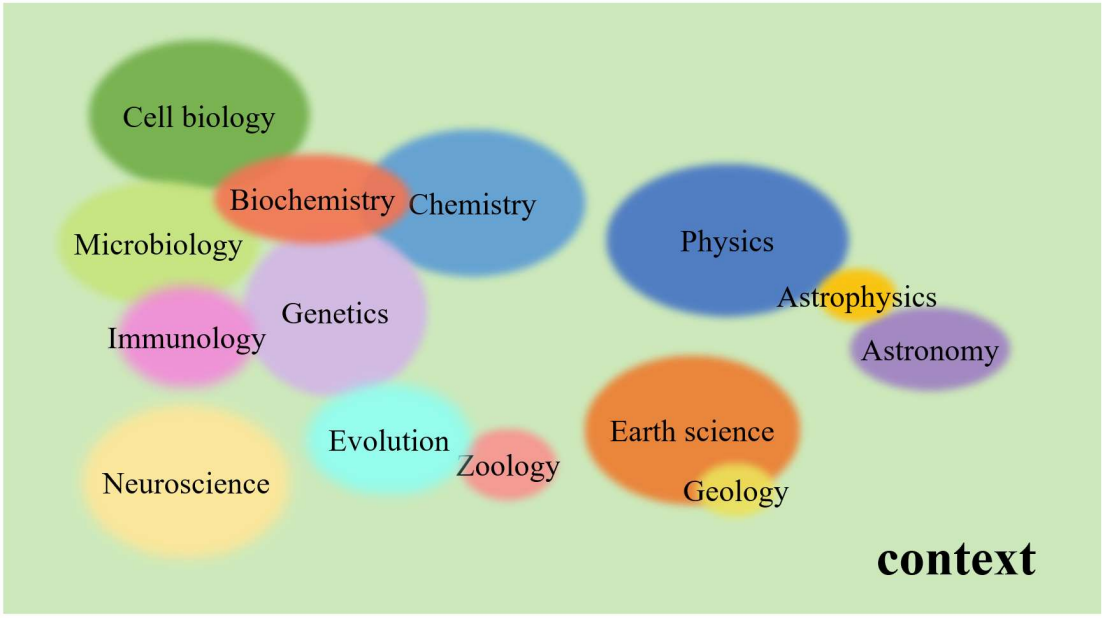

Figure 18: An illustration of scientific registers arising from their research context[475]

and dismiss obsolete or falsified data from its body of specialised scientific knowledge. In addition, scientific disciplines are spread across the broad context of natural science. The neighbouring specialties uphold similar theories, methods, concepts, and jargon, while the disciplines intellectually distanced apart support vastly different scientific paradigms. For example, the interdisciplinary field of biochemistry shares many concepts, specialised vocabulary, and research techniques with biology and chemistry. On the contrary, there are far fewer commonalities between biochemistry and astrophysics. As a result, biologists and chemists experience no challenge in understanding the register of biochemistry, but astrophysicists may face some difficulties communicating with biochemists. Hence, seeing scientific disciplines as different registers brings perspective to the dynamic and flexible nature of each discipline and the intricate relationships between different disciplines.

Fourth, the view of scientific discipline as registers reveals the arbitrariness in the classification of scientific disciplines and subdisciplines. The scientific disciplines with a long

[475] The size and the spatial location of each discipline are assigned arbitrarily.

history and highly prolific research activity have been traditionally identified as the main branches of science. Also, further diversifications in these branches have been identified as subdisciplines, subfields, or sub-branches. In the 21st-century context of science, where the existing disciplines change and new fields emerge continuously, the identification of a scientific field as a "discipline" or "subdiscipline" appears arbitrary. The "register" metaphor avoids the inconsistent and subjective labels of "main-" and "sub-." Each scientific discipline is a distinct register defined by a particular situation and sustained by the members of the disciplinary community. The different disciplines with some overlapping research contexts can develop similar communication patterns, but there is no hierarchical relationship between them.

In summary, science through the lens of "language" is a broad, general system of communication that includes various registers specialised in discussing a particular subject area. Each scientific register effectively transmits discipline-specific messages using jargon, complex phrases, visual representations, pragmatic skills, and communication channels germane to its discipline. It also reflects the research culture, norms, and identity of the disciplinary community and responds to its context. Considering the multiplicity of context-dependent, content-focused registers present in natural science, the term "science" denotes an assortment of diverse discourses devoted to disseminating specialised scientific knowledge.

2.2 Examples of scientific registers: microbiology, genetics, neuroscience

To give examples of the modern scientific registers, three disciplines in biological sciences—namely, microbiology, genetics, and neuroscience—are examined in detail here. First, microbiology is a variant of the scientific language used for talking about microorganisms, such as bacteria, viruses, archaea, fungi, and protozoa, and their activities. Although the Dutch textile merchant and self-taught scientist Antonie Van Leeuwenhoek first identified microorganisms using a primitive microscope in 1677, it was until the middle of the 1800s that

the context for the microbiology register emerged.[476] This new context emerged as scientists such as Louis Pasteur and Robert Koch began to debunk the extant theory of "spontaneous generation" and convincingly demonstrated that microorganisms were responsible for the fermentation of fluids, wound infection, and infectious diseases.[477] As significant forces in the fledging field of microbiology, Pasteur and Koch attracted other scientists to study the ubiquity, diversity, and abilities of microbes. According to Steven Opal, both Pasteur and Koch surrounded themselves with many brilliant and dedicated colleagues and collaborators, forming institutes and enhancing the prestige of working with microorganisms.[478] Moreover, the discoveries of various microbes and the extensive arsenal of techniques and laboratory procedures, including the isolation of pure bacterial cultures on an agar plate, autoclave, water purification device, oil immersion microscope, and staining method, enabled researchers to investigate a domain of phenomena that were previously unobservable or unknown and contributed to the maturation of microbiology as a register. In the 20th century, the developments of related disciplines such as genetics and biochemistry, as well as the advances in microscopes and microscopic techniques, expanded the scope of observation and knowledge of microorganisms.

The register of microbiology has distinct jargon and channels of communication. The lexicon of microbiology includes abiotic, biotic, aerobe, anaerobe, antibiotic, probiotic, procaryote, eukaryote, microbiome, microbiota, monotrichous, pathogen, *Bacilius subtilis, Caenorhabditis elegans, Escherichia coli,* microscope, agar, colony, culture, slide, sterilization, sanitization, and quorum sensing. These terms act as markers for the microbiology register. The researchers, who use this language variant, publish their research in interdisciplinary journals, such as *Nature, Science, PNAS,* or journals delineated by phylogenetic boundaries,

[476] Steven M. Opal, "A Brief History of Microbiology and Immunology," *Vaccines: A Biography* (2009), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7176178/.
[477] Ibid., 40.
[478] Ibid., 40-45.

like *Journal of Virology, Journal of Bacteriology,* and *Eukaryotic Cell,* or those focusing on a specific microbe, such as *Tuberculosis* and *AIDS.* Although these communication channels flourish with microbe-based specialisation, Arthur Casadevall and Ferric Fang caution that they can promote increasingly arcane nomenclature and impede interdisciplinary communication.[479] Overall, the microbe-based research context sustains the microbiology register.

Genetics is the language used explicitly for discussing biologically inherited traits. Similar to microbiology, the register of genetics did not form when Gregor Mendel, the Austrian monk, discovered certain patterns of genetic inheritance in 1866. The field of genetics emerged at the beginning of the 20th century when Mendel's laws were rediscovered. Practitioners from a wide range of disciplines, including cytology, botany, and eugenics, saw new opportunities and began to explore the issue of heredity. As they made discoveries and fuelled the proliferation of sophisticated research instruments, they laid out the grounds for creating the language of genetics. For example, William Bateson, a biologist at the University of Cambridge, investigated the implications of Mendel's work for theories of evolution and called the study of heredity "genetics" in 1905.[480] The Danish Botanist Wilhelm Johannsen, who also worked to uncover the mechanism of natural selection, coined the terms gene, genotype, and phenotype in 1909.[481] In 1911, Thomas Hunt Morgan and his students at Columbia University, the so-called "Drosophila group," demonstrated that the chromosomes are the physical basis of the genetic material and developed the technique of linkage mapping.[482] In 1918, R. A. Fisher indicated that Darwinian evolution is compatible with Mendelian inheritance. By the early 1930s, the context of research and the discipline community for genetics were firmly established.

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[479] Casadevall and Fang, "Specialized Science," 1359.
[480] Marion Vorms, "The Birth of Classical Genetics as the Junction of Two Disciplines: Conceptual Change as Representational Change," *Studies in History and Philosophy of Science Part A* 48 (2014): 106.
[481] Nils Roll-Hansen, "Commentary: Wilhelm Johannsen and the Problem of Heredity at the Turn of the 19th Century," *International Journal of Epidemiology* 43, no. 4 (2014), https://doi.org/10.1093/ije/dyu066.
[482] Vorms, "The Birth of Classical Genetics," 108.

The register of genetics continued to develop and flourish with the discovery of the structure of the chromosome in the 1940s and the double-helical structure of DNA in the 1950s.[483] In the early 1960s, researchers established that genes are transcribed into messenger RNA and then translated to proteins. In the 1970s and 1980s, the invention of various techniques and devices such as gene cloning, gene sequencing, RNA splicing, DNA fingerprinting, polymerase chain reaction, and Southern blot expanded the context of research and the scope of questions to be investigated by the disciplinary community. The advancements in comprehending the structure, organisation, and function of genetic material and the rules governing their transmission continue today. The driving force behind these scientific developments is the local and global alliance of scientists sharing ideas, information, techniques, and methods using the register of genetics.

The language of genetics allows the discussion of various topics related to genes, including, but not limited to, its chemical composition, structure, variation, mutation, expression, regulation, and transmission. It accommodates the dense technical content with jargon and discipline-specific expressions. For example, key terms like gene, allele, locus, DNA (deoxyribonucleic acid), RNA, chromosome, genotype, phenotype, carrier, codon, DNA polymerase, haploid, diploid, telomere, DNA microarray, Fluorescence *in situ* hybridisation (FISH), gene mapping, gene blotting, and cloning commonly occupy the field of the genetics register. The genetics discourse usually occurs within the expert community that shares similar cultural norms. Scientific journals such as *Nature Genetics, Nature Review Genetics, Genome Biology, Genome Research,* and *Nucleic Acids Research* facilitate the interchange of knowledge in genetics. Besides journal articles, reviews, textbooks, conference presentations, and meetings constitute alternative modes of the genetics register. Sometimes, geneticists

[483] Petter Portin and Adam Wilkins, "The Evolving Definition of the Term "Gene"," *Genetics* 205, no. 4 (2017): 267-88, https://doi.org/10.1534/genetics.116.196956.

transmit information to novice learners, such as undergraduate students and public non-specialists. In these situations, the frequency of the precise jargon used decreases, and the generalised version loses the unique flavour of the genetics register.

The register of neuroscience is another variant of the scientific language explicitly used for discussing knowledge related to the nervous system. The recognition of neuroscience as a discrete discipline is a recent phenomenon beginning in the mid-late 20th century.[484] Before the appearance of "modern neuroscience," several landmark discoveries and developments in research techniques from the late 18th to the mid-20th century paved the way. In 1791, Luigi Galvani introduced the concept of electrical excitability in nerve and muscle cells. In the 19th century, Franz Gall, César Legallois, and Jean Pierre Flourens explored how different areas of the brain are responsible for various functions, and empirical studies of patients with brain lesions corroborated the localisation of function. Using the silver staining procedure, Santiago Ramon y Cajal saw the sections of the brain under a light microscope and postulated that the nervous system is made up of discrete individual cells called neurons.[485] Also, a group of scientists, including Rudolf Virchow, Theodor Schwann, Heinrich Müller, Friedrich Merkel, and Jacob Henle, discovered glial cells that support neurons.[486] In the early 20th century, Julius Bernstein, Louis Lapicque, Keith Lucas, and Edgar Adrian explained the physiology of nerve impulses using the concepts of resting potential, threshold, ionic conductance, and the all-or-none principle. [487] Henry Dale and his lifelong friend Otto Loewi discovered

[484] W. Maxwell Cowan, Donald H. Harter, and Eric R. Kandel, "The Emergence of Modern Neuroscience: Some Implications for Neurology and Psychiatry," *Annual Review of Neuroscience* 23, no. 1 (2000), https://doi.org/10.1146/annurev.neuro.23.1.343.
[485] Larry W. Swanson, "Basic Plan of the Nervous System," in *Fundamental Neuroscience*, ed. Larry R. Squire et al. (San Diego, CA: Academic Press, 2013), 16.
[486] Helmut Kettenmann and Nicholas Wade, "A Short History of European Neuroscience - from the Late 18th to the Mid 20th Century," *FENS News*, February 25 2014, https://www.fens.org/Global/Online%20History%20Projects/Short%20History%20of%20European%20Neuroscience.pdf.
[487] Andrew P. Wickens, *A History of the Brain: From Stone Age Surgery to Modern Neuroscience* (London: Psychology Press, Taylor & Francis Group, 2015).

neurotransmitters.[488] While there were rapid improvements in understanding the structure of the nervous system and the manner of communication within it during this period, the research on the nervous system was localised in laboratories and scattered over various independent, long-established disciplines like anatomy, biochemistry, neurology, physiology, pharmacology, and behaviour.[489]

Around the 1950s and 1960s, scientists began to recognise the need to establish a unified discipline that offers a multidisciplinary approach to understanding the biology of the brain and its control of behaviour. Given the fast-changing research landscape due to new findings and technologies, scientists first sought to form global, national, and local institutes that facilitate communication, promote interdisciplinary research, and secure funding. For example, the International Brain Research Organization was founded under the auspice of UNESCO in 1960, the Brain Research Association in the United Kingdom and the European Brain and Behaviour Society were established in 1968, and the National Academy of Sciences-National Research Council in the United States authorised the formation of the Society for Neuroscience in 1969. Moreover, individuals such as David McKenzie Rioch and Frank Schmitt helped organise research programs that brought together specialists from various fields to pursue a common interest in understanding the brain. James McGaugh and Steven Kuffler encouraged the establishment of the department of neuroscience in universities.[490] Thus, the creation of tangible institutions allowed researchers and medical professionals to transcend traditional disciplinary boundaries and collaborate to study the nervous system.

The neuroscience register naturally emerged as researchers devised a coherent and precise way of communicating the ever-increasing complexity of the field. In the 1970s, the publishing of journals, such as the *Annual Review of Neuroscience* and *Neuroscience,* provided

[488] Ibid., 299, 303.
[489] Cowan, Harter, and Kandel, "The Emergence of Modern Neuroscience."
[490] Ibid., 345-47.

the platform for communication between scientists under the common intellectual framework of neuroscience. The annual meetings and conferences hosted by various neuroscience societies also facilitated discussions among scientists of different research backgrounds. While the earlier neuroscience register had been based heavily on neuroanatomy and electrophysiology, the register in the late 20th century incorporated some features of molecular biology, cellular biology, biochemistry, and genetics and invited experts in these areas to make contributions to neurobiology.[491] For example, the knowledge of vesicle exocytosis from cell biology assisted the understanding of how the presynaptic axon terminals release neurotransmitters, and the chemical signalling pathway studied in biochemistry disclosed the various effects of neurotransmitters on the post-synaptic cells. In the 1980s, the neuroscience register again expanded its scope by absorbing techniques and experimental approaches of cognitive psychology to examine the biological bases of higher cognitive function.[492] Besides merging with other disciplines, the neuroscience register dramatically transformed with the introduction of neuroimaging technologies, which opened the door to direct observation of brain structure and cognitive activities. Some crucial techniques include computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), and single-photon emission computed tomography (SPECT), found in the 1970s and 1980s and the development of functional MRI (fMRI) in 1990. The neuroscience register today continues to develop as neuroscientists grapple with understanding the human mind emerging from the interwoven biology of genes, proteins, neurons, and circuits, as well as the neural underpinnings of complex behaviours and neurological disorders in cooperation with scientists from other disciplines.

[491] Ibid., 348-49.
[492] Ibid., 349.

Today, the register of neuroscience exhibits unique characteristics that define its identity. With regards to its lexicon, the terms relate to the brain development, structure, function, activity, and disorder, like neuron, nerve, axon, myelin sheath, synapse, frontal lobes, occipital lobes, cerebellum, corpus callosum, cortex, hemisphere, action potential, acetylcholine, neurotransmitter, consciousness, perception, plasticity, olfactory, autism spectrum disorder, and epilepsy, signify the discourse of neuroscience. Considering the interdisciplinary nature of the field, it also borrows many jargons from other scientific disciplines, including physiology, anatomy, molecular biology, cell biology, developmental biology, mathematical modelling, and cognitive science. It sustains the discourse about the nervous system at different levels, ranging from the molecular and cellular compositions of individual neurons to the brain's sensory, motor, and cognitive activities. Professional organisations, such as the Society of Neuroscience, the International Brain Research Organization, and the Federation of European Neuroscience Societies, encourage the use of the neuroscience language by holding meetings that draw attendance from many researchers, postdoctoral fellows, graduate students, undergraduates, funding agencies, publishers, businesses, and policymakers. Various national and international-level research initiatives, like the United States' Brain Initiative in 2013 and the International Brain Initiative in 2017, further grow the disciplinary community that uses the neuroscience register. Ultimately, the distinct identity of the language of neuroscience derives from a common goal of understanding how the nervous system works rather than from a set of standard methods or theories.

Having explored the history and general properties of the microbiology, genetics, and neuroscience registers, how do microbiologists, geneticists, and neuroscientists use these registers to disseminate knowledge? How are the registers similar to and different from each other? In order to offer concrete examples for exploring these questions, two research articles and a letter report from the three disciplines are selected. The first research article, titled "A

new genomic blueprint of the human gut microbiota" by Almeida et al., is from *Nature* under the subject of microbiology.[493] The second is a letter or short report from *Nature Genetics* by Bonder et al. titled "The effect of host genetics on the gut microbiome."[494] It is related to the subjects of microbial genetics, genetic linkage study, and genome-wide association studies. The third research article by Muller et al., "Microbiota modulate sympathetic neurons via a gut-brain circuit," is published in the neuroscience section of *Nature*.[495] These journal articles have a common denominator of talking about gut microorganisms. However, each assumes the distinctive linguistic flair of its field. The abstracts of the three papers are as follows:

> **"A new genomic blueprint of the human gut microbiota"**
> The composition of the human gut microbiota is linked to health and disease, but knowledge of individual microbial species is needed to decipher their biological roles. Despite extensive culturing and sequencing efforts, the complete bacterial repertoire of the human gut microbiota remains undefined. Here we identify 1,952 uncultured candidate bacterial species by reconstructing 92,143 metagenome-assembled genomes from 11,850 human gut microbiomes. These uncultured genomes substantially expand the known species repertoire of the collective human gut microbiota, with a 281% increase in phylogenetic diversity…. Our work expands the known diversity of uncultured gut bacteria, which provides unprecedented resolution for taxonomic and functional characterization of the intestinal microbiota.[496]

> **"The effect of host genetics on the gut microbiome"**
> The gut microbiome is affected by multiple factors, including genetics. In this study, we assessed the influence of host genetics on microbial species, pathways and gene ontology categories, on the basis of metagenomic sequencing in 1,514 subjects. In a genome-wide analysis, we identified associations of 9 loci with microbial taxonomies and 33 loci with microbial pathways and gene ontology terms at $P < 5 \times 10^{-8}$. Additionally, in a targeted analysis of regions involved in complex diseases, innate and adaptive immunity, or food preferences, 32 loci were identified at the suggestive level of $P < 5 \times 10^{-6}$…. Our results demonstrate the importance of understanding host–microbe interactions to gain better insight into human health.[497]

> **"Microbiota modulate sympathetic neurons via a gut-brain circuit"**
> Connections between the gut and brain monitor the intestinal tissue and its microbial and dietary content, regulating both physiological intestinal functions such as nutrient

[493] Alexandre Almeida et al., "A New Genomic Blueprint of the Human Gut Microbiota," *Nature* 568, no. 7753 (2019), https://doi.org/10.1038/s41586-019-0965-1.
[494] Marc Jan Bonder et al., "The Effect of Host Genetics on the Gut Microbiome," *Nature Genetics* 48, no. 11 (2016), https://doi.org/10.1038/ng.3663.
[495] Paul A. Muller et al., "Microbiota Modulate Sympathetic Neurons Via a Gut–Brain Circuit," *Nature* 583, no. 7816 (Jul 1, 2020), https://doi.org/10.1038/s41586-020-2474-7.
[496] Almeida et al., "A New Genomic Blueprint of the Human Gut Microbiota," 499.
[497] Bonder et al., "The Effect of Host Genetics on the Gut Microbiome," 1407.

> absorption and motility, and brain-wired feeding behaviour. It is therefore plausible that circuits exist to detect gut microorganisms and relay this information to areas of the central nervous system that, in turn, regulate gut physiology. Here we characterize the influence of the microbiota on enteric-associated neurons by combining gnotobiotic mouse models with transcriptomics, circuit-tracing methods and functional manipulations. We find that the gut microbiome modulates gut-extrinsic sympathetic neurons: microbiota depletion leads to increased expression of the neuronal transcription factor cFos, and colonization of germ-free mice with bacteria that produce short-chain fatty acids suppresses cFos expression in the gut sympathetic ganglia…. These results reveal microbiota-dependent control of gut-extrinsic sympathetic activation through a gut-brain circuit.[498]

In the three abstracts, the most striking difference is the subject of focus related to gut microorganisms. In the first article representing the field of microbiology, the main topic of discussion is the individual microbial species in the human gut. Although the authors use a metagenomic dataset to identify bacterial species, their interest lies in the phylogeny and taxonomy analysis of the intestinal microbiota. Bonder et al.'s letter published in *Nature Genetics* also compares the gene of gut microbiota using the metagenome sequencing method. However, its main focus is to identify genomic loci in humans that influence the gut microbiome. Instead of investigating the genetic diversity of microorganisms like the first article, the second concentrates on the host genome and its effect on gut microbiota. The main interest of the third article by Muller et al. is the relationship between gut microorganisms and sympathetic neurons. A research article in the neuroscience section emphasises the gut-brain-gut circuit whereby distinct gut microorganisms and microbial metabolites activate gut-projecting neurons, which then modulate systemic immunity and metabolism.

Another distinct marker of linguistic difference among the three articles is the usage of jargon. When comparing the article by Almeida et al. and Bonder et al., the papers have differential preferences for the terms "microbiota" and "microbiome." The microbiota usually refers to the community of microorganisms in a specific environment. For instance, the gut microbiota includes bacteria, fungi, viruses, protozoa, and archaea found in the gut. The

[498] Muller et al., "Microbiota Modulate Sympathetic Neurons," 441.

microbiome denotes the collection of genomes of the microorganisms in a given environment. Given the emphasis on the microorganism, the first research paper in microbiology by Almeida et al. use “microbiota” 16 times and “microbiome” seven times in the main body, excluding the bibliography.

In comparison, the second report from *Nature Genetics* focuses its discussion on the genetic material and, therefore, employs “microbiome” 27 times and “microbiota” only four times. Besides the different patterns of use of microbiome and microbiota, other keywords and phrases in the articles hint at which register the article belongs to. In the first article by Almeida et al., terms like microbial species, culturing, phylogenetic diversity, and taxonomic and functional characterisation signify the language of microbiology. In the letter by Bonder et al., expressions like gene ontology categories, genome-wide analysis, loci, P (value) $< 5 \times 10^{-8}$, and association suggest the language of genetics.

Compared to the first two articles, the term microbiota or microbiome does not take centre stage in the research paper by Muller et al. Since this article emphasises the gut-brain circuit, the main keyword is “neuron,” which appears a total of 132 times. In the abstract, various terms like enteric-associated neurons, gut-extrinsic sympathetic neurons, neuronal transcription factor cFos, sympathetic ganglia, distal intestine-projecting vagal neurons, and sympathetic premotor neurons indicate that the research relates to neuroscience.

The languages of the three research articles also reveal the contrasting methodology typifying each scientific discipline. For Almeida et al.’s article, the de novo assembly and binning technique and phylogenetic and taxonomic analyses are some standard methods used in microbiology to recover potential genomes and build microbial phylogenetic trees. The quantitative trait locus association analysis utilised by Bonder et al. is a typical strategy in genetics to explain the genetic polymorphisms influencing a quantitative trait by finding a link between genotype and phenotype. In the research conducted by Muller et al., techniques such

as cholera toxin tracing, retrograde pseudorabies virus tracing, viscerofugal anterograde tracing, and brain immunofluorescence are typically used in neuroscience research to trace and visualise a specific network of neuronal circuitries.

While the three research writings from *Nature* and *Nature Genetics* display some points of disparity, they also exhibit similarities. First, they communicate the discipline-specific information in the structure of science journal articles. Most papers in peer-reviewed journals are composed of sections, including the title, authors and affiliations, abstract, introduction, methods, results, discussion, acknowledgements, and references. In the case of three sample articles, the discussion section is sometimes omitted, and the sections that deal with technical information, such as methods, figures, tables, and additional data, are placed after the main body as part of the supplementary information published online-only.

Second, the three articles also adopt a similar tone in language. Although Nature-branded journals encourage the authors to avoid jargon and acronyms where possible to increase impact and accessibility for non-specialists, the authors of the sample articles inevitably show great reliance on many specialised terms and expressions to achieve an explicit conveyance of meaning.[499] Nevertheless, they present information in a clear, direct, logical, consistent, and concise manner by using active voice and constructing simple sentences.

Another point of similarity among authors is the importance of statistics as well as mathematical and computer modelling methods to manage data and assess the statistical significance of their results. Finally, the authors universally highlight the interdisciplinary, holistic approach to understanding the object of enquiry. For example, in the neuroscience article by Muller et al., RNA sequencing techniques and colonisation methods developed in the field of genetics and microbiology were imported to the study of a gut-brain circuit. As a

[499] Douglas Biber, *University Language: A Corpus-Based Study of Spoken and Written Registers*, Studies in Corpus Linguistics, (Amsterdam; Philadelphia, PA: J. Benjamins, 2006), 55, 164.

result, the authors are able to invite specialists in genetics and microbiology for further discussion.

Admittedly, this small sample of articles cannot represent the entire registers of microbiology, genetics, and neuroscience. However, it can still provide snapshots of the language varieties of three scientific disciplines and their relationship. The three journal articles, as one of the most prevalent modes of communication in science, show how researchers share information with their respective discipline communities. They adopt particular research procedures and present results in a way acceptable to other members of their discipline. Moreover, they use precise and consistent language using specialised terminologies to avoid ambiguity in communicating information to the intended readers. The researchers reassert their disciplinary identity by discussing a subject within the scope of their discipline, using discipline-specific terms and expressions, and adhering to the norms of their discipline community. At the same time, they attempt to expand their research context by adopting methods and approaches from other related fields to provide a more holistic understanding of their research subject. By doing so, the registers of the three papers become somewhat similar and mutually intelligible.

2.3 Further considerations

The "language" metaphor, particularly the portrayal of scientific disciplines as individual registers, is a practical scheme for examining another important aspect of the "science" domain: the tension between specialisation and interdisciplinarity. A language diversifies when it is used in different contexts by different communities. Various sociocultural factors and the community's needs create specific features at the lexical, grammatical, and pragmatical levels and alter the original version of the language. When language users only adopt one register, they are well equipped to communicate within the context of the register but may be inapt for

use in other contexts. For instance, if a young student only speaks the casual online register, they may experience difficulties writing an essay in the formal academic register. Moreover, users of different registers may misunderstand each other or observe some communication gaps. Therefore, achieving a balance between mastering a register and acquiring some knowledge of other language variants is essential for becoming an effective communicator.

A very similar phenomenon is observed in contemporary science. Today, science requires a specialised knowledge base and methods to solve diverse problems. As a result, it encourages the proliferation of scientific disciplines and subdisciplines. The disciplinary organisation of knowledge and practice leads scientists to become experts in a selective area of research. As scientists continue to work within the discipline, they narrow their field of study, use specialised vocabulary, and work with a set of theories, methods, and exemplary problem-solutions. The researchers, deeply engrossed in their area, can adapt to the normative standards of research and effectively communicate with other members of the discipline. They also experience a sense of professionalism and pride by making contributions to advance the field.[500] Other benefits include securing resources for research and belonging to a network of support and collaboration established by the discipline.

While acquiring the skills to speak the field's register entails many advantages, the restrictive activity within the discipline can be deleterious. According to Fulvio Mazzocchi, specialisation can result in a narrowing intellectual horizon and fragmentation of knowledge.[501] Other disadvantages mentioned by Casadevall and Fang are the stagnation of the discipline, promotion of group-think, monopoly of information and resources, inability to evaluate the importance and quality of work critically, and anachronistic organisational structure of academic institutions.[502] Most importantly, specialisation creates language barriers segregating

[500] Casadevall and Fang, "Specialized Science," 1355-56.
[501]Fulvio Mazzocchi, "Scientific Research Across and Beyond Disciplines," *EMBO Reports* 20, 6 (2019): 2, https://doi.org/10.15252/embr.201947682.
[502] Casadevall and Fang, "Specialized Science," 1356-58.

scientists from different disciplines. When experts from multiple branches of science come together to investigate a common issue, they may not be able to comprehend each other or engage in meaningful discourse.

To avoid the tower of Babel phenomenon due to extreme specialisation, scientists today are trying various strategies to promote communication across and beyond disciplines. Interdisciplinary interactions occur when the languages of different fields expand and have some overlaps. Researchers learn to embrace dissimilar assumptions, models, theories, methodologies, and even reasoning styles at these intersections. They also practice adjusting their language to relay information in a way that is intelligible to experts in other fields. The increasing effort to share vocabularies, questions, and communication resources with different disciplines blurs the boundary of each register and boosts mobility among researchers. The scientists actively engaged in discourse across disciplines are not losing the ability to speak their original register; instead, they are diverting energy to enlarge the scope of expression by accommodating features of other disciplinary registers. Unfortunately, some factors, such as the structures of traditional academic departments and the systems of incentives focused on rewarding advancements within the discipline, pose a challenge to interdisciplinary communication. However, by maintaining fluency in one disciplinary register and, at the same time, gaining at least elementary proficiency in other scientific registers, scientists will be able to see beyond the boundaries of the discipline and collaborate with other experts to come up with creative, innovative, and even ground-breaking solutions to complex issues.

3. Varieties of Religion

Similar to science, the term “religion” covers a wide range of beliefs and practices. Even if one specific religion—in this case, Christianity—is addressed, no single form of Christian faith can be considered the standard or representative. Since Christianity has about 2.5 billion followers

spread around the globe, it is not surprising that there are multiple communities of Christians upholding different sets of doctrines and worship styles.[503] For example, some Christians see God causing and controlling all things; others argue that God limits his control; and some claim that God does not have unilateral, coercive control of any aspect of reality. There are also various musical styles of worship, including classical, contemporary, southern gospel, choral, and acapella. Although Christians believe that all true believers are joined together as one people of God and as members of the universal body of Christ, they express their faith in various ways.

From its beginning in the first century, Christianity was not a coherent, unified movement. After Jesus' death and resurrection, his followers spread the gospel from the Eastern Mediterranean to the Roman Empire and beyond. Many early Christian centres emerged in various locations, such as Jerusalem, Galilee, Antioch, Damascus, Alexandria, Asia Minor, Caesarea, Rome, Southern Gaul, and Ethiopia. As different Christian communities tried to understand the significance of Jesus and his public ministry in their own context, they came up with diverse interpretations, often incorporating some elements from their surrounding cultures and religions. The Book of Acts offers a witness to the competing views of different communities. For example, some Jewish Christians insisted on the observance of Jewish customs and laws, such as circumcision, while other Gentile communities that adopted Paul's teachings believed that they were included in God's New Covenant even if they did not follow the Jewish religious obligations like circumcision.

In the ante-Nicene period, the Christian movement remained a highly variegated phenomenon. There were diverse groups claiming apostolic succession and adhering to different Christian doctrines, especially on the identity of Jesus Christ. During this time, the

[503] Conrad Hackett and Marcin Stonawski, *The Changing Global Religious Landscape*, Pew Research Center (2017), 8, https://www.pewforum.org/wp-content/uploads/sites/7/2017/04/FULL-REPORT-WITH-APPENDIXES-A-AND-B-APRIL-3.pdf.

divisions and diversity of Christianity were deemed as a heretical schism that threatened orthodoxy and Christian unity. In the 21st century, there is a growing number of Christian communities that are more open to embracing diverse expressions of Christian faith as authentic, contextualised representations of the truth lived out in everyday life.

Today, the main branches of Christianity include Roman Catholicism, Orthodoxy, and Protestantism. According to research conducted by Pew Research Center in 2011, about 50% of all the Christians worldwide are Catholic (1.1 billion), about 37% are Protestant (801 million), about 12% are Orthodox (260 million), and other Christian groups make up the remaining 1% (28 million).[504] These branches can further divide into more minor traditions. For instance, Orthodoxy is typically divided into two large bodies: Eastern Orthodoxy and Oriental Orthodoxy. Protestantism is further separated into distinct branches such as Anglicanism, Baptists, Calvinism, Lutheranism, and Methodism. The multiple Christian identities and communities in contemporary society are treated as diverse manifestations of God's universal, unchanging Word in time, place, and culture.

The individual Christian branches are often referred to as "denominations." This word was first used in the late seventeenth century by groups of English Presbyterian, Baptist, and Congregationalist ministers, who separated from the Church of England but remained loyal to the British state.[505] These English dissenters identified their association as "the General Body of the Ministers of the Three Denominations" in order to avoid being described with the term "sect," which implied a sense of deviant or undesirable practices.[506] In the 20th century, the American theologian H. Richard Niebuhr suggested "denomination" as an alternative category of a religious group, contrasting Max Weber and Ernst Troeltsch's "church" and "sect"

[504] Conrad Hackett and Brian J. Grim, *Global Christianity: A Report on the Size and Distribution of the World's Christian Population*, Pew Research Center (2011), 21, https://assets.pewresearch.org/wp-content/uploads/sites/11/2011/12/Christianity-fullreport-web.pdf.
[505] Kevin J. Christiano, William H. Swatos, and Peter Kivisto, *Sociology of Religion: Contemporary Developments*, Third ed. (Lanham: Rowman & Littlefield Publishers, 2016), 91-92.
[506] Ibid., 92.

typologies. According to Weber and Troeltsch's church-sect scheme, "church" refers to a hierarchical, bureaucratic religious organisation that exercises a monopoly over the truth and is closely integrated into the larger society, while "sect" is a small religious group broken away from a church usually to restore what the members regard as the original religious teaching. Similar to a church, a sect claims ownership of the truth. Furthermore, a church invites individuals at all levels of society to join and adapts to the community's needs, whereas a sect is limited to those that qualify for membership and is often hostile or indifferent to secular social order.[507] Unlike Weber and Troeltsch, Niebuhr considered "church" and "sect" not as discrete categories but as the opposite ends of a social continuum and "denomination" as the intermediate stage or the midpoint in this continuum (see **Figure 19**).[508] When a sect, which broke away from the parent group to be free from theological perversion, attracts many new members and grows, it can become more bureaucratic and evolve into a denomination. Thus, for Niebuhr, a denomination is a religious organisation with some bureaucracy and hierarchy, generally supports the established social order but not as a formal part of the state and maintains a relatively harmonious relationship with other denominations.

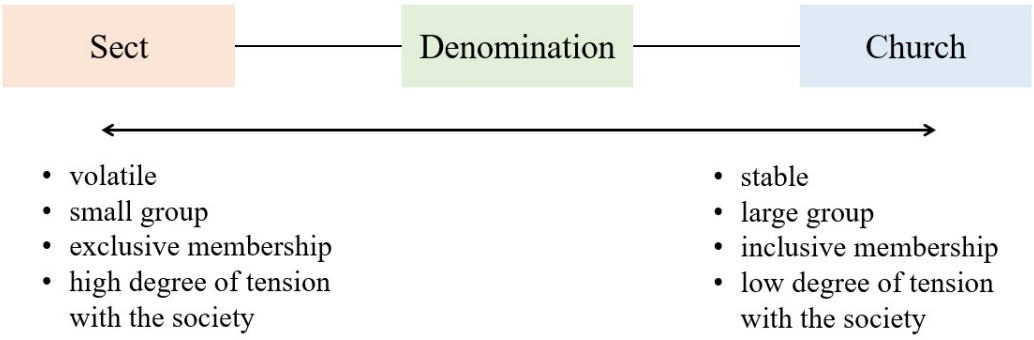

Figure 19: The sect-church continuum

The category of "denomination" is instrumental in describing various Christian churches in modern, pluralistic society. When Niebuhr introduced the concept of

[507] Ernst Troeltsch, *The Social Teaching of the Christian Churches* (New York, NY: Harper, [1912] 1960), 993.
[508] H. Richard Niebuhr, *The Social Sources of Denominationalism* (New York, NY: Meridian Books, [1929] 1957).

"denomination," he wanted to address the situation in the United States, where multiple religious groups co-exist in relatively peaceful competition.[509] Nonetheless, the term "denomination" also applies to other societies worldwide. In the 21st century, religious plurality is inevitable due to specialisation, individualism, secularisation, and multiculturalism. The established churches in countries like Greece, the United Kingdom, and the Netherlands, traditionally identified as having close unity of church and state, are losing their social influence and building ecumenical relationships with other religious communities.[510] For this reason, Inger Furseth and Pål Repstad conclude that every sizable religious community in contemporary Europe resembles a denomination.[511] The American theologian Barry Ensign-George also champions the use of "denomination" for highlighting how the human understandings of faith in different communities are "partial and fragmentary, and thus dependent and essentially connected to the wholeness of the Gospel."[512]

Unfortunately, the category of "denomination" has some drawbacks. First, the concept of the denomination cannot accommodate recent movements beyond the denominational divisions. For example, evangelicalism growing in the United States and parts of Africa, Latin America, and Asia is a transdenominational movement within Protestant Christianity built around networks of parachurch agencies rather than in a denomination or a collection of denominations.[513] There is also a rise in the nondenominational congregation. According to Roberts and Yamane, about 18% of the local churches in the United States are nondenominational.[514] Another type of organisation that does not fit into the "denomination"

[509] Ibid.
[510] Inger Furseth and Pål Repstad, *An Introduction to the Sociology of Religion: Classical and Contemporary Perspectives*, Ebook Central, (Aldershot, England; Burlington, VT: Ashgate Publishing Company, 2006), 140.
[511] Ibid.
[512] Barry Ensign-George, "Denomination as Ecclesiological Category: Sketching an Assessment," in *Denomination: Assessing an Ecclesiological Category*, ed. Paul M. Collins and Barry Ensign-George, Ecclesiological Investigations (London: T&T Clark, 2011), 3.
[513] Christian Smith, *American Evangelicalism: Embattled and Thriving* (Chicago, IL.: University of Chicago Press, 1998), 135.
[514] Keith A. Roberts and David Yamane, *Religion in Sociological Perspective*, 5th ed. (Thousand Oaks, CA; London: Pine Forge, 2012), 195.

category is the paradenominational groups and organisations established for a particular purpose. These groups operate alongside and across denominations and provide joint efforts to address social problems, such as world hunger, poverty, civil rights, and health care availability.[515] Some examples of these groups include the American Sunday School Union, YMCA, Gospel and Our Culture Network. Thus, the developments of transdenominational evangelicalism, nondenominationalism, and paradenominational groups create too many outliers for the "denomination" category.

Another objection to the denomination typology is that some Christians may be reluctant to identify their church as a "denomination." Given the strong Protestant overtone, Christians like Roman Catholics and Orthodox may consider the category of "denomination" inappropriate for describing their exclusive representation of the "one true church" commissioned by Jesus Christ. For example, the Anglican theologian Paul Avis prefers the use of "tradition" to "denomination" to describe the Anglican Communion because the former term "reflects the mystery of the Church considered as the body, the bride, the temple of Christ."[516]

Yet another critique is the exaggeration of the division of the Christian population. Under the denomination classification, each ecclesiastical body is portrayed as a separate entity with a unique set of beliefs and practices. However, some Christian groups are not entirely segregated from others.

Moreover, the ecumenical movements attempt to break down the boundaries of different denominations and merge them into one united Church. The recent efforts to join the Church of England and the Methodist Church in Britain exemplify two churches trying to unite. Therefore, the "denomination" category may not be applicable to connote the dynamic and complex interactions between Christian organisations in the contemporary, pluralistic society.

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[515] Ibid.

[516] Paul Avis, "Denomination: An Anglican Appraisal," in *Denomination: Assessing an Ecclesiological Category*, ed. Paul M. Collins and Barry Ensign-George, Ecclesiological Investigations (London: T&T Clark, 2011), 22.

3.1 Christian denominations as different dialects

Considering the drawbacks of the category of "denomination," the "language" metaphor, primarily focusing on the concept of dialect, posits an alternative tool to account for the diversities of Christianity. This religion branches into various denominations over time, like a language, split into related families of dialects. The origin of the Christian language can be traced back to Jesus of Nazareth, the incarnate Word of God. This language adopted aspects of the Jewish tradition but revolutionised them by proposing salvation by faith in Jesus Christ as the Messiah. The language spread as the followers of Jesus shared the gospel with others for many generations. When different congregations formed, the narrative of God's love for humanity demonstrated through Jesus laid the foundation of their language, but the unique beliefs, practices, and sociocultural values of the congregation were also imprinted in the language. Consequently, the specific language variant of each denomination signifies its peculiar history, doctrine, and patterns of worship.

The different Christian denominations are compared to "dialects" instead of "registers" because the language variation depends on the ecclesial communities upholding different beliefs and traditions. The vocabulary and expressions that Christians use do not differ much depending on situations like bible study, private prayer, or sermon. However, the languages of different Christian groups diverge due to contrasting doctrines and practices. Since the variation of the Christian language is determined by the features of the language users, not by the context of communication, the diversities of the Christian language are analogous to dialects.

The distinct dialect of each denomination plays a significant role in forming and maintaining its group identity. Sometimes, a Christian dialect emerges naturally and unintentionally due to geographical or social separation of the denomination. On the other hand, some dialects are intentionally created by a group of Christians breaking away from their

previous ecclesial community. These Christians invent new terms and expressions to capture their distinct traditions and mark their separate identities. Here, the dialect functions as an emblem of membership and solidarity of the new congregation.

While the dialect of each community binds its members, it can also act to distinguish and even discriminate against out-group identity. To illustrate, the Shincheonji Church of Jesus is an offshoot Christian new religious movement established by Lee Man-hee in South Korea. The members of this sect run a covert operation by attending other Protestant churches to recruit new members. One method the traditional Korean Protestants identify the disguised Shincheonji followers is to pay attention to the Shincheonji dialect. The Shincheonji members use the word "seed" to refer to the Word of God, "field" to mean one's heart, "tree" to denote a person, and "birth" to mean a soul. They also use words like "the gospel room" instead of the place for a bible study and the "father-daughter association" instead of the women's missionary group. Thus, the odd choice of vocabulary and expressions not often employed by the main Protestant denominations can give away one's identity as a Shincheonji believer.

Similar to any linguistic diversification, the division of the Christian language into denominational dialects can be ascribed to a complex mix of theological, political, and cultural factors. Consider the great schism between the Catholic Church and the Eastern Orthodox Church in the 11th century. The deterioration of the relationship between the Byzantine church and the Western church started during the preceding centuries with the increase of long-standing ecclesiastical differences and theological controversies around the issues of the procession of the Holy Spirit, the use of religious images, the use of leavened or unleavened bread, the emphasis on the divinity or humanity of Jesus Christ, and the enforcement of clerical celibacy. The political conflict regarding the Bishop of Rome's claim to universal jurisdiction and primacy over the four Eastern patriarchs aggravated the growing estrangement. The use of Latin in the Western church and Greek in the Eastern church as well as the geographical

separation caused the two churches to drift further apart. Therefore, the culmination of irreconcilable differences in doctrine, practice, ideology, language, and culture led to the institutional separation between the Orthodox Church and the Catholic Church in 1054.

What about the Protestants splintering from the Roman Catholic Church in the 16th century? Once again, a combination of religious, political, intellectual, and cultural variables led to the formation of Protestant churches. The rampant moral, financial, and administrative abuses of the Roman Catholic Church, evident in the activities like the selling of indulgences and church offices, nepotism, internal power struggles, and immoral behaviours of the clergy, created a growing demand for reform. In northern and central Europe, protesters such as Martin Luther, John Calvin, and Huldrych Zwingli commonly challenged Catholic teachings. They insisted that the Bible is the only reliable source of revelation and instruction (*sola scriptura*), and justification is by faith alone (*sola fide*). Besides the doctrinal controversies, the rise of nationalism, the erosion of papal authority, the increased literacy rate, the abundance of Protestant literature and vernacular Bibles, and the invention of the printing press all led to the fragmentation of Western Christendom into different Protestant dialects.

The emergence of a new denominational dialect can also stem from other social processes, such as racial conflict and immigration. For example, after the establishment of the Methodist Episcopal Church (MEC) in the United States in 1784, the African American Methodist congregations separated from the white-dominant MEC and founded the African Methodist Episcopal in 1816; the Methodist Episcopal Church, South divided from the MEC over the issue of slavery in 1844 and later split with the Colored Methodist Episcopal Church in 1870; and in 1939, the two historically white Methodist denominations and the Methodist Protestant Church joined to form the Methodist Church in 1939.[517] Another example is the presence of various Lutheran denominations in the United States. In the late 19th and early 20th

[517] Roberts and Yamane, *Religion in Sociological Perspective*, 188-89.

centuries, Lutheran immigrants from parts of Germany and Scandinavia formed separate ecclesial communities, Swedes established the Augustana Evangelical Lutheran Church in 1860, Danes founded the American Evangelical Lutheran Church in 1872, Finns set up the Finnish Evangelical Lutheran Church of America in 1890, and Norwegian started the Lutheran Free Church in 1897.[518] As these denominations matured over time, their theological and practical disparities became more prominent than the differences in ethnicity. From these examples, it is evident that the social aspects of race and ethnicity can contribute to the fissions and fusions of Christian dialects.

The view of a denomination as a distinct Christian dialect points to the dynamic, ongoing process of formation, deformation, and reformation within the church. Considering that a dialect is a special form of language belonging to a speech group, any changes to the linguistic community affect the dialect. The speech patterns fluctuate if the community is exposed to a new culture, interacts with different ethnic groups, or moves to another region. Likewise, Christian denominations are continually established and undergo reform due to various theological, political, and cultural reasons. In addition, linguistically akin but separate dialects can merge to become one dialect, and a single dialect can divide into multiple dialects. Similarly, some Christian denominations can join to ensure the unity of the Christian community and to break down any barriers in communication. For example, in 1968, merging the Evangelical United Brethren Church and the Methodist Church formed the United Methodist Church denomination. Thus, the comparison of Christian denominations to dialects underscores the dynamic history of denominations, which strives to communicate the gospel in a way that is relevant to the contemporary situation.

Just as adherence to a particular dialect comes from the recognition of the social meanings carried by the variation, being a part of a specific denomination implies complying

[518] Ibid., 189.

with the personal, religious, and sociocultural values of the denomination. By speaking the dialect of the denomination, one feels a sense of belonging to their religious community. For example, the users of the Catholic dialect are devoted to the beliefs, practices, and worldviews posited by the Catholic language. The Protestant dialect speakers communicate ideas, participate in communal activities, and experience a sense of shared identity through their Protestant lingo. Given all the benefits discussed thus far, the notion of "dialect" functions as an effective metaphor to illustrate the diversities of Christianity.

3.2 Examples of Christian dialects: Roman Catholicism, Eastern Orthodoxy, Baptists

Dialects are linguistic varieties that may contrast in pronunciation, grammar, vocabulary, spelling, and syntax. The diverse Christian dialects mainly differ in the lexicon, which captures each denomination's unique beliefs and practices. Just like "trainers" in British English and "sneakers" in American English denote the same thing, there are occasions where Christian dialects use different terms to convey similar ideas, concepts, or practices. On the other hand, similar to how British English and American English speakers use the same word, "braces," to mean very different objects, Christian denominations can use the same language to refer to disparate theology or activity. Among various branches of Christianity in the 21st century, three denominations—Roman Catholicism, Eastern Orthodoxy, and Baptists—are selected here to illustrate the linguistic differences.

One of the most prominent examples of Christian dialect differences is the names of Christian rites. The Roman Catholic Church calls these practices *sacraments,* whereas the Eastern Orthodox Church often uses the term *mysteries,* and the Baptist churches refer to them as *ordinances.* The three contrasting terms reflect differential theological emphases of the denominations.

For contemporary Roman Catholics, the word *sacrament* is most preferred. The term "sacrament" is derived indirectly from the Latin term *sacramentum,* which is the Vulgate rendering of the Greek word μυστήριον (*mystērion*). Although the transliteration of the Greek μυστήριον in Latin is *mysterium*, the Latin-speaking Christians during the patristic period also translated μυστήριον as *sacramentum* to emphasise the connection between the mystery of God's saving work and the administration of baptism and the sharing of bread and wine. Tertullian of Carthage compared the Christian practices of baptism, which is the outward sign of commitment and fidelity to Christ, to *sacramentum*, a Roman military term for a sacred oath of allegiance to the Roman state. Augustine of Hippo made a more detailed reflection of the term *sacramentum* to refer to the "visible forms of invisible grace" or a visible sign that points to the mystery of God of salvation in love.[519]According to the Catechism of the Catholic Church, the sacraments are defined as "efficacious signs of grace, instituted by Christ and entrusted to the Church, by which divine life is dispensed to us."[520] The Catholic Church acknowledges seven sacraments: Baptism, Confirmation (or Chrismation), the Eucharist, Penance, the Anointing of the Sick, Holy Orders, and Matrimony.[521] The first three are classified as the sacraments of Christian initiation, the next two are the sacraments of healing, and the last two are the sacraments at the service of communion.[522]

Eastern Orthodox Christians prefer the term *mystery* to denote the sacrament in Western Christianity. Similar to the Catholic Church, the Orthodox Church considers mysteries as visible vessels that convey divine sanctifying grace. However, Eastern Christians emphasise the mystical union of man with God through the Holy Spirit, the mystery of Christ, and the

[519] Jr. Thomas L. Humphries, "St. Augustine of Hippo," in *Christian Theologies of the Sacraments: A Comparative Introduction*, ed. Justin S. Holcomb and David A. Johnson (New York, NY: New York University Press, 2017).
[520] Catholic Church, *Catechism of the Catholic Church*, 2nd ed. (Washington, DC: United States Conference of Catholic Bishops, 2019), 1131. https://www.usccb.org/sites/default/files/flipbooks/catechism/.
[521] Ibid., 1210.
[522] Ibid., 1211.

mystery of the Kingdom of God already being experienced in the practices of baptism and other rites. Moreover, the Orthodox Church does not limit the number of mysteries to seven. While the Orthodox Church believes that there are seven major or great mysteries, it also recognises other actions, such as fasting, burning incense, and prayer, to transmit the grace of God. In fact, Orthodox Christians consider all Church practice sacramental or mystical.

Unlike the Roman Catholic and Orthodox Churches, Baptist churches employ the word *ordinance*, as opposed to sacrament or mystery, to describe the Christian rites. By calling the sacred acts ordinances, Baptists underscore how these practices are external symbols that demonstrate the participant's obedience to Christ's command and belonging to the church but are not necessary for salvation. Following the tradition of the first generation of Protestants who reexamined the Catholic system of sacraments, Baptists only recognise sacraments that meet the following criteria: instituted by Jesus Christ, intended for observance in the church, have a scriptural basis, and continued in the early church. Thus, only two rites—namely, baptism and Holy Communion—are considered ordinances held by Baptist churches.

Another example of the dialect differences among the three denominations is the titles for the breaking of bread and drinking wine. In the Roman Catholic Church, the *Eucharist* refers to one of the sacraments of initiation by which Catholics receive the body and blood of Christ. The term *Eucharist* comes from the Greek word εὐχαριστήσας (*eucharistēsas*), meaning thanksgiving. This word appears in Luke 22:19, "Then he took a loaf of bread, and when he had given thanks, he broke it and gave it to them, saying, 'This is my body, which is given for you. Do this in remembrance of me.'" By labelling the praxis of breaking bread and drinking wine as the Eucharist, Catholics focus on thanking God, the Father, for his generosity in, through, and with the Son.[523] The Catechism of the Catholic Church notes that the Eucharist

[523] Thomas O'Loughlin, *The Eucharist: Origins and Contemporary Understandings* (London: Bloomsbury T&T Clark, 2015), 28.

also alludes to "the Jewish blessings that proclaim—especially during a meal—God's works: creation, redemption, and sanctification."[524] It also states that the Eucharist "occupies a unique place as the 'Sacrament of Sacraments.'"[525] The Catholic Church teaches that the elements of bread and wine transform into the real, physical body and blood of Jesus Christ during the eucharistic prayer. Considering the presence of the body, blood, soul, and divinity of Jesus Christ, Catholics consider the Eucharist to be the re-presentation of the sacrifice of Christ offered once and for all on the cross.

The Roman Catholic Church also calls the Eucharist *Mass.* This word comes from the Latin *Missa,* which is a part of the concluding formula *Ite, missa est* ("Go, it is the sending") used at the end of the worship service for dismissing the congregation. It implies the sending forth (*missio*) of the faithful to fulfil God's will in everyday life.[526] During the first two centuries in the West, the Greek term *eucharistēsas* referred to both the consecrated bread and wine and the whole service.[527] But as Latin became the dominant language of the Western Roman Empire, the term *Missa* became more widely employed and superseded *eucharistēsas* to denote the entire Eucharistic liturgy. Today, Mass is the commonplace name for the Eucharistic service in the Roman rites.

Like the Catholic Church, the Eastern Orthodox Church refers to the holy ritual meal as the *Eucharist.* The Eastern Orthodox tradition also endorses the doctrine of transubstantiation and the sacrificial nature of the Eucharist. Nevertheless, the Orthodox church contrasts with the Western Church in that it does not outline the exact transformation process, preferring it to be a divine mystery. It also considers the invocation of the Holy Spirit upon the substances of bread and wine essential to the validity of the Eucharist. Consequently, in the

[524] Church, *Catechism of the Catholic Church*, 1328.
[525] Ibid., 1211.
[526] Ibid., 1332.
[527] Adrian Fortescue, "Liturgy of the Mass," in *The Catholic Encyclopedia* (New York, NY: Robert Appleton Company, 1910). http://www.newadvent.org/cathen/09790b.htm.

eucharistic liturgy of the Orthodox Church, the anaphora or the central prayer includes the priest asking God to descend the Holy Spirit. Another principal distinction of the Byzantine rite is the use of leavened bread, symbolising life in the living and resurrected body of Christ.

Most Eastern Orthodox Christians call the Eucharistic service the *Divine Liturgy* or *Holy Liturgy*. The word liturgy comes from the Greek term λειτουργία (leitourgia), meaning common work or public service. By entitling the Eucharistic service as *Divine Liturgy,* the Orthodox Church highlights how the service gathers and unites God's people to remember and celebrate the life of Christ and participate in the mystery of salvation through the Holy Spirit. Analogous to the Catholic Mass, the Divine Liturgy comprises two main divisions: the Liturgy of the Catechumens, which focuses on the Word of God, and the Liturgy of the Faithful, which centres on the Eucharist. Orthodox Christians, just like Roman Catholics, treat the Divine Liturgy as the sacrament of sacraments.

Unlike the Catholic and Orthodox churches, Baptist churches prefer the titles *Communion* and *Lord's Supper,* which are attested in the earliest biblical texts (cf. 1 Cor 10:16, 11:20). The word communion is derived from the Latin *communio,* which comes from the Greek κοινωνία (*koinonia*) meaning fellowship or participating in something together. By employing the term communion, Baptists underscore the way that the recipients unite with Christ and other believers as a single body by sharing at the table. The Lord's Supper, another name for the eucharist that Baptists utilise, communicates that Jesus is the host of the meal and serves as a reminder of the Last Supper of Jesus Christ and his ensuing sacrifice on the cross. It also functions as a time of renewal of faith and personal commitment. For Baptists, unlike Catholics or Orthodox Christians, the bread and wine do not turn into the physical body and blood of Christ during the Lord's Supper. Most Baptists believe that the ritual only acts to commemorate the death and resurrection of Jesus and anticipate the second coming.

While Catholic or Orthodox Christians partake in the Eucharist every Mass or Divine Liturgy, Baptists do not practice communion every worship service. Most Baptist churches observe the Lord's Supper once a month or once a quarter. Also, while Mass and Divine Liturgy are highly structured, liturgical, and focused on the sacraments, Baptist worship service is simple, non-liturgical, and centred around the sermon. Each congregation has the freedom to determine its own patterns of communion and worship structure because of the autonomy of the local church. Also, following the biblical teachings about the priesthood of believers, Baptist churches allow any believer to lead in worship and participate in open communion.

The examples outlined in this section offer a glimpse of how the languages of the three denominations—Roman Catholicism, Eastern Orthodoxy, and Baptist—reflect their distinctive developments in theology, doctrine, and practice over time. Although some denominations employ the same terms, they may not connote the same understanding. Therefore, effective and fruitful communication between various denominations requires a thorough analysis of the dialect similarities and differences.

3.3 Further considerations

The "language" metaphor, which portrays various Christian denominations in the 21st century as different dialects, includes the notion of the dialect continuum that can serve as a valuable framework to explore the relationship among the diverse Christian groups. A dialect continuum is a range of language varieties spoken across some geographical area such that the neighbouring dialects vary slightly, but the widely separated dialects are almost mutually unintelligible. This phenomenon underscores how linguistic differences accumulate over distance and drive the separation of dialects.

When applying this understanding to Christianity, the metaphor highlights that the Christian denominations as dialects are not wholly separate but arranged in a continuum. If

dialect changes over geographical distance, Christian denominations vary in theology, doctrine, culture, and history. Consequently, the dialects of the denominations that share similar historical lineage are mutually intelligible, but denominations with widely divergent pasts can experience some difficulties in communication. For example, given that Roman Catholicism has more points of commonalities in doctrine with Eastern Orthodoxy than Quakerism, the dialect of Roman Catholics resembles more of Eastern Orthodox Christians' lingo than the Quakers' language. Hence, Christian denominations with similar histories and theology have many overlaps in their dialects, thereby experiencing less of a language barrier.

Today, many different denominations are actively pursuing ecumenical ventures which advocate unity and encourage cooperation of Christians worldwide. Interdenominational communication plays a crucial role in achieving harmony among Christians. The view of denominations spread along a continuum equips Christians with an awareness that there is a range of mutual intelligibility among denominations. Some groups are easier to engage in a conversation with due to similarities in doctrine and history. On the other hand, some denominations face more challenges in participating in dialogue due to incompatible points in tradition. Nevertheless, by emphasising the commonalities, especially the faith in Christ, and recognising the differences in dialects, Christian denominations can talk to each other and achieve cohesion without compromising their unique, individual identities.

4. Implications for the relationship between science and religion

In summary, the "language" metaphor targeting the issue of linguistic variation has shed light on the diversities of science and religion (see **Figure 20**). Linguistics offers some conceptual categories to classify numerous forms of language. A language variety associated with a particular circumstance, situation, or function is referred to as a register. If a variety is a characteristic of a specific linguistic community, then it is called a dialect.

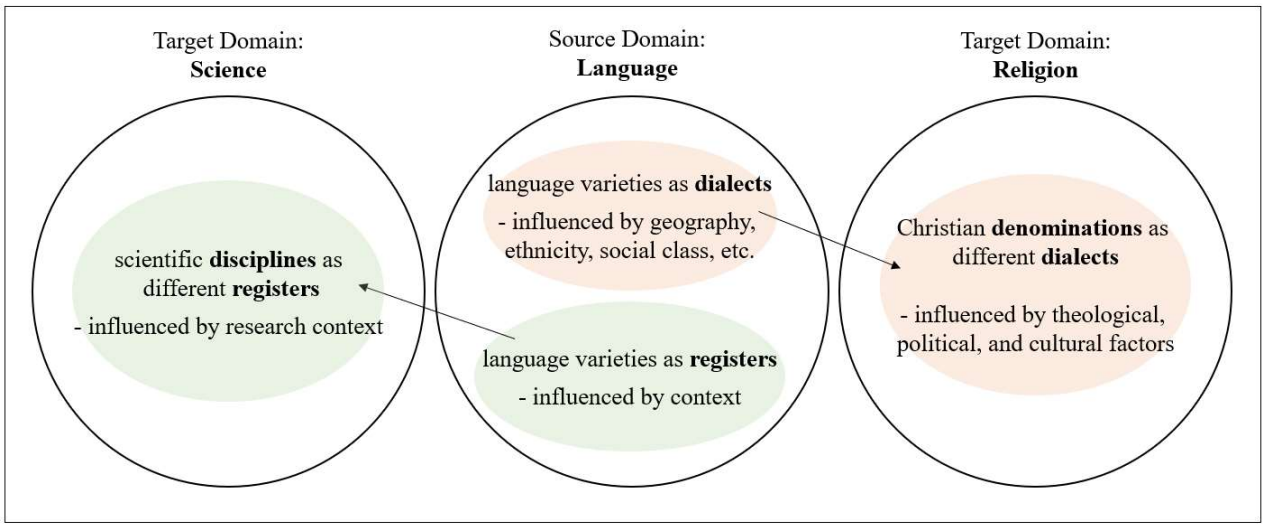

Figure 20: Cross-domain mapping of language variation onto science and religion

When seen as a language, Science is highly diverse. Each scientific discipline develops the general scientific language into a specialised language that addresses discipline-specific problem-solutions, methods, concepts, and goals. Since the narrowly defined area of research leads to a variation in scientific language, the specific language of a scientific discipline is a register of science. For instance, inorganic chemistry has a specific register employed to discuss the properties, behaviours, and synthesis of inorganic compounds, and geophysics use another register to explain the physical aspects of the earth using the principles and methods of physics.

The Christian language is also diversiform. The various Christian denominations develop unique dialects that reflect their different theologies, doctrines, and practices. The denominational dialects allow the linguistic community to experience a sense of membership and group solidarity. For example, if someone asks about the time of the Mass, the distinct word choice of "Mass" to refer to communal worship signifies that the person is Catholic.

In addition to providing a more true-to-life representation of the heterogeneous domains of "science" and "religion," the "language metaphor" stresses the importance of accounting for the diversities when exploring the relationship between science and religion. The past models

of science and religion overlooked the varieties of scientific or religious expressions while attempting to find the general patterns of the science-religion interaction. However, the metanarrative of the relationship between science and religion does not facilitate a fruitful dialogue between science and Christianity. In fact, the simplistic outlook can promote misunderstanding and impede successful discussion between the scientific and Christian communities.

Through the "language" metaphor, it becomes clear that there are many variations within the concepts of science and religion. When discussing the interaction between science and religion, it is essential to recognise that science and religion speak different languages and also pay attention to which dialects or registers are used in the discourse. For example, suppose a researcher in reproductive health and a Christian from a conservative Amish community engages in a dialogue on the topic of birth control. In that case, the participants must consider the differences in the scientific and religious language and the differences in the specific language varieties reflecting their distinct cultures and values. Only with such awareness can the speakers find ways to have a meaningful discussion, embrace disparities, negotiate tensions, explore possibilities of cooperation, and participate in an enriching experience.

Admittedly, the links between scientific disciplines and registers and Christian denominations and dialects are established subjectively. Nevertheless, the notions of register and dialect enlighten how scientific disciplines are value-laden, community-dependent modes of communication used in a particular context of research and how Christian denominational communities develop specific ways of expressing their ways of life of faith in Jesus Christ. Furthermore, the cross-domain mapping of "language" onto "science" and "religion" underscores the need for a detailed analysis of the specific language varieties involved in the science-religion interface because each variant is historically conditioned and reflective of

unique understandings and practices. Hence, the “language” metaphor addressing the plurality of science and Christianity makes a noteworthy contribution to the field of science and religion.

Chapter 4: Language and Worldview

All languages are different regarding signs, pronunciation, lexicon, grammar, and context of use. Each language comprises a unique set of words representing distinct ideas and objects specific to its linguistic community. Many linguistic features derive from the culture of its users, and the language people use also influences their cultural traditions. Each language also provides the lexicogrammatical structures to analyse and interact with the world in a particular way. If language organises one's experience of reality, can language affect one's thoughts and perception of the world? In other words, does language function as a mental framework to talk about reality?

The question of whether language structures thought has been a point of contention for over five centuries. Scholars like Edward Sapir and Benjamin Lee Whorf proposed that since the specifics of language orient the speaker in particular ways, the speakers of different languages must have divergent views. On the other hand, linguists, especially those that support the universalist school of thought, argue that all languages share the same underlying structure. They contend that what is considered linguistic variation is a surface phenomenon that does not influence the innate, universal language faculty.

Despite the ongoing debate on the exact relationship between language and cognition, most linguists today agree that linguistic categories direct attention to distinct parts of the world and help construct a worldview.[528] This term "worldview" comes from the German term *weltanschauung,* which denotes the internally processed view (*anschauung*) or representation of the world (*welt*).[529] To put it simply, it is one's interpretation of reality. A worldview is often

[528] Caleb Everett, *Linguistic Relativity: Evidence across Languages and Cognitive Domains*, ed. Gitte Kristiansen and Francisco J. Ruiz de Mendoza Ibáñez, vol. 25, Applications of Cognitive Linguistics, (Berlin; Boston, MA: De Gruyter Mouton, 2013), 19.
[529] James W. Underhill, *Humboldt, Worldview and Language*, University Press Scholarship Online, (Edinburgh: Edinburgh University Press, 2009), 55.

taken as a holistic framework of ideas, beliefs, and values through which an individual views the world. Moreover, a worldview seems to play a role in offering an orientation in life.

Science and Christianity can also help structure one's worldview as two different languages. Since the Renaissance and Enlightenment, significant advances in science and technology have led many to consider science a reliable source of knowledge for explaining reality. Additionally, since science uses philosophical presuppositions, scientific methods, theories, and empirical evidence to describe the world, the scientific worldview portrays the universe as real, orderly, and comprehensible through careful, systematic study.[530]

Christianity presents another view of reality rooted in the person of Jesus Christ. By adopting the Christian language, which affirms that Jesus is God, the Son incarnate, Christians become immersed in the grand narrative of creation, fall, redemption, and restoration. The Christian worldview guides Christians to navigate everyday life by teaching ways to interact with others, make decisions, uphold values, and practice virtues.

In this chapter, I evaluate the appropriateness of the "language" metaphor for the field of science and religion using the concept of linguistic worldview. I begin by asserting that language influences one's perception and experience of the world. Then, I discuss some examples of the existing scientific and religious worldviews—notably, the scientific worldview held by Gürol Irzik and Robert Nola and the religious one held by James Orr. These two worldviews are not chosen as archetypes but as one of many scientific and Christian worldviews held by some communities. Following these examples, I transfer the concept of worldview to the metaphorical framework. I discuss how the language of science and the language of Christianity structure one's perception of the world. To conclude, I argue that

[530] Hugh G. Gauch, "Science, Worldviews, and Education," in *Science, Worldviews and Education*, ed. Michael R. Matthews (Dordrecht: Springer Netherlands, 2009), 32; John J. Carvalho, "Overview of the Structure of a Scientific Worldview," *Zygon* 41, no. 1 (2006): 115-17, https://doi.org/10.1111/j.1467-9744.2006.00729.x.

acquiring more than one language encourages the speaker to construct a more comprehensive, enriched worldview.

1. Linguistic worldview

As young children grow up, they acquire their home language without conscious learning. They naturally learn and master multiple skills, such as a sophisticated choreography of mouth and throat for making distinctive sounds, the ability to listen and recognise these distinctions, the knowledge of signs and grammar, and comprehension of both explicit and implicit meanings. As they learn to speak and understand a specific language, the words and grammar guide them in talking about the world. They use their newly discovered vocabulary to describe different aspects of the world they experience. But how exactly is language related to worldview?

1.1 Sapir-Whorf hypothesis

Benjamin Lee Whorf is often noted as the primary thinker who popularised the research on the effects of language and cognition in the mid-20th century.[531] Following the work of Edward Sapir, Whorf claimed that language works as a filter on reality. Having studied the structures and vocabularies of various languages, he proposed that since the concepts used to speak are shaped differently, language systems orient speakers in different ways and produce distinct worldviews. This idea is called the "Sapir-Whorf hypothesis."[532]

There are two forms of this hypothesis. The strong version called the principle of "linguistic determinism" argues that language determines thought. The proponents of this version insist that the differences within languages cause differences in thought processes. An

[531] Whorf is the primary proponent to investigate research in the area of language and thought, but this idea is first clearly articulated by the 19th century scholars like Wilhelm von Humboldt and Johann Gottfried Herder.
[532] The term is somewhat of a misnomer because the original idea was intended to be a research program rather than an empirical hypothesis. Also, Whorf worked independently from Sapir.

inevitable corollary to the hypothesis is the following: if there is no way to express a concept in a language, then that concept is not available to the language users.[533] However, people successfully conceptualise ineffable ideas and perceive objects with no corresponding word in the mental lexicon. Therefore, the "strong" version is considered false.

In contrast to this extreme version, the weak form is called the principle of "linguistic relativism." It asserts that language used in a given culture influences or directs the thoughts and experiences of that culture but does not go so far as to claim that language determines them. According to the weak version, linguistic disparities may result in habitually different ways of thinking because contrasting languages force their speakers to attend to various aspects of the world. Franz Boas and Benjamin Lee Whorf pointed out a notable example of how English speakers, Inuit Eskimos, and Aztecs describe snow. In English, there is only one term "snow," but the notion of snow is more finely divided in the Inuit language. For example, Inuit Eskimos use different words for falling snow, snow on the ground, drifting snow, wet snow, snow packed hard like ice, and wind-driven flying snow.[534] For Aztecs, "snow" is encompassed in one word that denotes other related concepts, such as ice or cold.[535] This example shows that the lexical disparities in the three languages reflect and reinforce the differences in how English speakers, Inuit Eskimos, and Aztecs conceptualise "snow."

In recent years, other lines of research have supported the relativistic position. John A. Lucy groups them into two dominant categories: structure-centred and domain-centred.[536] A structure-centred approach investigates how different lexicogrammatical structures, such as

[533] The classic example of linguistic determinism is George Orwell's 1984.
[534] Franz Boas, *Handbook of American Indian Languages*, vol. 1 (Washington, D. C.: Government Printing Office, 1911), 25-26; Benjamin Lee Whorf, *Science and Linguistics*, vol. 42 (Cambridge, MA: MIT Technology Review, 1940), 228.
[535] Terry Regier, Alexandra Carstensen, and Charles Kemp, "Languages Support Efficient Communication About the Environment: Words for Snow Revisited," *PLoS ONE* 11, no. 4 (2016): 2, https://doi.org/10.1371/journal.pone.0151138.
[536] John A. Lucy, "Recent Advances in the Study of Linguistic Relativity in Historical Context: A Critical Assessment," *Language Learning* 66, no. 3 (Sept 1, 2016), https://doi.org/10.1111/lang.12195.

number and gender, are associated with cognitive differences. For example, the experiment conducted by Boroditsky et al. demonstrates that the arbitrary grammatical gender assigned to inanimate referents leads speakers to assign stereotypically male or female characteristics to these objects.[537] A domain-centred approach focuses on how languages categorise a domain of experience like colour, time, and space. For instance, the studies on colour reveal that speakers of a language with more distinct colour terms were faster in discriminating colours, and colour naming affects colour perception primarily in the right visual field.[538]

What is evident from the vast research literature on the effect of linguistic labels and structures on thought is that language influences the cognitive process and one's perception of the world. As people listen and speak a specific language, they become accustomed to how their language dissects reality, organises it into concepts, and ascribes significance.[539] However, this is not to assert that language is a prerequisite for thought. Instead, as Wallace Chafe contends, thoughts are initially formed by interactions with the world outside of language.[540] Language offers semantic resources to articulate and process reality and the general attitude toward the world embedded in language feedback into thought. Hence, speakers of different languages conceptualise the world differently because they are habituated to the ways their language interprets the world.

[537] Lera Boroditsky, Lauren A. Schmidt, and Webb Phillips, "Sex, Syntax and Semantics," in *Language in Mind: Advances in the Study of Language and Thought.* (Cambridge, MA, US: MIT Press, 2003).
[538] Aubrey L. Gilbert et al., "Whorf Hypothesis Is Supported in the Right Visual Field but Not the Left," *Proceedings of the National Academy of Sciences of the United States of America* 103, no. 2 (2006), http://www.pnas.org/content/103/2/489.abstract; Jonathan Winawer et al., "Russian Blues Reveal Effects of Language on Color Discrimination," *Proceedings of the National Academy of Sciences* 104, no. 19 (2007), http://www.pnas.org/content/104/19/7780.abstract.
[539] Whorf, *Science and Linguistics*, 42, 227.
[540] Wallace Chafe, "Rethinking Whorf," in *Thought-Based Linguistics: How Languages Turn Thoughts into Sounds* (Cambridge: Cambridge University Press, 2018), 111-12.

1.2 How language represents the world

It is important to note that language always responds to the needs of the speech community. To revisit the example of the notion of "snow" mentioned previously, Inuit Eskimos live in a cold climate and face situations where they need to communicate precisely and informatively about ice and snow. As a result, they came up with semantically fine-grained categories to represent different types of snow. On the other hand, Aztecs living in a warmer environment rarely talk about snow. Therefore, a broad semantic notion encompassing ice and snow satisfies their communicative need.[541] Besides the term "snow," there are numerous other examples, such as kinship categories and colour naming, illustrating how the subdivisions of a category are moulded by the local need for effective communication.[542]

Furthermore, language reflects the history and culture of its users. For example, in the Korean language, a system of honorifics is used to show respect to the addressee, who is older or of higher social status. The honorific language stems from the Korean Confucianism tradition that emphasises hierarchy according to seniority or rank. In English, many idioms, such as "don't judge a book by its cover," "every cloud has a silver lining," or "you can't make an omelette without breaking eggs," assume the cultural standards and beliefs of English-speaking societies. Such examples demonstrate that language, as a social activity, imprints the communal values, customs, beliefs, and habits of thought and action in its lexicon and structure. Language embodies its community's history, culture, and communicative needs. Consequently, it offers a subjective, anthropocentric, and social interpretation of reality, influencing the perception, interaction, and understanding of a given environment or situation.[543]

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[541] Regier, Carstensen, and Kemp, "Languages Support Efficient Communication About the Environment," 2.
[542] C. Kemp and T. Regier, "Kinship Categories across Languages Reflect General Communicative Principles," *Science* 336, no. 6084 (May 25, 2012), https://doi.org/10.1126/science.1218811; N. Zaslavsky et al., "Color Naming Reflects Both Perceptual Structure and Communicative Need," *Topics in Cognitive Science* 11, no. 1 (2019), https://doi.org/10.1111/tops.12395.
[543] Jerzy Bartmiński, *Aspects of Cognitive Ethnolinguistics*, trans. Adam Głaz, ed. Jörg Zinken, Advances in Cognitive Linguistics, (London; Oakville, Connecticut: Equinox, 2010), 23.

In *Tractatus Logico-Philosophicus,* Ludwig Wittgenstein claims that "the limits of my language mean the limits of my world."[544] Here, Wittgenstein argues that something exists potentially in the world if and only if it is within the scope of thought reflected through the range of language. Although many contemporary scholars reject Wittgenstein's deterministic view of language limiting the breadth of thought, his statement nevertheless highlights one crucial aspect worth examining: the limit of the world. While language describes reality, it also significantly constrains the understanding and interpretation of the world. In other words, the language used to express thought maps the boundaries of reality. Language forces attention on only specific parts rather than the entire reality. Thus, language exhibits a valuable picture of *my* world but not the *whole* world.

To summarise, language directs attention to different parts of the world, influences thought and action, and obliges its users to interpret reality in a particular way. As language discloses reality and gives meaning to experience, it affects how language users view themselves, the world, and their place in it. A language one speaks is not a photograph of the real world but a map that resembles specific structures of the world and accounts for its usefulness. It does not provide an exhaustive illustration or the most accurate interpretation of the entire world.

2. Linguistic worldview of science

In contemporary culture, people experience the impressive uses of science every day through technology. Compared to the past, when communication was limited to writing, today's online platform enables people to send, receive, and respond to messages instantly. Science, the deliverer of new tools and methods for enhancing productivity, transforms agriculture. Science

[544] Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, trans. David Pears and Brian McGuinness, Routledge Classics, (London: Routledge, [1922] 2001), 5.6.

and technology also grant people to control natural forces for power generation and play a vital role in developing innovative tests and treatments in the healthcare industry. Besides its economic impact, science also seeps into society and culture and constantly affects people's daily lives. For example, discoveries by Galileo, Newton, and Einstein changed how we see and understand the solar system and the universe. Darwin's theory of evolution brought terms like "evolution," "survival," and "natural selection" into public discourse. There are countless other examples of science and technology eliciting subtle and dramatic changes in people's lives and what things mean to them.

2.1 Scientific worldviews

Some scientists, such as Richard Dawkins, Edward O. Wilson and Steven Pinker, have overconfidence and over-reliance on science. They urge that science is the only way of knowing reality and that the one presented by science is the true reality. They undervalue any belief that cannot be scientifically justified or scientifically knowable. Furthermore, they insist on importing attitudes, values, methods, and concepts from the natural sciences into other sociocultural domains. This view of the world has been described as "scientism." However, science is different from scientism. Scientism, especially the ontological version, is concerned with a materialistic metaphysical perspective, which demands that science should be the only view of the world. Despite some proponents, other scientists criticise the view. For instance, Richard N. Williams states, "Scientism attempts to hijack science to support metaphysical commitments in which science has no particular interest, and to which it owes no particular debt."[545] Other critics contend that scientism does not accurately represent the worldview derived from modern science.

[545] Richard N. Williams, "Introduction," in *Scientism: The New Orthodoxy* (London: Bloomsbury, 2015), 3.

Two philosophers, Gürol Irzik and Robert Nola, reject scientism and offer an alternative view of the relationship between mainstream science and worldview. They insist that scientific activity is founded on worldview commitments but does not provide an exclusionary and hegemonic worldview that answers every worldview question.[546] Since Irzik and Nola explain their position in response to Hugh G. Gauch Jr.'s argument in "Science, Worldviews, and Education," it is necessary to examine Gauch's stance first.[547]

In his essay, Gauch proposes that science is not built on worldview content, but its conclusions can support a particular worldview. To explain this position, Gauch begins by outlining the seven "pillars" of the mainstream scientific enterprise that the position papers of the American Association for the Advancement of Science (AAAS) and the National Academy of Sciences (NAS) of the United States endorse. They are the following:

> *Pillar P1: Realism.* The physical world, which science seeks to understand, is real.
> *Pillar P2: Presuppositions.* Science presupposes that the world is orderly and comprehensible.
> Pillar P3: *Evidence*. Science demands evidence for its conclusions.
> *Pillar P4: Logic.* Scientific thinking uses standard and settled logic.
> Pillar P5: *Limits*. Science has limits in its understanding of the world.
> Pillar P6: *Universality*. Science is public, welcoming persons from all cultures.
> Pillar P7: *Worldview*. One of science's important ambitions is contributing to a meaningful worldview.[548]

Gauch then indicates that the current scientific community is inconsistent with their position on the relationship between science and worldviews. For some scientists, science foregoes universal claims about truth and the world and takes no part in investigating typical worldview questions, such as the existence of God. Others argue that many major scientific journals and societies have explored science's worldview import. For example, AAAS's insistent preamble—"we live in a directional, although not teleological, universe" — carries a particular

[546] Gürol Irzik and Robert Nola, "Worldviews and Their Relation to Science," in *Science, Worldviews and Education*, ed. Michael R. Matthews (Dordrecht: Springer Netherlands, 2009).
[547] Gauch, "Science, Worldviews, and Education."
[548] Ibid., 32-33.

worldview and marginalises those that believe the universe to be purposeful.[549] Instead of taking part in either side, Gauch proposes an alternative thesis aligned with the seven pillars. He argues that science is worldview independent vis-á-vis its presuppositions and methods, but its evidence can influence one to favour a particular worldview.[550] In Gauch's words, "a worldview-independent method applied to worldview-informative evidence can reach worldview-distinctive conclusions."[551]

In contrast to Gauch, Irzik and Nola assert that science has worldview-dependent contents and generates worldview implications. They first define the term "worldview" as "a set of beliefs, which provide, or purports to provide, a coherent and unified framework for answering worldview questions," such as the origin of the universe, structure of reality, and human nature, based on the best available science.[552]

Then, revisiting Gauch's seven pillars, Irzik and Nola point out that the scientific presuppositions and reasoning described by the pillars contain worldview import. For instance, pillar P1 realism posits the existence of an external, physical reality independent of the human mind. According to Irzik and Nola, this assumption contains worldview content because it partially explains what sorts of things exist in the universe.[553] The authors also mention that this metaphysical claim is not an absolute presupposition of science due to the proponents of idealism and phenomenalism questioning its validity. In the case of pillar P2, they hold that the statement—the world is orderly and comprehensible by human beings—answers the question about the structure of reality. In addition, they manifest that P2 rejects worldviews like neo-Kantianism, that view the world as chaotic and thus unknowable.[554] Irzik and Nola further

[549] American Association for the Advancement of Science, *The Liberal Art of Science* (Washington D.C.: AAAS, 1990), xiii.
[550] Gauch, "Science, Worldviews, and Education," 36.
[551] Ibid.
[552] Irzik and Nola, "Worldviews and Their Relation to Science," 83.
[553] Ibid., 89.
[554] Ibid.

advance that pillar P4 logic is far from worldview-independent. To state knowledge about the world is obtained through the scientific method confirms that nature can be examined and understood while negating the worldview belief that knowledge of nature is gained by revelation and faith. In addition, they mention that P4 excludes worldviews comprised of doctrines, like the Trinity or the Eucharist, that are beyond the comprehension of standard logic.[555] Given that Gauch's pillars affirm a worldview that endorses the existence of the physical, orderly, and comprehensible world, Irzik and Nola show that these presuppositions take a particular worldview stance.

So, what are the primary sources of worldview import characterising science according to Irzik and Nola? First is *the weak form of realism*. They accept that there is a directly accessible mind-independent reality that science can investigate. While adhering to metaphysical realism, they neither affirm nor reject the claim that the physical world is the only thing that exists. Irzik and Nola also concede that science, by applying its methods to empirical evidence, provides real knowledge of the physical, orderly world. Referring to Gauch's remark that "the evidence reflects reality," they expound that the scientific method is powerful enough to yield knowledge regarding the world and that empirical evidence corresponds to physical reality.[556] Although the two philosophers openly support metaphysical and epistemological realism, they remain vague about semantical realism.

Another crucial presupposition of science with worldview-content is the *criticisability* of the scientific activity. Irzik and Nola attribute the epistemic success of science to its critical nature and assert that it should be the 0^{th} pillar of science. They state, "scientific ideas are criticisable. Science is open to criticism and embodies an institutional willingness to accept and learn from criticism."[557] By assuming criticisability as an essential component of science,

[555] Ibid., 90.
[556] Gauch, "Science, Worldviews, and Education," 36.
[557] Irzik and Nola, "Worldviews and Their Relation to Science," 92.

they aver that scientific theories face regular empirical and logical scrutiny and that science can change as theories change.[558] They discredit any dogmatic worldview beliefs that are not open to criticism as well.

Irzik and Nola also highlight *methodological naturalism* as a fundamental presupposition of worldview beliefs. They explain, "methodological naturalism is a doctrine about admissible explanations in science; it requires that explanation within science should appeal only to acceptable naturalistic items."[559] They clarify this version of naturalism in contrast to ontological naturalism and physicalism. Under ontological or metaphysical naturalism, the world comprises only natural elements, principles, and relations that science postulates. In other words, what can be explained by science is all that exists in nature. Physicalism is a narrower metaphysical doctrine that admits everything as physical. To borrow Irzik and Nola's words again, "reality is just physical, and if anything else exists then either it is reducible to, or supervenes upon, the physical."[560] Unlike ontological naturalism, which recognises reified abstract items, physicalism insists that reality only involves matter-energy in space-time, not abstract objects. Like ontological naturalism and physicalism, methodological naturalism excludes any supernatural explanations of natural phenomena. However, unlike the two doctrines that refute the existence of supernatural entities like God, angels, and spirits, methodological naturalism is silent about their existence. In addition, since methodological naturalism merely demands that scientific methods be employed to explain physical reality, it leaves room for social, religious, or other explanations for non-physical entities. In consideration of the varieties of naturalism, Irzik and Nola attest that methodological naturalism is an ontological requirement of contemporary mainstream science, and science aligns more closely with a worldview which offers answers to questions about

[558] Ibid., 86, 95.
[559] Ibid., 85.
[560] Ibid.

nature using knowledge acquired through empirical means.[561] They remark, "to give up methodological naturalism is to give up science."[562]

When constructing a scientific worldview, Irzik and Nola contend that one must "use the best available relevant science as a means of answering as many worldview questions as possible." [563] They argue that science, based on weak realism, criticisability, and methodological naturalism, can respond to questions like the origin of life or the meaning of human life in naturalistic terms.[564] But at the same time, they recognise that this framework does not provide the most satisfactory answers to all worldview issues.[565] They point out that the scientific worldview is not equipped to discuss entities beyond the physical realm and remains vague about the truth value of theoretical claims. Furthermore, they accept that this scientific worldview is not permanent because it transforms with the shifts in scientific presuppositions, theories, evidence, and context. Considering the limits of science, they show openness to using other resources like philosophy, art, literature, and even religion to answer worldview questions that lie beyond the scope of the scientific enterprise. In their words, "science is a major resource for a generation as many worthwhile worldview beliefs as possible; but it is not necessarily the only resource."[566]

While Irzik and Nola present a detailed outlook of the scientific worldview, they only provide a philosophical account of the relation between science and worldview. Their definition of worldview only pertains to the epistemic value of science. Moreover, although science's main aim is to understand the properties and causal relations of the natural world, science is not merely a conceptual or propositional activity of thought. It is also a performative,

[561] Ibid., 93.
[562] Ibid.
[563] Ibid., 86.
[564] Ibid., 87.
[565] Ibid., 86.
[566] Ibid.

lived-through, meaningful experience, a social activity involving a community of scientists who shape the methods, norms, and values.

2.2 How science as language represents the world

The "language" metaphor allows an organic understanding of how science, as part of a form of life, influences thought and worldview. The metaphor asserts that scientists use language as a medium not only to describe and understand but also to interact with the natural world. The language of science provides answers to several essential questions about life and the world. It also orients people in the world and helps them manipulate the environment effectively. The "language" metaphor examines the complex relationship between science and worldview from semantic and pragmatic levels.

As mentioned in Chapter 1, comparable to the language made up of words and grammar, scientific language comprises human constructs, such as scientific explanations, theories, models, methods, concepts, and their interrelations. These constructs derive from observing natural events, inferring similarities in those observations, and finding a label for the observed commonality or its underlying cause. As ideal objects of the mind, scientific constructs are subjective, linked, and dependent on the guiding paradigm of the scientific community. For instance, time is not absolute because it is relative to the observer's perspective. If a clock moves away from a stationary observer and another at rest, the observer will find the clock moving away to tick slower than the stationary one. The mole, the SI unit for measuring the amount of a substance, is also a construct closely related to molar mass, atomic mass unit, and the Avogadro constant. In 2017, the International Bureau of Weights and Measures (BIPM)

changed the definition of the mole as the amount of substance containing exactly $6.02214076 \times 10^{23}$ elementary entities.[567]

Just as words and grammar together form meaningful statements, various scientific constructs work together to deliver information about specific natural phenomena of interest. To provide a consistent message to the audience, scientists produce clear definitions of the constructs and persuade others to adopt the same definitions and use them consistently. Whether scientists are engaged in the stage of observation, inference, experiment, analysis, or conclusion, these constructs play a critical role in offering uniform, shared understandings across the scientific community.

The communally endorsed constructs influence the way scientists think about the physical world. Consider quantum mechanics, for instance. Compared to classical mechanics, quantum mechanics posits concepts such as "wave-particle duality," "uncertainty," and "probability" at the centre of discussion. By adopting the language of quantum theory, many scientists tend to focus on probable outcomes rather than definite states, positions, or movements. They are more inclined to see objects not as discrete, well-defined identities but as both particles and waves existing in a haze of probability. They acknowledge the fundamental limitations in one's ability to understand and predict the universe. Furthermore, many recognise that cause and effect may not always have a linear relationship. While the language of quantum mechanics does not lead to a definitive view of the world, it certainly helps scientists recognise that physical reality is more interconnected, entangled, and observer-dependent than previously thought.[568]

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[567] International Bureau for Weights and Measures, "Proceedings of the 106th Meeting of the International Committee for Weights and Measures" (2017), 23.

[568] Michael Grodzicki, *Physical Reality - Construction or Discovery?: An Introduction to the Methodology and Aims of Physics* (Cham: Springer, 2021), 316, 31-32; Richard DeWitt, *Worldviews: An Introduction to the History and Philosophy of Science*, Third ed. (Chichester: Wiley Blackwell, 2018), 256-57.

The theory of evolution is another prominent example of a scientific construct structuring the view of the natural world. Since Charles Darwin and Alfred Russel Wallace's discovery, terminologies like "natural selection," "genetic variation," "adaptation," "competition," and "survival" have offered the organising framework to talk about the biological and behavioural traits of different organisms. As scientists incorporate evolutionary theory in their language, they actively avoid descriptions of the universe or life forms as goal-driven or teleological.[569] This portrayal can challenge the traditional notion of God, who created the universe with a detailed blueprint and grand purpose. In addition, the concepts like "common ancestor" and "speciation" transform how scientists render human life. Rather than depicting humans as "special" creations through a supernatural process, the evolutionary language characterises humans as the result of a natural process and just one type among millions of species living on Earth. In the words of the evolutionary language, humans are not at the apex of life but on equal footing with other forms of life. As this example illustrates, scientists describe and perceive physical reality and our place in the universe in a particular way through the constructs of evolution.

Besides scientific constructs, other factors embedded in scientific discourse also influence the perception of the world. First, just like any other language, scientific language reflects the culture, norms, and values of the scientific community. As a result, the worldview is affected by non-linguistic, non-scientific factors such as institutional values or personal beliefs. Second, a specific field of science uses a distinct scientific register. For instance, the register of physics, chemistry, microbiology, genetics, and geology differ in the lexicon and other linguistic features. Consequently, various scientific disciplines may share a general view of the natural world but find disparities in understanding a specific natural phenomenon. Considering the narrow scope of subjects in a particular scientific field, a specialist may have

[569] Ibid., *Worldviews: An Introduction to the History and Philosophy of Science*, 300-19.

a highly detailed outlook of one area but a hazy vision of the other regions of physical reality. Another vital point about language is that the language of science is not given in complete form but co-constructed by the participants of the scientific activity. As people use scientific language, they add new constructs or revise the old ones to improve the scope or effectiveness of communication. Language users can also abandon faulty or irrelevant paradigms and take on a new paradigm. Scientific discourse is a human endeavour, and the human agent ultimately directs the course of language evolution. Thus, the perception of the world is contingent on the language users.

Given that the "language" metaphor assumes the undertone of constructivism, one may propose that it advances an anti-realist view of reality. However, the "language" metaphor, I argue, is founded on the presuppositions of realism because the constructs of science correspond to the Kantian "thing-in-itself." While acknowledging the socially constructive character of scientific language, the metaphor recognises that the historically evolving systems of collective scientific activities, the speech-acts, the individuals who are part of these systems, and the individuals' cognition involved in the scientific discourse are all real. Hence, science points to the real, physical world.

An important point to mention is the limits of the scientific worldview. Despite the claims of the proponents of scientism, science cannot describe the entire reality. Science can explain how the natural world works using hypothetico-deductive and statistical-relevance methods, but the availability of scientific tools, techniques, and scientific constructs restrict what can be expressed through science.[570] Furthermore, science is not designed to deal with all aspects of human concerns. For example, issues like moral values, human responsibilities, intentions, meanings, and feelings remain outside the scope of scientific language. Also, any

[570] Carvalho, "Overview of the Structure of a Scientific Worldview," 118-20; Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science*, World Perspectives, (London: George Allen & Unwin, 1959), 173.

statement about the metaphysical reality lies outside the scope of science. Since the world we live in is complex and multidimensional, the language of science sheds light on only limited areas of the world.

3. Linguistic worldview of religion

In the 21st century, religious influence in society is waning as people become more secular. Nevertheless, religion continues to be a powerful force in shaping people's lives. It not only provides meaning and purpose to life to the believers but also directs their thoughts and actions. Christianity is no different. Christians believe that their faith in Jesus Christ is the source of their life and purpose. They identify themselves as faithful followers of Christ and strive to adhere to his teachings. As Christians pursue this way of life, they adopt a particular view of the world.

Christians use unique language to express their beliefs about God and ultimate reality. A collection of historical accounts, poems, prayers, proverbs, parables, didactic letters, and prophecies found in the Bible narrates the story of God demonstrating his love towards his creations. The distinct theological concepts, such as "sin," "grace," "Trinity," "redemption," "resurrection," "ascension," and "the Second Coming," appear foreign to non-believers. But for Christians, this language of faith is a valuable medium to communicate their relationship with God and to view the world.

The language of Christianity is not the same for different Christian communities. While all Christian denominations endorse the central narrative of creation-fall-redemption, many Christian communities have distinct dialects revealing a set of doctrine, tradition, and practice specific to their denomination.[571] There are also linguistic disparities on the level of individual

[571] Tawa Anderson, Michael Clark, and David Naugle, *An Introduction to Christian Worldview: Pursuing God's Perspective in a Pluralistic World* (London: Inter-Varsity Press, 2017), 22.

Christians. Every Christian has a different experience of God, reflected in how one speaks about their relationship with God. Considering the wide variety of vocabularies, cultures, and experiences, Christians uphold similar overarching perceptions of the world but with some contrasting particularities. This section outlines James Orr's particular view of the Christian worldview and compares it with the worldview presented by the language of Christianity.

3.1 James Orr's Christian worldview

James Orr, the Scottish evangelical Protestant theologian and minister, is one of the earliest scholars to appropriate the concept of worldview for Christian thought. In a series of lectures, later published as *A Christian View of God and the World* (1893), Orr offers an extensive account of the view of reality from the Reformed tradition. Orr intends to respond to the post-Enlightenment culture dominating the West and defend Christianity as a unified vision of the whole of life.[572] Orr states,

> [T]here is a definite Christian view of things, which has a character, coherence, and unity of its own, and stands in sharp contrast with counter theories and speculations, and… this world-view has the stamp of reason and reality upon itself, and can amply justify itself at the bar both of history and of experience. I shall endeavour to show that the Christian view of thing forms a logical whole which cannot be infringed on, or accepted or rejected piecemeal, but stands or falls in its integrity, and can only suffer from attempts at amalgamation or compromise with theories which rest on totally distinct bases.[573]

According to Orr, the Christian worldview centres on and is rooted in the person of Jesus Christ, the Son of God, who fulfils the salvation history:

> He who with his whole heart believes in Jesus as the Son of God is thereby committed to much else besides. He is committed to a view of God, to a view of man, to a view of sin, to a view of Redemption, to a view of the purpose of God in creation and history, to a view of human destiny, found only in Christianity. This forms a "Weltanschauung," or "Christian view of the world," which stands in marked contrast within theories wrought out from a purely philosophical or scientific standpoint.[574]

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[572] James Orr, *The Christian View of God and the World as Centring in the Incarnation*, 2nd ed. (Edinburgh: Andrew Elliot, 1893), 4.
[573] Ibid., 16.
[574] Ibid., 4.

Here, Orr asserts that faith in Jesus Christ entails a host of convictions that generate a coherent, comprehensive system of belief that embraces all aspects of reality.

Having explained the overall purpose and the central thesis, Orr outlines nine fundamental propositions of the Christian worldview that affirm the following:

1. the existence of a personal, ethical, self-revealing God
2. the creation of the world by God, who is immanently present in it, transcends over it, and governs it for moral ends
3. the spiritual nature and dignity of man as created in the image of God
4. the fall of man into sin
5. the historical self-revelation of God to the patriarchs and in the line of Israel
6. the incarnation of Jesus Christ as the eternal Son of God taking human form
7. the redemption of the world through the atoning death and resurrection of Jesus Christ
8. the founding of a kingdom of God on earth, which includes the spiritual salvation of individuals and the establishment of a new order of society
9. the fact that history has a goal and that Christ will return for judgment, the resurrection of the dead, and the final separation of righteous and wicked.[575]

Elaborating on these essential statements and contrasting them with counter theories, Orr confirms God as the ultimate reality and explains human nature, purpose, and destiny. He also expounds on how the world formed and where it is headed. Orr underscores that these worldview components are not entirely new but rest upon the worldview perspectives revealed in both the Old and New Testaments.[576] Moreover, he stresses that the Christian *weltanschauung* is the higher system that reunites, synthesises, and even completes all truths into a living whole with Christ supreme.[577] Some critics undermine Orr's Christian worldview on the basis that Christianity is a spiritual system founded on subjective religious experiences rather than on dogmatic affirmations. Orr responds to them by advancing that Christianity cannot eliminate the cognitive elements from spirituality, which is the process of growing in the faith and knowledge of Christ.[578] According to David Naugle, one of Orr's distinctive contributions is "[t]hat the Christian faith may be conceived as a Christocentric, self-

[575] Ibid., 37-40.
[576] Ibid., 13-14.
[577] Ibid., 13.
[578] Ibid., 22-25.

authenticating system of biblical truth characterised by inner integrity, rational coherence, empirical coherence verisimilitude, and existential power."[579] Indeed, Orr's pioneering and apologetic approach to conceiving biblical faith as a robust, coherent, systematic worldview of all reality has been of enduring value to the Christian community.

Christian scholars like Francis Schaeffer, C. S. Lewis, and James Sire have followed Orr's legacy in providing a Christian view of reality. However, their approaches have been chiefly targeting the conceptual aspect of Christianity. While they demonstrated that Christianity is a cognitively sound and comprehensive system of distinctive doctrinal affirmations about reality, knowledge, human nature, and morality, they failed to account for the performative aspect. After all, Christianity is living out the gospel in both words and deeds.

3.2 How religion as language represents the world

The "language" metaphor provides a satisfactory model for understanding Christianity's theoretical and practical aspects, converging to form a coherent worldview. In Christianity, language is used in all areas of the Christian life. The Bible is the sacred scripture of Christianity, revealing who God is and what his plan and purpose are for the universe. Christians read and learn the Bible to anchor their lives in Jesus, the living Word. During public worship, Christians use language to grow in a loving relationship with God. As they read a passage from the Scriptures, sing a hymn, listen to a sermon, pray, or participate in communion, they use the distinct Christian language to express their faith and praise God. By discussing Christianity as a meaningful discourse about faith in Jesus Christ that transforms the participant's attitude and view of life, one can investigate both conceptual and experiential sides of Christianity in the ordinary, personal experience.

[579] David K. Naugle, *Worldview: The History of a Concept* (Grand Rapids, MI: William B. Eerdmans Publishing Company, 2002), 13.

Christianity as a language presents its unique worldview broadly in three ways: (1) a story; (2) a collection of propositions containing worldview beliefs in theological constructs; and (3) a set of speech-acts. James Sire, one of the most influential evangelical worldview proponents over the past fifty years, defines "worldview" as "a commitment, a fundamental orientation of the heart, that can be expressed as a story."[580] As Sire notes, Christian language is often expressed in a story form. Jesus' disciples told stories about Jesus. Christians today narrate the grand story of God revealed in the Bible and share their testimony of faith with others.

So, what is the Christian story? The New Testament scholar N. T. Wright sets out an influential account of this story, which we may note here.[581] Christians believe that God is the alpha and omega, the beginning and the end of the Christian narrative. God is the master storyteller, and the story is about God's interaction with his people, focusing on the significance of the history of Jesus Christ – a point also emphasised by James Orr and James Sire.[582]

The Christian storyline, as this is developed by Wright, has four major plot movements: creation, fall, redemption, and restoration. Christians consider this story to be their own.[583] They believe that they are the characters in this narrative and their lives are a part of God's redemptive plan from creation to the new creation. Sire confirms, "Christians see their lives and the lives of others as tiny chapters in that master story."[584] The shared story of God's salvation, with emphasis on the relationship between God and his people, provides the framework to make sense of individual and corporate experience. Furthermore, the story

[580] James W. Sire, *The Universe Next Door: A Basic Worldview Catalog*, 5th ed. (Downers Grove, IL: InterVarsity Press, 2009), 20.
[581] N. T. Wright, *Scripture and the Authority of God* (London: SPCK, 2005).
[582] Orr, *The Christian View*, 4; Sire, *The Universe Next Door*, 7. cf. R. David Nelson, "The Gospel of Jesus Christ as a Story to Be Told: The "Narrative" Theologies of Eberhard Jüngel and Hans Frei," *Pro Ecclesia* 29, no. 1 (2020), https://doi.org/10.1177/1063851219872169.
[583] See the analysis in Edward T. Oakes, "Apologetics and the Pathos of Narrative Theology," *The Journal of Religion* 72, no. 1 (1992), http://www.jstor.org/stable/1204101.
[584] Sire, *The Universe Next Door*, 7.

engenders a communal understanding of who they are, what the world is like, and how to approach life as God intended. It glues individual believers together as one body. Since Christians believe that God professes his love throughout the story, the act of storytelling transforms the listener and elicits a response in love, obedience, and praise to God.[585] Thus, Christians adopt a coherent, comprehensive vision of the world, enter into a covenantal relationship with God, and orient life in awareness and gratitude for God's saving work by recounting the Christian metanarrative. Therefore, the Christian narrative provides the grand structure of the Christian worldview.

Christians often talk about their faith in narratives and stories, but they also communicate in propositions. Using various theological constructs, they convey biblical understandings explicitly and systematically. Throughout history, Christians have devised a set of doctrines and dogmas to disclose the authentic meaning of faith revealed in the Holy Scriptures. Compared to the narratives, these statements are usually narrower in scope, dealing with a particular subject related to God and the Christian faith. To articulate the legitimate message to the audience and hand it to future generations, Christians have carefully selected specific theological constructs carrying specific meanings.

For instance, consider the process of using various theological constructs to describe the identity of Jesus Christ, which was also briefly mentioned in Chapter 1. In the first few centuries, patristic writers struggled to articulate and develop a unified, orthodox account of the person of Jesus Christ according to various Christological statements, models, and images in the New Testament. At the beginning of the fourth century, Arius, a priest in Alexandria, Egypt, stated that Jesus, the Son, does not have the same essence or substance (*ousia*) as the Father. He denied the full deity of Christ and claimed that Jesus is a finite and created being, yet first and foremost among the creatures. In response to the controversy precipitated by Arius,

[585] Latour, "Thou Shall Not Freeze-Frame," 29.

the Council of Nicaea and Constantinople repudiated Arianism and affirmed that Jesus Christ is "the only-begotten Son of God, begotten of the Father before all worlds (æons); Light of Light, very God of very God, begotten, not made, being of one substance (*homoousios*) with the Father."[586] The intentional use of the construct "*homoousios"* was to proclaim the full equality of the Son with the Father.

Although the Nicene creed settled the language about Christ affirming his true deity, the next set of issues concerned describing how Jesus Christ was both God and human. Apollinaris of Laodicea asserted that divinity and humanity are united in the one person of Jesus Christ, but the human nature of Christ is incomplete. In emphasising the deity of Jesus, Apollinaris argued that a rational human mind was replaced by Logos. Nestorius of Antioch espoused that Christ has two distinct, independent faces or persons (*prosopa*), which are the visible and manifested expression of the two underlying natures in a close moral union. Nestorius espoused that the divine *prosopon* is the Logos, the Son of God, and the human *prosopon* is Jesus of Nazareth, the son of Mary. In opposition to Nestorius's "Two Sons" teaching, Eutyches declared that the incarnate Word has only one nature, the divine nature that absorbed human nature. For Eutyches, the divine-human nature of Jesus was consubstantial (*homoousian*) with the Father but not with man.

Faced with these controversies surrounding the divinity and humanity of Jesus, the Council of Chalcedon in 451 presented the orthodox Christological doctrine. The Chalcedon definition of Jesus Christ is as follows:

> The same perfect in Godhead and also perfect in manhood; truly God and truly man, of a reasonable soul and body; consubstantial with us according to the manhood; in all things like unto us, without sin; begotten before all ages of the Father according to the Godhead, and in these latter days, for us and for our salvation, born of the virgin Mary, the mother of God, according to the manhood; one and the same Christ, Son, Lord, Only-begotten, to be acknowledged in two natures, inconfusedly, unchangeably, indivisibly, inseparably; the distinction of natures being by no means taken away by the union, but rather the

[586] Philip Schaff, *The Creeds of Christendom with a History and Critical Notes*, vol. 1, Theological and Philosophical Library, (New York, NY: Harper, 1877), 29.

> property of each nature being preserved, and concurring in one Person and one Subsistence, not parted or divided into two persons, but one and the same Son, and only begotten, God the Word, the Lord Jesus Christ…[587]

This definition publicly rejected Arianism that denied the full deity of Christ, condemned the error of Apollinaris in refuting the fullness of Jesus' human nature, repudiated Nestorianism for rejecting the union of two natures in one person, and denounced Eutychianism for blending the distinct divine and human natures of Christ. Against these heresies, the Chalcedonian definition firmly established that Jesus Christ is the Logos, the second person in the God-head, who assumed a human nature and became the God-man, one person (*prosopon*) and one subsistence (*hypostasis*) with both divine and human natures.[588] It certified that Jesus is both fully God and fully human, thereby consubstantial with the Father and man.

While the Chalcedonian statement neither proved to be universally acceptable nor ended the Christological disputes, it presented a precise way of organising and connecting various theological constructs to describe the person and nature of Jesus Christ. For the following generations of Christians, the language of the "two natures" formula made explicit that Jesus not only reveals the character and nature of God but also fully relates to humanity. Hence, Immanuel, "God with us." Furthermore, the specific pairing of the constructs "*prosopon*" and "*hypostasis*" expressed Jesus as the God-man, the Son of God who took human nature for humanity. By upholding this definition, Christians continue to structure their thoughts and experiences around God's love and saving acts in Jesus Christ.[589]

As shown in the example of the doctrine of Christ, propositional statements made of combinations of theological constructs disclose biblical truths revealed by God and lead believers into holy living. Similar to words that provide mental categories to structure the world

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[587] Ibid., *The Creeds of Christendom, with a History and Critical Notes*, vol. 2, Theological and Philosophical Library, (New York: Harper, 1877), 62. For the significance of this Council, see Coakley, "What Does Chalcedon Solve and What Does It Not? Some Reflections on the Status and Meaning of the Chalcedonian 'Definition'."

[588] Schaff, *The Creeds of Christendom with a History and Critical Notes*, 1, 30-32.

[589] For the discussion of these points, see McFarland, *The Word Made Flesh: A Theology of the Incarnation*.

and create a worldview, propositional statements containing what Christians believe to be true organise their experience of the world and help with the worldview formation process. Each religious community employs specific theological constructs to convey the gospel meaningfully in their tradition and cultural context. Despite these differences, the general Christian language in a propositional format not only directs attention to God and ultimate reality but also shapes one's interaction with the world.

The notion of speech-act provides another layer of perspective regarding how Christian language forms a unique worldview. In addition to the narrative and propositional forms of language use, speech-act accounts for the performative aspect of language. J. L. Austin proposed that speech uttered in a particular context *performs* a specific action. The speaker also acts while speaking the terms like "apologise," "love," "warn," and "thank." As a collection of speech-acts, Christianity provides a new way to interact and experience the world beyond the physical. For instance, by praying to God, Christians perform the act of seeking the supernatural deity. Also, the act of proclaiming God's love to other Christians transforms the participants to experience a sense of spiritual connection with each other. Since the speech-acts of Christianity expose the participants to new experiences and realms of reality, speech-acts are essential for constructing a Christian worldview.

Overall, the "language" metaphor highlights that Christianity as a language provides a way to express, understand, and interpret God, humanity, the world, the church, and the future. When narrating the grand story of God's plan to redeem his people, Christians realise they are part of that plan. They recognise that Jesus, the Son, came to earth and died upon the cross because of their sins. This way, the story enables true *metanoia,* a radical change of mind. In addition to the stories, Christians express their faith in propositional statements. They share biblical understandings handed on to them and offer specific guidance on how to practice the Christian faith. If the stories provide a broad, general worldview, propositional statements

structuring theological constructs in a particular pattern attend to the specifics of reality. Furthermore, the speech-acts in discourse allow the participants to order their experiences of the divine and the ultimate truth. Despite the limitations of human language, Christians, using narratives, propositions, and speech-acts, find their language adequate to talk about, reflect on, and experience the God-given and God-grounded worldview.[590]

4. Implications for the relationship between science and religion

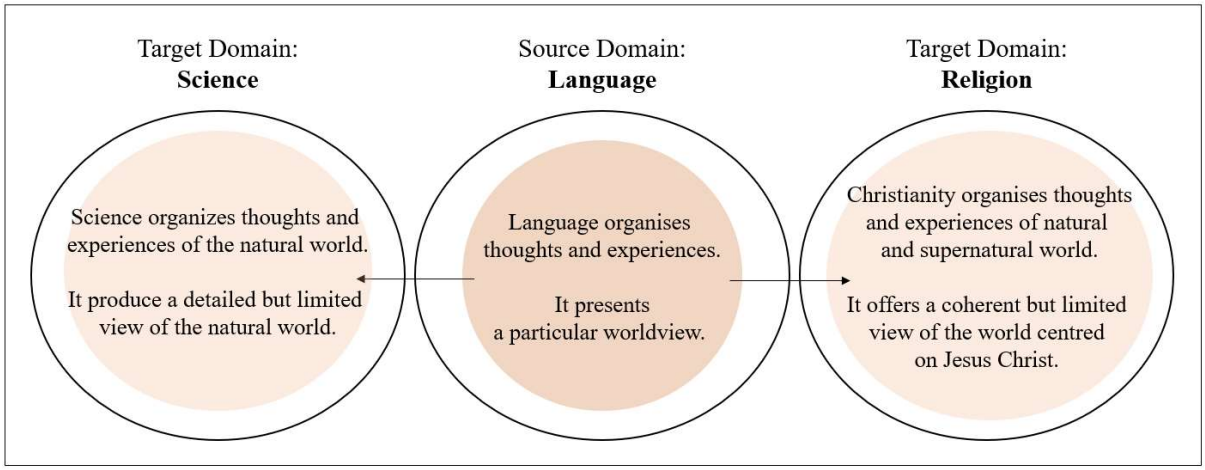

Figure 21: Cross-domain mapping of linguistic worldview onto science and religion

To summarise, the "language" metaphor, emphasising linguistic worldview, provides the space to discuss how science and religion offer an understanding of the world and affect one's orientation in life (see **Figure 21**). While language represents external reality using words and grammar, it also influences how one perceives and interacts with this reality. When people communicate in a specific language, they are accustomed to the ways their language dissects the world, organises it in concepts, and denotes meaning.

Science, as a language, has been developed to disseminate knowledge of the properties and causal relations of the natural world. Using scientific constructs, scientists not only

[590] Alister E. McGrath, *Narrative Apologetics: Sharing the Relevance, Joy, and Wonder of the Christian Faith* (Grand Rapids, MI: Baker Books, 2019), 10.

exchange information about nature but also acclimate to how the interconnected system of scientific constructs structures the natural world. Since scientific discourse is enculturated, embodied experience, the social, cultural, and institutional milieu can influence how the individual scientist perceives nature. The language of science is used to reveal the workings of nature but is restricted by the specific subject area, availability of methods of investigation, and other non-scientific factors. Therefore, while the language of science contributes to increasing the resolution of the picture of the physical world, it still presents a provisional, local, and partial vision of reality.

As another language, Christianity presents a particular worldview by narrating the grand story of the Bible, articulating Christian beliefs in propositional statements, and performing speech-acts. The Christian narrative of creation, fall, redemption, and restoration reveals that human beings, albeit sinful and broken, are the recipients of Jesus' self-giving love so that they can be saved and restored. Propositional statements like doctrines and dogmas have been carefully worded to disclose shared biblical understandings on specific subjects. Speech-acts open the door to experiencing spiritual reality. Christianity informs life's purpose, value, and meaning through stories, propositions, and speech-acts. It creates a coherent worldview and influences how Christians comprehend, imagine, and interact with the world. Nevertheless, the language of Christianity is limited and inadequate to express the infinite, incorporeal God or the full mysteries of spiritual reality. It is also not equipped to generate meaningful discourses in specific areas of the natural world, such as the brain's anatomy or the role of the Supreme Court in the United Kingdom.

Human beings desire to hold a coherent understanding of the world and their place within it. Language embedded with beliefs, goals, values, identity, and meaning in life serves as a frame for the speakers to describe and interpret the world. The resulting linguistic worldview also influences their interaction with the world, whether they are aware of it. But

since reality is multileveled, dynamic, and complex, one language may be insufficient for capturing a comprehensive picture of reality.

Those who rely on the language of science to depict reality may face limitations due to the nature of scientific language. With methodological naturalism at its foundation, the science language is not designed for discussing ontological problems, ethics, purpose, aesthetics, or value. Leo Tolstoy nicely captures this point:

> A plain, reasonable working man… expects science to tell him how he ought to live: how to treat his family, his neighbors and the men of other tribes, how to restrain his passions, what to believe in and what not to believe in, and much else. But what does our science say to him on these matters? It triumphantly tells him how many million miles it is from the Earth to the Sun… it tells of the chemical components of the Milky Way… 'But I don't want any of those things,' says a plain and reasonable man – 'I want to know how to live.'[591]

Indeed, science offers a way to talk about things that can be measured or modelled mathematically. But if someone wants to communicate about non-measurable, extra-scientific domains of human life, the speakers of the scientific language are left with two options: (1) extend the scope of the scientific language to cover areas like ontology and ethics or (2) use other languages that are more apt in dealing with areas beyond the limits of science.

Some people side with the first option. For instance, Francis Crick describes human beings in purely biological terms: "'You,' your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules…. You're nothing but a pack of neurons."[592] The claim of "nothing but" the physical is making an ontological claim about human nature rather than simply outlining which biological components enable brain function. It stretches the contextual boundaries in which the language of science is meaningful. When

[591] Leo Tolstoy, "Modern Science," in *Essays and Letters* (New York, NY: Funk and Wagnalls Company, 1904), 221-22.
[592] Francis Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul* (London: Simon & Schuster, 1994), 3. On the general problem of determining the appropriate limits of reduction in science, see Ingo Brigandt, "Beyond Reduction and Pluralism: Toward an Epistemology of Explanatory Integration in Biology," *Erkenntnis* 73, no. 3 (2010), https://doi.org/10.1007/s10670-010-9233-3; John Bickle, "Reducing Mind to Molecular Pathways: Explicating the Reductionism Implicit in Current Cellular and Molecular Neuroscience," *Synthese* 151, no. 3 (2006), https://doi.org/10.1007/s11229-006-9015-2.

taking this position, people may communicate a certain perception of reality, but their world is somewhat bleak and confined to the physical.

Others choose the latter option, seeking additional languages to complement the language of science. The language of Christianity is one candidate that proffers a wealth of words and habits of communication that denote ideas and experiences not expressed by the language of science. For instance, the concept of human nature described using the languages of science and the language of Christianity could be the following: human beings are animals created in the image of God, born with intrinsic value and dignity, equipped with a complex brain that enables the highly advanced cognitive function, fallen but redeemed by God, and living in a particular sociocultural context. By integrating two languages, one can produce a fuller, more vibrant picture of reality that encompasses the physical as well as the spiritual and incorporates issues like meaning, direction, and purpose.

Besides those who mainly speak the language of science, some people rely primarily on the language of Christianity to communicate and interpret reality. They can see the world under the coherent worldview of Christianity but may lack the detailed understanding of nature rendered by science. To articulate the workings of nature, they can adopt the language of science. However, when first learning the scientific language, people may encounter points of contention with previously held Christian beliefs. In this case, they can do one of the following: (1) reject the new view posited by science, (2) adjust understandings from either Christianity or science to remove points of contradiction, or (3) reject the original view of Christianity. Taking one of the options outlined here is a matter of personal preference. But whichever option one chooses, they try to hold a coherent view of reality constructed through their languages.

Considering the complex and multi-layered reality that we live in, one language may not be enough to provide a satisfying, global worldview. By using multiple languages, one can

draw in diverse linguistic resources to organise, interpret, and engage with the world. The resulting linguistic worldview will not be overly simplistic or general but rather individualised, coherent, and expansive. Therefore, the "language" metaphor sheds light on how science and religion together can offer an enriching, comprehensive view of the world.

Chapter 5: Language, Identity, and Power

The language or the language variety one speaks is an individual possession as well as a communal possession. One must acquire shared knowledge of how various symbols arrange according to conventional rules in order to convey meaning. The members of the speech community also possess this shared linguistic knowledge for communication. The language one speaks reflects not only the history, traditions, customs, and values of the speech community but also the specific characteristics of the community, such as sex, age, ethnicity, and social class. The particular language one speaks, therefore, can function as an emblem that signifies which group the speaker belongs to.

Sometimes, language can create, sustain, and replicate fundamental inequalities in societies. Communicating using a particular language can be associated with a specific privilege, status, or capital. This can lead to an imbalance in the power relations between those within and those outside the speech community. Language then becomes a tool for constructing and maintaining power and status.

In this chapter, I analyse how the issues of identity and power related to language demonstrate the utility of the "language" model for science and religion. All languages influence the identity formation process and manipulation of power. But given that the issues of identity and power focus on the sociocultural dimension of language, it is more fruitful to bring a concrete example into the discussion than to outline the general properties of language related to those issues. Consequently, I investigate the Korean language as a case study to address the interplay between language, identity, and power. The Korean language is selected not simply due to my personal familiarity with the subject but, more importantly, because of its rich history. The Korean language has been associated with the identity of the Korean people and has reflected the struggles for power between different social classes, coloniser and

colonised, and divided nations. Although only the Korean language is considered here, the discussion on linguistic identity and power is relevant to any other language.

I begin the chapter by exploring how different groups of Koreans assert their identity and power through the use or disuse of language. Then, I point to the similarities between the Korean language and the language of science or religion. I demonstrate that the languages of science and religion reflect the identity of their respective linguistic community and offer a sense of belonging to their language users. The metaphor also reveals that languages of science and Christianity influence and are influenced by the power structure in society. I then turn to how the language of science and religion relate to each other. I address the issues of scientism and Christian fundamentalism to illustrate how different scientific and Christian communities struggle for power and legitimacy over the understanding of the world. The topics of linguistic identity and power confirm the usefulness of the "language" metaphor in representing the intricate science-religion relationship.

1. Korean language, identity, and power

The Korean language is part of the Altaic language family, which includes other northern Asia languages such as Mongolian, Finnish, and Hungarian. Although the precise origin of the Korean language remains in dispute, many scholars suggest that the political and cultural unification during the Unified Silla period from the sixth to the fourteenth century merged various groups who populated the Korean peninsula into a homogeneous society and led to the development of a single language of Korean.[593]

[593] Ki-Moon Lee and S. Robert Ramsey, *A History of the Korean Language* (Cambridge: Cambridge University Press, 2011), 31-49. https://www.cambridge.org/core/books/history-of-the-korean-language/53A69B381D2534210A336CCB8879F605.

The year 1443 marks the development of the unique 28-letter Korean alphabet called "*Hunminjeong'eum*" by King Sejong.[594] Before the invention of the Korean alphabet, Korean speech was written with a complex system of Classical Chinese characters. Since learning the Chinese characters required years of education, only the nobles could read and write. With the introduction of the simple writing system, the lower classes, who lacked the opportunity for schooling, became literate and experienced some improvements in their quality of life. While the Korean script gained popularity among the commoners for its easy accessibility and learnability, the members of the elite nobility class, known as *yangban*, opposed and even called for the prohibition of *Hunminjeong'eum.* They feared losing their aristocratic privilege and power if more commoners became literate. Many scholars also resisted using the Korean alphabet due to the disinclination of cultural and political estrangement from China. Consequently, the Chinese writing system persisted as the written language of government and high literature, while the Korean alphabet was denigrated as the vulgar script of women and children.[595] Until the end of the 19th century, the Korean script was held in low esteem, had no official status, and was never a subject of formal education.[596]

From the 1880s until 1910, the nationalist movements promoted the Korean language and elevated the status of the Korean script. During this period, Korea was situated both temporally and physically between the Qing dynasty of China and the Empire of Japan.[597] As a tributary state of the Qing Empire, Korea relied on China for trade and military support. The Japanese Empire also sought opportunities to tighten its grip on the Korean peninsula and reduce Chinese influence. Other foreign powers, such as Russia and the United States, tried to assume control of Korean affairs and become the dominant player in the East. Besides the

[594] The modern version of *Hunminjeong'eum* called *hangul* consists of 24 letters, 14 consonants and 10 vowels.
[595] Iksop Lee and S. Robert Ramsey, *The Korean Language*, Suny Series in Korean Studies, (Albany: State University of New York Press, 2000), 301.
[596] Ross King, "North and South Korea," in *Language and National Identity in Asia*, ed. Andrew Simpson (Oxford; New York, NY: Oxford University Press, 2007), 204.
[597] Schmid Andre, *Korea between Empires* (New York, NY: Columbia University Press, 2002), 3.

external political conflicts, Korea was plagued internally by civil disorder. Many peasants and farmers participated in organised revolts against the local rulers and demanded reforms to end social inequality, economic disparity, and corruption.[598] They also treated the influx of new technologies, capital, knowledge, and religion from the West as a threat to their identity and culture. Given the context of the intense international rivalry over Korea and internal disarray, a diverse group of scholars, reformers, and publicists called for purging foreign influence on Korean culture while reviving indigenous traditions. For these nationalists, the acts of speaking and writing the Korean language became a way of demonstrating their ethnic identity and cultural autonomy. In 1894, one of the statutes of the Kabo Reform proclaimed the Korean alphabet as the legitimate "national" script and promulgated all official documents to be written in the Korean alphabet or a mixture of the Korean script and Chinese characters.[599] The modern schools run by Western missionaries or Japanese supporters taught Korean as part of the curriculum.[600] Although mixed Chinese-Korean script was more prevalent than full Korean script, Koreans still regarded the Korean language as a potent symbol of unadulterated Koreanness.

When the Japanese Empire annexed Korea in 1910, the Korean language lost its short-lived "national" status, and the Japanese language took over its prestigious standing. During the initial phase of colonisation, the Japanese government envisioned that fostering a love for the Japanese language among Koreans would transform them into loyal imperial subjects.[601] Treating a unified national language as the very condition of a unified nation, the Governor-General of Korea forced the Korean colony to regard the Japanese language as "*kokugo* (the national language)*"* instead of "*nihongo* (the Japanese language)" and suppressed the use of

[598] Ibid., 25.
[599] King, "North and South Korea," 204-5.
[600] Ibid., 206.
[601] Christina Yi, *Colonizing Language: Cultural Production and Language Politics in Modern Japan and Korea* (New York: Columbia University Press, 2018), 2.

Korean in public.[602] Christina Yi said, "Promoting the Japanese language became increasingly important to the [Governor-General of Korea] not only for advancing practical goals, such as effectively incorporating Korean volunteer soldiers into the Japanese military, but also for maintaining the ideology of inclusion and imperial benevolence."[603] The new administration in Korea considered *kokugo* education as an effective means to achieve peaceful assimilation and social cohesion.[604] The Japanese policymakers created Korea's first public education system offering instructions in the Japanese language. They also brought teachers from the Japanese mainland and compiled textbooks specially designed for Koreans. In addition, the Japanese government introduced Japanese-language newspapers, periodicals, radio broadcasts, books, music, and movies to promote the image of *kokugo* as a language of modernity and progress.[605] The ideology of *kokugo* aimed to bind the colonisers and the colonised together as one community, at least at the level of discourse. In reality, however, it exposed the distinction between the two groups and encouraged the segregation practice in education and legislation.

The massive uprising against the Japanese government on 1 March 1919 transformed the Japanese assimilation policy for Korea and aided the development of the Korean language. Rather than continuing the aggressive political, economic, linguistic, and cultural coercion, the colonial authorities enacted more lenient, long-term governing strategies to appease the Korean people.[606] Presupposing the superiority of the Japanese culture that would eventually eradicate the Korean culture, the Japanese officials permitted limited freedom in education, political organisation, and other cultural matters, such as Korean language publications. They also

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[602] Ibid., xx.
[603] Yŏn-suk Yi and Maki Hubbard, *The Ideology of Kokugo: Nationalizing Language in Modern Japan*, English-language ed., University Press Scholarship Online, (Honolulu: University of Hawai'i Press, [2009] 2016), xxii.
[604] Mark Caprio, *Japanese Assimilation Policies in Colonial Korea, 1910-1945*, 1st ed., Korean Studies of the Henry M. Jackson School of International Studies, (Seattle, WA: University of Washington Press, 2009), 81; Soon-Yong Pak and Keumjoong Hwang, "Assimilation and Segregation of Imperial Subjects: "Educating" the Colonised During the 1910–1945 Japanese Colonial Rule of Korea," *Paedagogica Historica* 47, no. 3 (2011): 381, https://doi.org/10.1080/00309230.2010.534104.
[605] Yi and Hubbard, *The Ideology of Kokugo*, 163-64.
[606] Pak and Hwang, "Assimilation and Segregation," 385.

commissioned various Korean language cultivation projects and set up the first official Korean orthography for the elementary school curriculum. In 1920, the Japanese government published the first comprehensive dictionary of Korean.[607] Moreover, in the following year, the Japanese government permitted the establishment of the Korean Language Society and encouraged the standardisation and modernisation of the Korean language. One crucial advancement by the Korean Language Society was promulgating the name "hangul" to denote the new standardised orthography.[608] The Japanese government also authorise three Korean newspapers: *Tonga ilbo, Choson ilbo,* and *Chungang ilbo.*[609] Until the early 1930s, the lenient cultural reforms of the Japanese administration led to a relative flourishing of research and publications in the Korean language.

With the outbreak of the Second Sino-Japanese War in 1937, the Japanese government accelerated the radical assimilation policy on the Korean colony and suppressed the Korean language. Since Korea was strategically positioned between the Japanese mainland and the battlefields in China, the Japanese authorities coerced to transform Koreans into loyal subjects who would participate and cooperate in the war efforts. Championing the slogan "*Naisen ittai* (Korea and Japan are one body)," the colonial administration strengthened Japanese language programmes while limiting and eventually terminating the Korean language curriculum in schools.[610] In 1938, the government issued a "Japanese everyday-use policy" prohibiting the use of Korean in public.[611] The members of the Korean Language Society or anyone who promoted Korean language education were arrested and imprisoned. The following year, the Japanese authorities ceased the publication of two major Korean-language newspapers, *Choson*

[607] King, "North and South Korea," 207.
[608] Ibid.
[609] Caprio, *Japanese Assimilation Policies*, 128.
[610] Sang-sook Jeon, "The Characteristics of Japanese Colonial Rule in Korea," *The Journal of Northeast Asian History* 8, no. 1 (2011): 45-46.
[611] King, "North and South Korea," 208.

ilbo and *Tonga ilbo*.[612] Furthermore, the Governor-General of Korea announced the "Name Change" ordinance in 1940 that forced Koreans to adopt a Japanese-style name. Without a Japanese name, Koreans could not enrol in schools, were denied services at government offices, and were excluded from receiving food rations and other essential supplies.[613]

The aggressive linguistic assimilation policies through universal schooling during wartime made a significant proportion of the Korean population fluent in Japanese and grew the pro-Japanese sentiment. However, the experiences of forced labour, exploitation of resources, social inequality, and suppression of the Korean culture further separated Koreans from the Japanese. They even drove some to speak and write Korean as a sign of rebellion against Japan and patriotism for Korea. Therefore, despite Japanese efforts to inculcate the notion of *naisen ittai* in the Korean people using *kokugo,* the harsh reality of the colonised impeded Koreans from abandoning their language and identity.

After the defeat of Japan in World War II, the Korean people recovered the Korean language. Japan's unconditional surrender in 1945 left the Korean peninsula in the hands of the Allies. In 1948, the Republic of Korea (ROK) was established in the southern part of Korea with the help of the United States, followed by the formation of the Democratic People's Republic of Korea (DPRK) in the North under the guidance of the Soviet Union. After the Korean War (1950-1953), the two distinct governments faced similar concerns of widespread illiteracy, orthographic representation of Korean, removal of any vestige of Japanese influence in the Korean language, and standardisation.[614] However, North and South Korea, with radically different political ideologies, took divergent approaches to developing the Korean language.[615]

[612] Ibid.
[613] Pak and Hwang, "Assimilation and Segregation," 391.
[614] King, "North and South Korea," 210.
[615] Ibid., 217.

In North Korea, the communist leader Kim Il Sung treated the Korean language as a vital element for creating a socialist society and directed the language policy to "purify" the Korean language by discouraging the use of Chinese characters and replacing any foreign loanwords with native Korean words. Kim Il Sung also advanced the view that the DPRK is the sole protector of the Korean heritage by eliminating foreign influences in its language.[616]

Unlike the North deliberately removing any individuals with former ties to local elites or to the Japanese colonial administration from the communist government, the South Korean government left many Japanese-educated elites well-versed in Chinese characters in office. As a result, the government went back and forth on the language policy concerning the employment of Chinese characters.[617] Additionally, in contrast to North Korea engaged in policies of isolation from the rest of the world, South Korea, which was open to Westernisation, did not regard the adoption of foreign words (except for the Japanese lexicon) as a threat to the Korean identity, but rather as a source of enrichment for the language.[618] Overall, considering the political climates of North and South Korea, North Korea executed a more normative, consistent, and tightly controlled language planning to cultivate the image of a homogeneous nation of descent from a unique linguistic source, whereas South Korea adopted a more lenient policy allowing the use of Chinese characters and foreign loanwords.

Today, the Korean language symbolises the national identity of North and South Korea. According to Ross King, both North and South Korea exhibit language patriotism and nationalism, characterised by the emphatic praise of the Korean language, identification of the linguistic character and nature with a unique national character, and assertion of the superiority of Korean.[619] What is interesting about the Korean language is the demonstration of great pride in the Korean alphabet, *hangul*. Koreans show admiration for the invention of the Korean script

[616] Ibid., 214.
[617] Ibid., 216.
[618] Ibid., 216-17.
[619] Ibid., 218-19.

by King Sejong, and this script-related linguistic nationalism is evident in the fact that both the ROK and the DPRK observe a holiday to commemorate this intellectual and cultural achievement.[620] Another indication of the strong connection between the Korean language and national identity is the common designation for the Korean language as "woorimal," literally meaning "our language." The first-person plural pronoun *woori* (we, our) describing the Korean language serves as a reminder to distinguish the in-group as the Korean nation bound by a single language from the out-group using different languages. For North and South Korea, the continuing display of language nationalism is a way of asserting the unique national identity and sovereignty in a time of cultural and economic globalisation.

In summary, the unique history of the Korean language reveals that language is not only a system of communication but also a means of establishing and maintaining power, status, and identity. As the French sociologist Pierre Bourdieu expounds, language is a form of cultural capital that confers a certain social status mediated through power relations.[621] Before the Japanese occupation, the ability to write Korean using Chinese characters was a special privilege assigned to the elite nobles, who could afford the luxury of education. When King Sejong introduced "Hunminjeong'eum," the upper class vehemently resisted the implementation, fearing they would lose their power and sociocultural status. During the Japanese colonisation, the Japanese Empire demonstrated its imperialistic power and control by enforcing the Japanese language as Korea's "national" language. The Japanese government's linguistic assimilation policies, including Japanese education, threatened the Korean culture and identity. Since the restoration of Korean independence, the Korean language has become the emblem of Korean ethnic identity and sovereignty. Koreans praise their language,

[620] Ibid., 221-22.
[621] Pierre Bourdieu, "The Forms of Capital," in *Handbook of Theory and Research for the Sociology of Education*, ed. John G. Richardson (New York, NY: Greenwood Press, 1986).

especially *hangul*, for reflecting their unique history, culture, and society. Hence, the Korean national identity, pride, and power are embodied in and symbolised by the Korean language.

2. Science as the language of identity and power

Just as the ability to speak, read, and write the Korean language suggests one's membership in the Korean community, the ability to communicate using science implies certain aspects about language users. For instance, if someone engages in a technical discussion about the effect of retinoic acid signalling on the development of the prefrontal cortex, they would have received some education in biochemistry and neuroscience. If someone writes a research article on the role of protein UTX in tumour growth suppression, the author would be the molecular biologist involved in the research. Interestingly, science, like the Korean language, characterises its language users.

There are many similarities between the Korean language and science on the issues of identity and power. First, just as the Korean language emerged with the construction of a homogenous society, science developed with the establishment of the scientific community, which occurred in the 19th century. Before the 19th century, those who studied the physical universe were called "natural philosophers." They tried to improve their understanding of the universe and their place in the universe by independently collecting specimens, conducting experiments, and sharing their findings with others through personal correspondence. They also discussed topics of metaphysics, epistemology, and theology. Some social organisations, such as the Royal Society of London and the Paris Academy of Sciences, were formed for those interested in studying nature. But these were more of gentlemen's clubs for the elites than merit-based academic societies. In the 19th century, however, the growing importance of science in society drew scientifically inclined individuals together as a separate social group. Numerous local scientific communities formed, with some organised around specific

subdisciplines, such as chemistry, physics, and astronomy. For example, Thomas Huxley and his eight colleagues started the X-Club in 1864 to establish natural history as a scientific discipline and free it from clerical influence. In addition to the birth of new societies, more academic institutions offered advanced education and training, set standards of scientific research, and promoted the specialisation of scientific fields. The expanded paid job opportunities for scientific research created an institutionally defined boundary line between science and non-science, scientists and amateurs.[622]

Another crucial factor for establishing a coherent professional scientific community in the 19th century was the increase of scientific journals, conferences, and meetings. Many scientists chose to publish their work in specialised scientific journals rather than periodicals or general magazines to target a specific audience that can engage with their research. The academic journals provided a space for scientists to share and review new scientific knowledge and participate in discussions with other scientists. The selectivity of prestigious journals motivated researchers to improve the quality of their work. Various meetings and conferences also encouraged communication among scientists and further drove the professionalisation of science. Overall, the creation of the distinct scientific community in the 19th century enabled its members to develop specific habits and standards of communication and produce the language of science.

Second, similar to the Korean language symbolising the identity of the Korean people, participation in scientific activity signifies one's identity as a scientist. The term "scientist" is also of recent origin in 1833 by the English philosopher and historian of science William Whewell. In *The Philosophy of the Inductive Sciences,* Whewell asserted, "We need very much a name to describe a cultivator of science in general. I should incline to call him a *Scientist*.

[622] Joseph Ben-David, "The Profession of Science and Its Powers," *Minerva* 10, no. 3 (1972): 367-68, http://www.jstor.org/stable/41822160.

Thus we might say, that as an Artist is a Musician, Painter, or Poet, a Scientist is a Mathematician, Physicist, or Naturalist."[623] As Whewell suggested, intellectuals in the second half of the 19th century who were involved in studying the natural world adopted the term "scientist" to describe themselves. The practitioners of science promoted this new title to set themselves apart from others, especially clergymen, priests, and theologians.[624] By the early twentieth century, the word "scientist" became the title of one's professional career. In his 1917 lecture at Munich University, the German sociologist Max Weber even treated the nature of being a professional scientist as a vocation or calling for a career.[625]

In the 21st century, the label "scientist" denotes a profession and a social identity, which is one's self-concept based on membership in a social group. In their study, Heidi Carlone and Angela Johnson assert that there are three dimensions—namely, *competence, performance,* and *recognition*—that constitute the "science identity."[626] Competence refers to having scientific knowledge and the motivation to understand the world scientifically. Performance means the ability to demonstrate competence with scientific practices. Some examples of performance are the use of research tools and equipment, fluency with all forms of scientific talk and ways of acting, and skills for interacting in various formal and informal scientific settings.[627] Lastly, recognition concerns one's self-recognition as well as recognition by others as a "science person."[628] They explain that one's science identity exists in various degrees and combinations of these criteria. For instance, one can have strong competence and performance in a relevant

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[623] William Whewell, *The Philosophy of the Inductive Sciences: Founded Upon Their History*, vol. 1, Cambridge Library Collection. Philosophy, (Cambridge: Cambridge University Press, 1840), 113.
[624] Frank M. Turner, "The Victorian Conflict between Science and Religion: A Professional Dimension," *Isis* 69, no. 3 (1978), http://www.jstor.org/stable/231040; Gowan Dawson and Bernard V. Lightman, *Victorian Scientific Naturalism: Community, Identity, Continuity* (Chicago, IL: The University of Chicago Press, 2014).
[625] Max Weber, "Science as a Vocation," in *The Vocation Lectures: 'Science as a Vocation'; 'Politics as a Vocation'*, ed. David S. Owen, Tracy B. Strong, and Rodney Livingstone (Indianapolis, IN: Hackett Publishing Company, Inc., 2004).
[626] Heidi B. Carlone and Angela Johnson, "Understanding the Science Experiences of Successful Women of Color: Science Identity as an Analytic Lens," *Journal of Research in Science Teaching* 44, no. 8 (2007), https://doi.org/10.1002/tea.20237.
[627] Ibid., 1190.
[628] Ibid.

scientific field but may not be recognised by others as a credible scientist. Nonetheless, they argue that forming a strong "science identity" is related to positive experiences in science.

When applying Carlone and Johnson's view of the "science identity" to the language model, proficiency in science is an effective indicator of all three dimensions of the scientist prototype. The *competence* criterion is reflected in the specific words and phrases that the scientists use. If scientists can use scientific jargon and communicate scientific content meaningfully, they are demonstrating scientific understanding. The *performance* aspect is revealed in the ways that one speaks the language of science to share scientific knowledge. When someone is proficient in a language, they have the vocabulary and the syntactic and pragmatic rules for effective communication. Therefore, someone with highly advanced language skills in science suggests that they understand the intricacies of syntax and pragmatics of science and convey complex scientific knowledge in a clear, precise manner. The notion of *recognition* is also expressed by linguistic proficiency because mastering a language requires comprehending the scientific community's rules, norms, and values. Such understanding is possible only if someone is a member of the scientific community. Therefore, proficiency in science is a credible marker of one's identity as a scientist.

Third, just as formal language education promoted the development of the Korean language and increased the literacy rate, science education today plays a crucial role in teaching and advancing the scientific language. In contemporary society, a higher educational qualification is a prerequisite to entry into the profession of scientific research. Science education at primary and secondary schools generally aims to build a body of key foundational scientific knowledge and concepts and develop an understanding of science's nature, methods and uses. In higher education, universities, colleges, academies, institutes of technology, and other higher-level institutions provide education and practical laboratory experience in science. While first-year undergraduate students usually take introductory courses, upper-year students

commit to a specific scientific discipline, such as biology, chemistry, physics, or astronomy, and receive specialised instruction and research training. They not only attend lectures to study various scientific theories, concepts, and processes but also work in a lab to practice using lab equipment, analysing data, and writing lab reports. The undergraduate degree thus equips students with general and specialised scientific vocabulary, teaches the rules of science, and develops scientific language skills.

While undergraduate education in science produces scientifically literate citizens, complete mastery of the language of science is typically achieved through a postgraduate degree. During a master's or doctorate course, students can apply the practical skills and knowledge they acquired from their prior studies to design and conduct research independently under the supervision of a faculty member. As students research a specific subject, they become highly specialised in a narrow field of science. Furthermore, they communicate and network with other scientists through seminars, lectures, meetings, conferences, and publications. At the end of their postgraduate degree, students establish themselves intellectually and technically capable of independent research and demonstrate full command of the scientific language used in their field. Philip Schwartzkroin notes, "The Ph.D (or comparable degree) is your membership card that gets you into the society of scientists. It puts you in a position to start exercising intellectual choice, to take responsibility for research design, and to receive credit for significant research contributions."[629] Therefore, postgraduate programs offer rigorous education, research training, and linguistic proficiency necessary for scientific careers.

Besides producing competent scientists, higher education institutions facilitate the development of science. Universities create the space for highly skilled scientists to conduct research, generate new scientific knowledge and methodological tools, and advance various scientific fields. They secure funding and resources—such as lab facilities, research equipment,

[629] P. A. Schwartzkroin, *So You Want to Be a Scientist?* (New York: Oxford University Press, 2009), 11.

library use, and access to publications—necessary for cutting-edge research. Furthermore, academic institutions encourage scientific discourse by stimulating collaboration between specialists from different fields and carrying out interdisciplinary projects. They also host conferences and invite people from other institutions, science and technology organisations, industry, and public authorities to give talks and presentations. Another important function of academic institutions is establishing and safeguarding scientific standards and norms. Similar to the establishment of formal language education encouraging the standardisation of Korean, science education promotes the scientific community to define what scientific knowledge and research skills are necessary for their field of study. Academic institutions teach their students according to these standards and reward those meeting the expectations. Hence, science education is indispensable for increasing science literacy and advancing the language of science.

Finally, just as the ability to write Korean in Chinese characters entailed high social status and privilege to the *yangban* group, someone proficient in science is considered an expert in science and assumes certain rights and authority in contemporary society. Giovanni Frazzetto notes, "Without doubt, science has put on a new face in the past century. It has come to occupy a central role in society and now enjoys a privileged position among the knowledge-producing disciplines."[630] In a similar vein, Steven Shapin mentions, "Science is our most powerful form of knowledge; it's scientists—or at least those pretending to be scientists—that are turned to when we want an account of how matters stand in the natural world."[631] Accordingly, contemporary society respects science practitioners as experts producing specialised knowledge about the natural world and regards the scientific method as a reliable, if not supreme, process for acquiring knowledge. Given the rigorous education and training

[630] Giovanni Frazzetto, "The Changing Identity of the Scientist," *EMBO Rep* 5, no. 1 (2004): 11, https://doi.org/10.1038/sj.embor.7400061.
[631] Steven Shapin, "Science and the Modern World," in *The Handbook of Science and Technology Studies*, ed. Edward J. Hackett et al. (Cambridge, MA; London: MIT Press, 2008), 442.

required for a career in science, scientists are thought to possess a high level of technical knowledge, problem-solving skills, analytical capabilities, and research competence. In addition, the advancements in technology, medicine, and other areas of applied science also put scientists in a positive light. In an international survey conducted by Pew Research Center from October 2019 to March 2020, Funk et al. report that the public trusts scientists to do what is right and to benefit society.[632]

There are some other factors besides knowledgeability that contribute to the perceived credibility of scientists as experts. Institutional affiliation and professional credentials—for example, having advanced degrees and publishing in prestigious scientific journals—are salient markers of credibility.[633] The belief in the personal disinterestedness of scientists is another significant source of credibility.[634] According to the American sociologist Robert Merton, the norm of disinterestedness mandates that scientists, unbiased by their interests, ideologies, or social context, produce publicly beneficial knowledge and act for the good of the entire scientific enterprise.[635] He also attributes scientists' disinterested practices to the institutional structures and standards of science, including the verifiability of results, expert scrutiny by peers, and public and testable character.[636] The consensus within the scientific community is yet another element bolstering the cultural authority of the scientists. Timothy O'Brien attests, "As scientific opinions become embedded among those of a community of experts, they become more difficult to deconstruct and less susceptible to criticism, especially

[632] Cary Funk et al., *Science and Scientists Held in High Esteem across Global Publics* (Washington D.C.: Pew Research Center, 2020), https://www.pewresearch.org/science/wp-content/uploads/sites/16/2020/09/PS_2020.09.29_global-science_REPORT.pdf.
[633] Gordon Gauchat, "The Cultural Authority of Science: Public Trust and Acceptance of Organized Science," *Public Understanding of Science* 20, no. 6 (2010): 765, https://doi.org/10.1177/0963662510365246.
[634] Ibid.; Timothy L. O'Brien, "Scientific Authority in Policy Contexts: Public Attitudes About Environmental Scientists, Medical Researchers, and Economists," *Public Understanding of Science* 22, no. 7 (2013), https://doi.org/10.1177/0963662511435054.
[635] Robert King Merton, "The Normative Structure of Science," in *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago, IL: University of Chicago Press, 1973), 276.
[636] Ibid.

by non-experts."[637] Theodore Brown also confirms that reaching a consensus is crucial for establishing scientists' authority.[638] Overall, scientists' expert knowledge, institutional affiliation, personal disinterestedness, and harmony within the scientific community facilitate scientists in harnessing public trust.

Given the credibility of scientists, the claims made by scientists have authority over many political and economic decisions. For instance, the US government organisations like the Environmental Protection Agency, the Food and Drug Administration, and the Centers for Disease Control and Prevention employ scientists as policy advisors.[639] The policymakers trust scientists to offer neutral, objective knowledge. The scientific advisors perform their role by providing data on relevant issues, monitoring current and future trends, diagnosing and managing risks, presenting a range of choices, and recommending an optimal course of action.[640] Yet, the increasing role of corporate and government investors in funding costly scientific research activities has cast doubt on the objectivity, neutrality, and disinterestedness of scientific enterprise.[641] The commercialisation of science has also transformed science from an autonomous and scholarly enterprise into a service for society.[642] Despite the indistinct boundaries between science, politics, and economics, many scientists continue to espouse an ethos based on meritocracy, peer review, independence, and openness and yield practical, expert knowledge.[643] Consequently, the general public reveres scientists as experts with the power to explain how the natural world works, influence public policy and meet society's needs.

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[637] O'Brien, "Scientific Authority," 302.
[638] Theodore L. Brown, *Imperfect Oracle: The Epistemic and Moral Authority of Science* (University Park, PA: Pennsylvania State University Press, 2009), 224-35.
[639] O'Brien, "Scientific Authority."
[640] Pita Spruijt et al., "Different Roles and Viewpoints of Scientific Experts in Advising on Environmental Health Risks," *Risk Analysis* 33, no. 10 (2013), https://doi.org/10.1111/risa.12020; Esther Turnhout et al., "New Roles of Science in Society: Different Repertoires of Knowledge Brokering," *Science and Public Policy* 40, no. 3 (2013), https://doi.org/10.1093/scipol/scs114.
[641] Philip Mirowski and Esther-Mirjam Sent, "The Commercialization of Science and the Response of Sts," in *The Handbook of Science and Technology Studies*, ed. Edward J. Hackett et al. (Cambridge, MA; London: MIT Press, 2008), 674-75.
[642] Frazzetto, "The Changing Identity of the Scientist," 20; Gauchat, "The Cultural Authority of Science."
[643] Shapin, "Science and the Modern World," 444.

Scientists, thus, signify their prestigious social class and epistemic authority by communicating in scientific language.

3. Religion as the language of identity and power

Like the Korean language, religion is instrumental in forming the identity of the religious community, and the Christian language is no exception. For those without the Christian faith, words like fasting, discipleship, repentance, and worship appear strange and meaningless. For Christians, however, these words carry significant meaning and characterise who they are and how they view life. As Christians participate in linguistic activities, such as reading the Bible, singing hymns, or discussing a bible passage, they experience a sense of belonging to God and the wider Christian community.

Christianity has many points of resemblance with the Korean language on the issues of identity and power. To begin, just as the creation of the Korean writing system *Hunminjeong'eum* by King Sejong marked a new era in the history of the Korean language, the birth of Jesus of Nazareth indicated the defining moment for Christianity. Before the invention of *Hunminjeong'eum,* Koreans relied on Chinese characters to transcribe their speech. But the introduction of the new script made the Korean language, including the oral and written components, fully native to the Korean people. Similarly, the nativity of Jesus of Nazareth is a seminal event for the Christian language because all Christian words, expressions, rules, and culture centre on Jesus. Moreover, Jesus is the initiator of Christianity. He taught his followers that he was the incarnate Son of God and the Messiah prophesied in the Jewish scriptures. Jesus also expounded that he was the only way to eternal salvation. Subsequent to Jesus' death and resurrection, his disciples and other followers of Jesus began to talk about the truths Jesus explained and spread the good news of the coming of the Kingdom of God when Jesus returns.

Thus, the discourses regarding the birth, life, death, and resurrection of Jesus Christ and the lifestyle following Jesus' teachings characterise Christianity as a language.[644]

Another point of similarity between the Korean language and the language of Christianity is that both languages developed with the formation of a unified linguistic community. The earliest Christian community in the first century comprised small, sectarian groups practising a form of Judaism that focused on Jesus as Lord and the Messiah. Initially, the community gathered in Jerusalem. But as the Jesus movement expanded along the routes of the Jewish Diaspora within the Graeco-Roman world, the community became ethnically and culturally heterogeneous. According to Harry Eberts, at least four main groups drove the first-century Jesus movement.[645] The *Twelve of Galilee,* first known as the disciples, were led by Peter to carry out missions around the already-established Jewish synagogues of Galilee and environs.[646] The *Brothers of the Lord,* led by James, approached "Hebrews," who were Jews that spoke Aramaic in their homes but used Hebrews in synagogues and were socially isolated from Greek society.[647] The brethren considered Jerusalem as the epicentre of their ministry and dispersed to the surrounding areas. Another group called the *Hellenists,* under Stephen and Philip's leadership, ministered to other Hellenistic Jews who only spoke Greek and barely understood Hebrew or Aramaic. This group actively spread the gospel in Greek-speaking synagogues around Samaria, Caesarea, Antioch, Alexandria, and Ephesus.[648] The *Apostles,* guided by Barnabus and Paul, went to the synagogues in what is now Turkey and Greece to speak about the resurrection of Jesus Christ. Their ministry was directed to diaspora Jews and gentile "God-fearers," who were non-Jewish sympathisers of Judaism but not proselytes, and

[644] Although Jesus is the founder of the language of Christianity, it does not imply that all elements of the Christian language emerged after the birth of Jesus. The Christian language appropriated components from the Jewish and other surrounding cultures and reinterpreted them through the lens of Jesus Christ.
[645] Harry W. Eberts, "Plurality and Ethnicity in Early Christian Mission," *Sociology of Religion* 58, no. 4 (1997): 305, https://doi.org/10.2307/3711918.
[646] Ibid., 309.
[647] Ibid., 305.
[648] Ibid., 317.

diaspora Jews.[649] While the early Christian groups were from different backgrounds and had distinct theologies, worship rituals, and methods of church governance, they spoke of the importance of belonging to a single body. The emphasis on translocal unity based on the belief that Jesus is the son of God and the resurrected Jewish Messiah brought the diverse ethnic groups into one speech community.[650]

For the first-generation Christians, communicating a shared memory of Christ and the Christian lifestyle was crucial for establishing group cohesion. In *Matthew and the Margins,* Warren Carter asserts that Matthew's gospel sought to build a community of disciples by presenting Jesus as the definitive revealer of God's presence, reinforcing commitment to Jesus, urging compliance with rituals like baptism and prayer, vilifying the religious leaders, and reinterpreting the Jewish worldview around Jesus.[651] In the study on the Gospel of John, Philip Esler and Ronald Piper contend that the characters of Lazarus, Mary, and Martha served to model the identity of Johannine Christ-followers.[652] Also, Philip Esler's studies on Galatians and Romans suggest that Paul urged to bring together the Jewish and Gentile Christ-followers while underscoring the distinctions between Christian in-group and non-Christian out-group members.[653] Like Esler, Matthew Marohl indicates that the author of the letter to the Hebrews tried to integrate the addressees and Jesus into a shared narrative in which Jesus is the prototype of the common Christian in-group identity. [654] In addition, Marohl argues that the author's repeated use of "us" and "them" highlights the differences between the faithful and the

[649] Ibid., 314.
[650] Judith Lieu, "Text and Identity," in *Christian Identity in the Jewish and Graeco-Roman World* (Oxford: Oxford University Press, 2004), 4.
[651] Warren Carter, *Matthew and the Margins: A Socio-Political and Religious Reading* (Sheffield: Sheffield Academic Press, 2000), 7-8.
[652] Philip F. Esler and Ronald A. Piper, *Lazarus, Mary and Martha: Social-Scientific Approaches to the Gospel of John* (Minneapolis, MN: Fortress, 2006).
[653] Philip Francis Esler, *Galatians*, New Testament Readings, (London: Routledge, 1998); Ibid., *The First Christians in Their Social Worlds: Social-Scientific Approaches to New Testament Interpretation* (London: Routledge, 1994); Ibid., *Conflict and Identity in Romans: The Social Setting of Paul's Letter* (Minneapolis, MN: Fortress, 2003).
[654] Matthew J. Marohl, *Faithfulness and the Purpose of Hebrews: A Social Identity Approach* (Pickwick Publications, 2008).

unfaithful. As these examples indicate, the stories and correspondences regarding Jesus helped foster a sense of distinctive community of Jesus' followers who are accustomed to Jewish and Graeco-Roman culture yet pursue a different identity and lifestyle. In other words, people reinforced their belonging to Christ and a new community of Christ-followers by actively participating in the discourse focusing on Jesus of Nazareth.

Third, much like the Japanese colonists' oppression advancing the Korean language as a symbol of national pride and identity, the Roman persecution of Christians in the first three centuries matured the language of Christianity and promoted it as a marker of identity. The usage of the word "Christian" during this period, for instance, illustrates how one word became the quintessential term for demonstrating one's identity. When Herod Agrippa II said to Paul, "Are you so quickly persuading me to become a Christian (Acts 26:28)," the word "Christian" carried a derisive tone referring to followers of Christ that refused to acknowledge the Roman rule. Similarly, when Tacitus recorded the events of the Great Fire of Rome in 64 CE, he stated:

> …to scotch the rumour, Nero substituted as culprits, and punished with the utmost refinements of cruelty, a class of men, loathed for their vices, whom the crowd styled Christians.… First, then, the confessed members of the sect were arrested; next, on their disclosures, vast numbers were convicted, not so much on the count of arson as for hatred of the human race. And derision accompanied their end: they were covered with wild beasts' skins and torn to death by dogs; or they were fastened on crosses, and, when daylight failed were burned to serve as lamps by night.[655]

In this record, Tacitus adopted the epithet "Christian" to describe the dissident group of Christ followers. He portrayed Christians as sordid based on the popular gossip of Christians practising cannibalism and sexual promiscuity, thus deserving punishment. During Roman persecution, those who professed to be Christians suffered many penalties, including imprisonment, beating, stoning, crucifixion, being fed to wild animals, and burning. However, with Peter's endorsement of the term (1 Peter 4:16), the early church members continued to

[655] Cornelius Tacitus, *Annals: Books 13-16*, ed. Jeffrey Henderson, trans. John Jackson, vol. 5 (Cambridge, MA; London: Harvard University Press, 1937).

profess their identity with the name "Christian" and affirmed their belonging in the new community following Christ. According to the *Martyrdom of Polycarp,* the second-century bishop of Smyrna Polycarp declared, "I should swear by the fortune of Caesar, and pretend not to know who and what I am, hear me declare with boldness, I am a Christian."[656] Polycarp regarded the word "Christian" as a proud self-designation, not a commission of a capital crime. Like Polycarp, many Christ followers used the epithet "Christian" to describe their identity.[657]

In addition to the word "Christian," the rise of martyrdom narratives during the periods of persecution encouraged the development of the Christian language and identity. While some Christians apostatised in the face of violence, others showed readiness to suffer and die for their faith. In his letter to the Romans, Ignatius repeatedly stated his desire to die so that he could participate in Christ's passion.[658] Clement also inspired Christians to persevere amid suffering to "gather the imperishable fruit of the resurrection."[659] The continued persecution naturally grew the number of martyrdom stories of Christian leaders, Christian communities, and ordinary men and women. People recounted the lives of Christian martyrs as tales of triumphant heroes standing up to Roman cruelty with courage, boldly affirming their faith publicly, and facing death with joy. Some narratives were textualised and circulated within the Christian communities. A few examples include *The Martyrdom of Polycarp, The Martyrdom of Ptolemaeus and Lucius, The Acts of the Scillitan Martyrs, The Martyrdom of Apollonius, The Martyrdom of Perpetua and Felicitas,* and *The Martyrdom of Irenaeus, Bishop of Sirmium.*

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[656] *The Martyrdom of Polycarp*. trans. Alexander Roberts and James Donaldson, Ante-Nicene Fathers (Buffalo, NY: Christian Literature Publishing Co., 1985), 10.1.
[657] cf. 1 Peter 4:16, "The Martyrdom of Carpus, Papylus, and Agathonice," in *The Acts of the Martyrs*, ed. Herbert A. Musurillo (Oxford: Clarendon Press, 1972).
[658] Ignatius, *The Epistle of Ignatius to the Romans*, ed. Alexander Roberts, James Donaldson, and Cleveland A. Coxe, trans. Alexander Roberts and James Donaldson, vol. 1, Ante-Nicene Fathers, (Buffalo, NY: Christian Literature Publishing Co., [1885]).
[659] Clement of Alexandria, *The Second Epistle of Clement*, ed. Allan Menzies, trans. John Keith, vol. 9, Ante-Nicene Fathers, (Buffalo, NY: Christian LIterature Publishing Co., [1896]).

In her analysis of the narrative features of the early martyrdom documents, Marijana Vuković notes that these narratives employed carefully constructed martyr figures and almost propagandistic rhetoric to encourage the Christian audience to bolster faith and endure suffering.[660] In texts like *The Acts of the Scillitan Martyrs* and *The Martyrdom of Irenaeus*, Christian martyrs maintained a neutral, unemotional tone during their dialogue with the persecutors to accentuate the bold, fearless willingness to die. Additionally, the martyrs in *The Martyrdom of Perpetua and Felicitas* and *The Martyrdom of Irenaeus* appeared insensitive to pain and impervious to torture during their death scenes.[661] It was only the martyrs' families that grieved over the suffering.

Through the oral and textual accounts of the Christian martyrs, the early Christian communities saw the suffering and readiness to die for Christ as essential elements of being "faithful." The martyrdom narratives invited the audience to share the collective memory of religious suffering and follow the way of life, demonstrating the love for God even until death.[662] Therefore, just as Tertullian famously characterised the blood of the martyrs as the seed of the church, the discourse about the lives of the Christian martyrs during the times of persecution cultivated the Christian language and self-understanding.

The first three centuries of persecution also encouraged the incorporation of visual symbols into the Christian language. Since many Christians could not display Christian doctrines openly through textual or oral modes of communication for fear of severe abuse and imprisonment, they used more inconspicuous symbols to express their belief and identity. This is mentioned in the writing of Clement of Alexandria:

> And let our seals be either a dove, or a fish, or a ship scudding before the wind, or a musical lyre, which Polycrates used, or a ship's anchor, which Seleucus got engraved

[660] Marijana Vuković, "The Early Christian Martyrdom Narratives: Narrative Features, Intertextuality and the Authoritative Texts Behind," (Leiden, The Netherlands: Brill, 2017).
[661] Ibid., 286.
[662] Judith Lieu, "'I Am a Christian': Martyrdom and the Beginning of 'Christian' Identity," in *Neither Jew nor Greek?: Constructing Early Christianity* (London: Bloomsbury T & T Clark, 2016), 223-27.

> as a device; and if there be one fishing, he will remember the apostle, and the children drawn out of the water.[663]

One of the most important symbols used by the early Christians was the fish or *ichthys* symbol. The *ichthys* was an ideal Christological symbol because it was already a common religious symbol in Judaism and the cults of the ancient world. In Christianity, the fish was often associated with the sacraments of communion and baptism, as well as the stories of Jonah and the feeding of the five thousand. Also, the Greek word for fish, ΙΧΘΥΣ, formed the initial letters of the acrostic "**Ι**ησοῦς **Χ**ρῑστός **Θ**εοῦ **Υ**ἱός **Σ**ωτήρ," which means "Jesus Christ, Son of God, Saviour."[664] Consequently, the fish symbol was adopted to mark Christian meeting places and tombs and distinguish fellow Christians from the persecutors.

Another popular aniconic form used by the early Christians was the Chi-Rho ☧ symbol. This symbol is a monogram formed by putting together the first two letters—"**X** (chi)" and "**P** (rho)"—of the Greek word **XP**ΙΣΤΟΣ (*Christos*). Before the early Christian times, the pagan Greek scribes used the Chi-Rho symbol, signifying "*chrēston,"* meaning good, to mark a passage deemed valuable or relevant. When the early Christians appropriated this symbol into their language, they used it to refer to Christ or Christianity. They often inscribed the symbol ☧ on the walls of the catacombs, tombstones, and slabs that seal the tombs to indicate that Christians were buried there. Considering the dangers of using easily understandable text or speech to communicate their faith, Christians utilised the aniconic forms, such as and ☧. However meaningless and obscure to the outsiders, these symbols became a valuable means of communication and visible reminders of faith and values for the early Christian community.

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[663] Clement of Alexandria, *The Paedagogus*, ed. Alexander Roberts, James Donaldson, and Cleveland A. Coxe, trans. William Wilson, vol. 2, Ante-Nicene Fathers, (Buffalo, NY: Christian Literature Publishing Co., 1885), 3, 11.

[664] Robin Margaret Jensen, *Understanding Early Christian Art*, Taylor & Francis Ebooks, (London; New York, NY: Routledge, 2000), 50.

Like the Japanese colonisation prohibiting the use of Korean, the periods of persecution of early Christians prevented Christians from publicly promoting and affirming their belief and identity. Christians, despite various obstacles, matured their language by developing more concrete expressions of what it means to be a follower of Christ. The epithet "Christian" became an emblem of one's identity. The chronicles of suffering and martyrdom presented the stages for Christian discourse. The creative use of visual symbols enriched the Christian language. Therefore, the first three centuries of hardship and violence faced by the early Christians were beneficial for developing Christian vocabulary.

The fourth point of parallel between the Korean language and the language of Christianity is that the language speakers gain or lose privileges depending on the power structure associated with their language. According to Bourdieu's concept of linguistic capital, the ability to speak the language is a form of capital that predetermines the speaker's social status, influences access to economic and social opportunities, and entails a sense of membership in a community with a shared linguistic identity, culture, and values. Such insight is also applicable to Christianity. When Christianity became the official religion of the Roman Empire, Christians' social status changed drastically. They no longer needed to be in hiding, without fear of their legal rights being rescinded or their property confiscated. The new alliance of church and state in the Middle Ages brought many privileges and power to the clergy, who were God's appointed representatives responsible for interpreting and communicating God's messages to the people. With the Roman papacy as its head, the Church legitimised what could be said about God and exercised enormous influence over people's lives, from the royal families to the peasants. The Church also monopolised education and accumulated vast amounts of wealth. The people regarded the members of the clergy entrusted with the ability to engage in a proper discourse about God and the Bible. Considering the preeminent authority of the religious institution and the exalted status of any discussion or reflection on the divine,

it is no surprise that the people during the High Middle Ages enthroned theology as the "queen of sciences (*regina scientiarum*)."[665]

In the early modern period, various changes in the status of the Church influenced the trajectory of the Christian language. Although the people's lives revolved much around the Church, the widespread corruption within the Church directed the laity to mistrust the current ecclesiastical structure. Just like the *yangbans* resisting the widespread use of *hangul* due to the possibility of losing their elite standing, the clergy opposed the doctrine of the priesthood of all believers, dreading that the clergymen would lose their special status as the sole mediators between God and the people. However, increasing voices for reform from theologians, such as Martin Luther and Huldrych Zwingli, and the introduction of vernacular translations of the Bible enabled the laity to participate in the Christian discourse and develop a personal relationship with God.

While the Reformation invited a wider group of people to partake in the conversation about God and the Christian faith, the prestige of the Christian language abated with the waning significance of religion in the late modern period. Enlightenment rationalism elevated human reason above divine revelation and depreciated religious authorities. Industrialisation placed empirical knowledge obtained from physical sciences above all other forms of knowledge, especially theology. The trends of secularism in historically Christian countries severed all ties between religion and government. As modern society transitioned to minimise or remove the role of religion in any public sphere, the sociocultural capital linked to learning Christian doctrine or participating in Christian rituals declined.

Today, the sociocultural significance of Christianity may be in decline. In Western societies, religion is separate from politics, economy, science, education, and healthcare;

[665] Gijsbert van den Brink, "How Theology Stopped Being Regina Scientiarum—and How Its Story Continues," *Studies in Christian Ethics* 32, no. 4 (2019), https://doi.org/10.1177/0953946819868092; Thomas, *Summa Theologica*, I 1, 5.

consequently, the impact of religion on social, cultural, moral, and political life is diminishing. Various religious institutions are marginalised, and any conversation about faith is shunned in the public sphere. Christianity no longer acts as the "sacred canopy," which overarches society and offers a coherent worldview.[666] Instead, it is considered one of many subsystems that can provide a framework for meaning-making.

Although the language of Christianity in the 21st-century Western world yields less compelling political power or social privileges compared to the Middle Ages, the adherents of Christianity nonetheless enjoy a strong sense of communal identity and belonging. As Christians perform diverse linguistic activities, such as reading the Bible, praying to God, or reciting the eucharistic prayer, they are reminded of and actively reaffirm their identity as Jesus' followers. Moreover, exchanging information and resources among Christian language users entails certain sociocultural benefits. Thus, the trends of secularisation, privatisation, and pluralisation in the postmodern world may have decreased the overall power and privileges associated with the language of Christianity compared to the past when religion dominated all aspects of life, but the community of Christians today still profits from speaking the language of Christianity.

The final point of correspondence between Korean and the Christian language is that both languages reflect and advance social change. When the vernacular alphabet *hangul* was invented to empower the lower social class or the foreign loanwords were removed by the North Korean government to promote national solidarity and socialist ideologies, the Korean language stimulated the movement of power in society. Similarly, the language of Christianity transforms with the society which faces certain sociopolitical issues.

[666] Peter L. Berger, *The Sacred Canopy: Elements of a Sociological Theory of Religion*, 1st ed. (Garden City, NY: Doubleday, 1967).

Christian feminist theology is a good illustration of the Christianity language reflecting a change in the socioeconomic and political framework. Feminist theology is one of several new theologies that emerged in the 1960s and 1970s in the context of the Second Wave of feminism in the United States.[667] This movement seeks to understand and advance the equality, justice, and flourishing of women from a Christian perspective. Feminist theology critically examines and challenges the patriarchal paradigm of power and domination that has shaped the church, the Bible, and the translation and interpretation of the Bible. It tries to promote women's access to church leadership and retrieve women's agency and histories. Furthermore, feminist theologians, acknowledging the contextual and constructed character of knowledge, strive to re-imagine and reconstruct the traditional theological language and symbols with respect to the lives of women.[668]

The language for describing God is one area of investigation by feminist theologians. The characterisation of God the Father and the Son being masculine by analogy or God's loving relationship with humanity conceived as fatherhood are some examples of the Christian language being discriminatory and resulting in oppression, silencing, and exclusion of women in various areas of life, including the church. Noting the traditional, male-dominated Christian language, theologians such as Rosemary Radford Ruether and Mary Daly call for the adoption of more inclusive, gender-neutral, or gender-transcendent language.[669] In *Sexism and God-Talk,* Ruether proposes the use of "God/ess" to express the combination of both masculine and feminine forms of the divine whilst affirming that God is one.[670] Ruether's neologism attempts to underscore God's imminence over and against the patriarchal sky deity. She also calls for

[667] Mary McClintock Fulkerson and Sheila Briggs, "Introduction," ed. Sheila Briggs and Mary McClintock Fulkerson, *The Oxford Handbook of Feminist Theology* (Oxford: Oxford University Press, 2011). 1.
[668] Serene Jones, "Feminist Theology and the Global Imagination," in *The Oxford Handbook of Feminist Theology*, ed. Sheila Briggs and Mary McClintock Fulkerson (Oxford: Oxford University Press, 2011).
[669] Rosemary Radford Ruether, *Sexism and God-Talk: Toward a Feminist Theology* (London: SCM, 1983); Mary Daly, *Beyond God the Father: Toward a Philosophy of Women's Liberation* (Boston, MA: Beacon Press, [1973] 1985).
[670] Ruether, *Sexism and God-Talk*, 46.

the use of female imageries and metaphors like Sophia present in the Wisdom tradition to refer to God.[671] In *Beyond God the Father,* Daly rebukes the masculine bias of theological language, stating that "if God is male, then the male is God."[672] She argues that the male divinity should be reconceptualised as a verb rather than a noun—God is not a great Being, but the process of "being." Regarding the name of the triune God, Janet Martin Soskice suggests replacing the language of fatherhood and sonship with the desexualised language of the Trinity, such as Creator, Sustainer, and Redeemer.[673] Other feminist theologians present the doctrine of the Trinity with emphasis on God's relational identity, which serves as a model of human sociality.[674]

In the 21st century, feminist theology has become a global movement as women in different sociocultural contexts with different concerns and values object to androcentric teachings and practices of the church. Influenced by poststructuralism and anti-essentialism, feminist theologians recognise that there is no *one* "feminist theology" originally defined by the interests of middle-class Western women, but many feminist theologies encompassing the voices of women from all over the world.[675] For instance, there is womanist theology, which centres on the experiences of African American women; *dalit* women's theology arising out of the perspectives of low-caste Christian Indian women; and *minjung* feminist theology addressing the situation of the poor and marginalised Korean women. Although the varieties of feminist theology have different perspectives and methods, they commonly strive to accommodate the unique experiences of women in Christian discourse and empower women.

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[671] Ibid., 9.
[672] Daly, *Beyond God the Father*, 19.
[673] Janet Martin Soskice, "Trinity and Feminism," in *The Cambridge Companion to Feminist Theology*, ed. Susan Frank Parsons, Cambridge Companions to Religion (Cambridge: Cambridge University Press, 2002), 141.
[674] Jones, "Feminist Theology and the Global Imagination," 32-33.
[675] Kwok Pui-lan, "Feminist Theology as Intercultural Discourse," in *The Cambridge Companion to Feminist Theology*, ed. Susan Frank Parsons, Cambridge Companions to Religion (Cambridge: Cambridge University Press, 2002).

Besides the language of feminist theology, the languages of other contextual theologies utilise the contextualised expressions of the gospel that emerge from responding to the dynamics of context. Whether liberation theology in Latin America, Minjung theology in South Korea, postcolonial theology for postcolonial countries, or queer theology for LGBTQIA individuals, contextual theologians place their sociocultural issues at the forefront of the theological process and adjust their language to accommodate these concerns. They change the traditional names, metaphors, symbols, and idioms present in various areas of theological language, not limited to the doctrines of God, creation, humanity, redemption, Christology, sin, faith, eschatology, and ecclesiology. Through contextualised language, Christians who have been marginalised, oppressed, and underrepresented in the past have a voice in the Christian discourse and proceed to transform society.

4. Implications for the relationship between science and religion

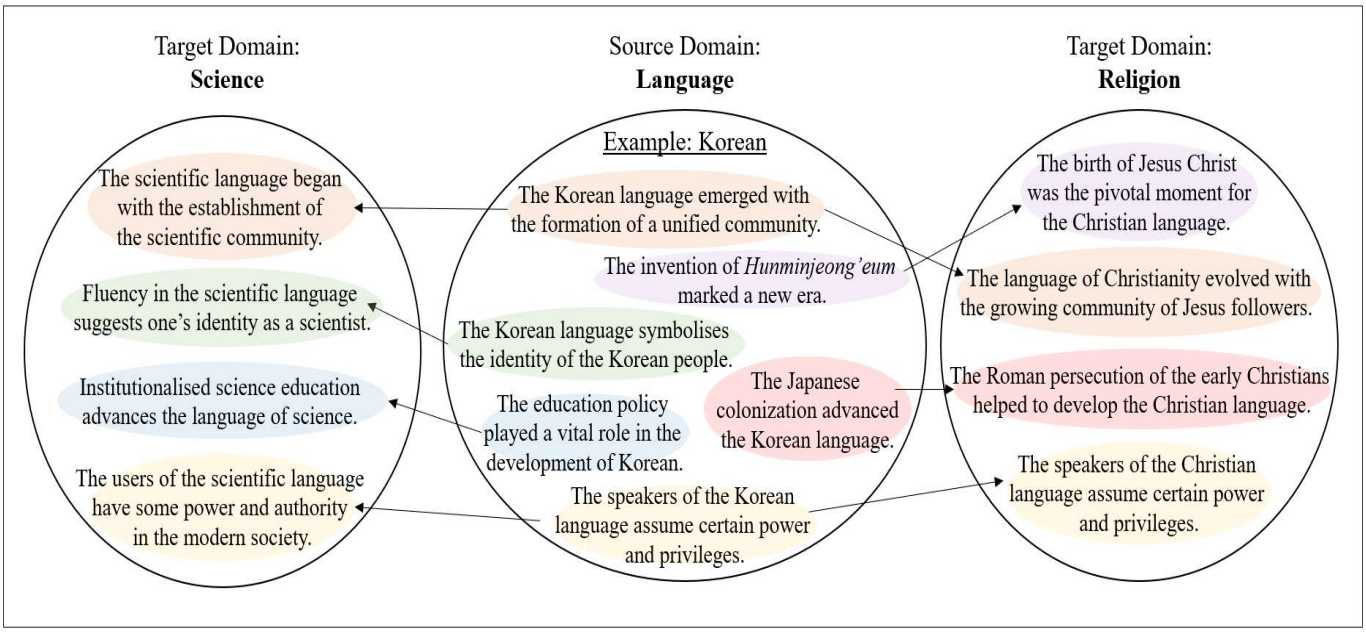

Figure 22: Cross-domain mapping of linguistic identity and power onto science and religion

In this chapter, the "language" metaphor has introduced the concepts of identity and power to understand science, religion, and their relationship. It presents the Korean language as a concrete example to be mapped onto science and religion (see **Figure 22**).

The language of science, like any other language in the world, arose with a community devoted to understanding nature through logical reasoning and systematic empirical observation. Just like the Korean language is a symbol of national identity, science is an emblem of professional scientists. Similar to the formal education established by the Japanese colonists advancing the Korean language, science education provided by academic institutions is a driving force for developing the language of science. Finally, the speakers of the scientific language are regarded the experts in science, producing valid and reliable knowledge.

Christianity also has many points of similarity with the Korean language. If the invention of *Hunminjeong'eum* marks a defining moment in the history of the Korean language, the birth of Jesus of Nazareth is a milestone in the evolution of the language of Christianity. The language of Christianity emerged gradually from the community of Jesus' followers, who needed to communicate their beliefs and practices. Similar to the Japanese oppression of the Korean people promoting the development of the Korean language, the Roman persecution of early Christians led the Christian language to mature and flourish. Throughout history, the status of the language of Christianity has changed with the fluctuating public attitudes towards religion. In modern Western society, Christianity is meaningful for only the religious adherents. But just as the Korean language is a proud expression of one's Koreanness, the language of Christianity is a manifestation of one's non-negotiable Christian identity and a tool for liberation, empowerment, and well-being of minority communities.

Besides the apparent similarities between the Korean language and the language of science or religion, the case of the Korean language is pertinent to the study of science and religion because of the issues of power and identity related to the Korean language during the

Japanese annexation of Korea. When the Japanese Empire colonised Korea, the Japanese government forced Koreans to learn and speak Japanese in hopes of transforming them into loyal subjects. They also dogmatised the Japanese language as the national language of the Korean people and prohibited the use of Korean in public. During the Japanese occupation, the Japanese' attitude of cultural superiority, especially towards its language, is comparable to the trends of scientism in science and fundamentalism in religion.

Scientism, as briefly mentioned in the previous chapter, is the thesis that only the methods of science provide an understanding of the world and reality and that only science can effectively address moral and existential questions. Mikael Stenmark denotes scientism as "scientific expansionism," claiming that "*the boundaries of science could and should be expanded in such a way that something that has not previously been understood as science can now become or be transformed into science (or if that is after all not possible it must be rejected)* [italics in the original]."[676] Considering the practical successes of science, some people insist on a more ambitious outlook that science has no limits or boundaries and that only the reality science can discover exists.[677] In this way, scientism is the imperialist expanding the territory of science and asserting the dominance of science over all realms of reality.

Under the framework of the "language" metaphor, the advocates of scientism would say that the language of science should be the standard language for all. They would view the scientific language as the only means capable of communicating the full story of reality and maintain that there is no limit to what can be said using the language of science. For instance, scientific constructs and methods will, in due time, enable a proper discussion about the value of Leonardo da Vinci's Mona Lisa, and the debate on abortion will end with a more advanced

[676] Mikael Stenmark, "Scientism and Its Rivals," in *Scientism: Prospects and Problems*, ed. Jeroen de Ridder, René van Woudenberg, Rikz Peels (New York, NY: Oxford University Press, 2018), 58.
[677] Stenmark classifies such position as ontological scientism.

scientific understanding of human life. However convincing these statements may seem, they appear illogical and even impossible.

Just like any other language, the language of science has its limits of expression. Emerging from the community of professional scientists to meet their unique communicative needs, the language of science is superior in describing nature through the scientific method, but it is not designed to engage in any meaningful discourse about non-naturalistic dimensions of reality. In other words, the language of science is not a system of communication equipped to address concepts like morality, intention, and religion in a meaningful way. Thus, no matter how much science evolves, its boundaries do not extend beyond the natural world.

In the domain of religion, fundamentalism exhibits a struggle for absolute authority. The term "fundamentalism" has its origin in the late 19th-century and early 20th-century Protestant movements emerging in response to modernism, secularism, ecumenism, pluralism, and other social changes.[678] It generally carries a religious connotation denoting a strict adherence to basic principles considered fundamental, essential, authoritative, and inerrant truths. In the context of Christianity, fundamentalism refers to the primacy of certain Christian doctrines, such as the inerrancy of the Bible, the virgin birth of Christ, and his substitutionary atonement.[679] It advocates the literal interpretation of scripture and insists on applying such understanding to all social, economic, political, and cultural aspects of life. Fundamentalists believe that they have a hold on absolute truth and assert that their understanding is the only accurate view of the world. Consequently, they dogmatically dismiss any conflicting views, claiming them illegitimate and erroneous. However, asserting the supremacy of their worldview and pressing their principles to be the overarching ideology of the existing socio-political structures are inherently totalitarian and imperialistic.

[678] Roger W. Stump, "When Faiths Collide: The Case of Fundamentalism," in *Clashes of Knowledge*, ed. Peter Meusburger, Michael Welker, and Edgar Wunder (Dordrecht: Springer Netherlands, 2008), 181.
[679] Ibid., 177.

Fundamentalists' view transferred to the system of the "language" metaphor can be expressed as such: the language of Christianity founded on certain principles should be the most authoritative language for any discourse. As an example, fundamentalists would say that the language of Christianity should guide the way scientists talk about the origin of Earth, politicians make a speech, or songwriters write lyrics. While fundamentalists try to promote the Christian language as the standard language within the existing institutions and refuse to cede a degree of legitimacy and power to the languages of others, they end up generating an overt sense of conflict and disparaging the value of other languages.

The language of Christianity is a valuable tool for communicating Christian beliefs and values, but it is not conceived for the purpose of establishing dominance in the political or social sphere. It recognises the legitimacy of other languages and appreciates the diversity of expression they entail. Although the language of Christianity can posit an overarching, coherent worldview guiding any discourse, it has its limits of applicability. It is not best suited for talking about the process of genetic mutation, the structure of the Supreme Court in the United Kingdom, or the value of cryptocurrency. Considering these restrictions, the speakers of the language of Christianity must not only be open to but also rely on alternative views of reality presented by other languages.

To conclude, the "language" metaphor highlights the issues of identity and power as complicating factors in the science-religion relationship. When science and religion appear to be in a head-to-head battle, this is because science and religion are struggling for power over a specific domain or threatening their social identity. On the other hand, when science and religion appear compatible, the two entities do not claim authority on a particular area of understanding but respect each other's contributions.

In the world of languages, there is no superior or inferior language, no dominant or subordinate language. All languages are equally important, valuable, and well-suited for their

purposes. Each language shapes and reflects the identity of its linguistic community. It possesses certain prestige and power but does not claim its exclusivity or supremacy over others. The same goes for science and religion. Science is neither superior nor inferior to religion; religion is neither dominant over nor subordinate to science. Both science and religion are important ways to talk about various aspects of reality. They manipulate power relations and characterise who the person is in the world. One can be more comfortable using the language of science or the language of religion, but this is a matter of personal preference than a matter of quality. Therefore, the "language" metaphor shows that both science and religion are legitimate sources of knowledge, identity, and power and that the science-religion relationship is often affected by the struggle to affirm and maintain personal or communal identity and power.

Chapter 6: Bilingualism and Translation

As a bilingual speaker of Korean and English, I occasionally have people asking the question, "do you think in Korean or English?" The underlying assumptions in the question are that one language dominates a bilingual speaker's cognition and that when the non-primary language is used, it is produced by translating from the primary language. These premises correspond to a particular view of bilingualism called the monolingual or fractional view. François Grosjean depicts this view of a bilingual as "two monolinguals in one person."[680]

If this view were correct, I would answer either "Korean" or "English." However, I usually say, "I think in both languages." While some specific cognitive activities, such as multiplication or prayer, are conducted only in one language, Korean and English are never considered separate entities in my mind.

My answer aligns with what Grosjean calls the bilingual or holistic view. According to this position, a bilingual person is not the result of the sum of two independent monolinguals but an individual who integrates two languages and constructs a "unique and specific linguistic configuration."[681] A bilingual relies on a holistic language faculty that accommodates the different languages.

In this chapter, I assess whether the "language" metaphor, precisely the issues of bilingualism and translation, contributes to understanding the relationship between science and religion. Unlike the previous chapters that explored how the metaphor helps to conceptualise the "science" and "religion" concepts as well as their relationship, this chapter primarily focuses on the relationship between science and religion. Considering the scope of the

[680] François Grosjean, "Neurolinguists, Beware! The Bilingual Is Not Two Monolinguals in One Person," *Brain and Language* 36, no. 1 (1989): 3, https://www.sciencedirect.com/science/article/pii/0093934X89900485.
[681] Ibid., 6.

discussion, I limit the analysis to the general science-religion interaction in contemporary society.

To begin, I define bilingualism and the various forms of bilingualism. I also address the findings from the neuroscientific research concerning bilingualism. Furthermore, I explore the process of becoming a bilingual speaker and reflect on whether bilingual speakers are competent translators. After reviewing the topics of bilingualism and translation, I map these ideas onto the fields of science and religion. The way two languages interact in the mind of a bilingual individual, the process of acquiring another language, and the benefits of becoming a bilingual speaker are the points of relevance for the science-religion relationship. Moreover, I introduce Francis Collins and John Polkinghorne as individuals bilingual in the languages of science and religion. Following the discussion on the qualifications for skilled translators, I recommend Alister McGrath to be a competent translator for both the scientific and religious communities. Overall, the analysis of the meaning of the "language" metaphor spotlighting the concepts of bilingualism and translation reveals that just like the two languages of the bilingual speaker existing as a holistic, comprehensive, and efficient system, science and religion can sustain a complementary and integrated relationship by fostering an environment promoting interdisciplinary conversations between science and religion.

1. What are bilingualism and translation?

It is generally estimated that more than half of the world's population is bilingual.[682] In the United States, approximately 20% of the population is bilingual, and about 56% of the people across the European Union identify as being bilingual.[683] Owing to the globalising society where more people are interacting with others who speak different languages, and the ease of

[682] François Grosjean, *Bilingual: Life and Reality* (Cambridge, MA: Harvard University Press, 2010).
[683] Ellen Bialystok, Fergus I. M. Craik, and Gigi Luk, "Bilingualism: Consequences for Mind and Brain," *Trends in Cognitive Sciences* 16, no. 4 (2012), https://doi.org/10.1016/j.tics.2012.03.001; U.S. Census Bureau, Language Use in the United States: 2011, ACS-22 (2011).

access to information made possible by the Internet, the population of bilinguals in various parts of the world is on the rise.

1.1 Definition of bilingualism

Bilingualism broadly denotes the ability to use two different languages. But do all bilinguals have a native-like competence in two languages, or do some people have minimal proficiency in the second language? For instance, can a person who speaks English as the mother tongue and studied French for two years be called a bilingual? Can a person with high competence in the second language but an extremely strong foreign accent be identified as bilingual? Therefore, being bilingual can mean different things to different people.

There are many elements contributing to the difficulty in defining "bilingualism." One of the challenges is the question of degree. Language competence is on the continuum ranging from complete fluency to minimal proficiency. Also, there are variances of competence in four language modalities—speaking, listening, reading, and writing—which can further divide into more specific skills. For example, speaking can include precise areas of vocabulary, grammar, and accent. Another factor impeding the formation of a universal definition is the diverse relationship between the two languages of the bilingual. The two languages may be used for separate cognitive tasks and have varying sociocultural statuses. Considering the multiple dimensions of bilingualism, scholars adopt a definition which fits their own purpose and context rather than devising and imposing a generic, comprehensive definition.

For this chapter, I use Yuko G. Butler and Kenji Hakuta's definition of bilingualism, which is "the psychological and social states of individuals or groups of people that result from interaction via language in which two or more linguistic codes (including dialects) are used for

communication."[684] Here, they describe bilingualism in two levels of the social dimension—individual and community. *Individual bilingualism,* which Josiane Hamers and Michel Blanc call *bilinguality,* is the state of an individual who communicates using more than one language with various degrees of proficiency in oral and/or written forms.[685] *Societal bilingualism* refers to the state of a linguistic community comprised of speakers being able to use two or more languages.

1.2 Types of individual bilingualism

There are classifications of individual bilingualism based on the different linguistic, cognitive, and developmental dimensions. Regarding the degree of proficiency, Elizabeth Peal and Wallace Lambert distinguish between *balanced* and *dominant* (or *unbalanced*) bilinguals. Balanced bilinguals acquire mastery of both languages, whereas dominant bilinguals are individuals whose proficiency in one language is higher than the other variety.[686] Another typology of bilinguality is *productive* (or *active*) and *receptive* (or *passive*). While productive bilinguals are competent in both understanding and producing a language, receptive bilinguals can understand but cannot produce a language.[687] Regarding the age of language acquisition, bilingual speakers can be classified as *simultaneous* if they were exposed to two (or more) languages from birth or *sequential* if they learned one language after another through formal education or other means. Another classification category based on sociocultural status and language context is *elective* and *circumstantial* bilingualism.[688] Elective bilinguals are those who voluntarily acquire a second language for additional sociocultural benefits. On the other

[684] Yuko G. Butler and Kenji Hakuta, "Bilingualism and Second Language Acquisition," in *The Handbook of Bilingualism* (Oxford: Blackwell Publishing Ltd, 2006), 115.
[685] Ibid.
[686] Ibid.
[687] John Edwards, "Foundations of Bilingualism," in *The Handbook of Bilingualism* (Oxford: Blackwell Publishing Ltd, 2006), 10.
[688] Guadalupe Valdés and Richard Figueroa, *Bilingualism and Testing: A Special Case of Bias* (Norwood, NJ: Ablex, 1994).

hand, circumstantial bilinguals learn the second language due to their social, geographical, or political situation. Concerning the effect of the second language on the retention of the first language, *additive* bilinguals are individuals who enhance their second language without losing proficiency in the first language, and *subtractive* bilinguals are those who learn the second language at the expense of losing the first language.[689] While these major typologies help identify diverse cognitive, developmental, social, and cultural factors that affect bilinguality, it is essential to note that "the dimensions of bilingualism are," borrowing Butler and Hakuta's words, "continuous and not simply categorical constructs."[690]

1.3 Features of individual bilingualism

Compared to monolinguals, bilingual speakers have an expanded linguistic repertoire, which is the set of skills and knowledge a person has of one or more language varieties. Since bilinguals acquire and use two sets of words, grammatical structure, and pragmatic rules distinctive to each linguistic culture, a bilingual speaker can understand and address a broader range of cultural aspects compared to monolinguals.

Another pervasive feature of bilinguality is what François Grosjean terms the complementarity principle. Grosjean explains the complementarity principle: "Bilinguals usually acquire and use their languages for different purposes, in different domains of life, with different people. Different aspects of life often require different languages."[691] According to the complementarity principle, bilinguals choose one or more language varieties for a wide range of domains of life, such as work, education, family, religion, politics, leisure, shopping, and sports. For example, someone bilingual in French and German can use German in family

[689] Wallace E. Lambert, "A Canadian Experiment in the Development of Bilingual Competence," *The Canadian Modern Language Review* 31, no. 2 (1974), https://doi.org/10.3138/cmlr.31.2.108.
[690] Butler and Hakuta, "Bilingualism and Second Language Acquisition," 118.
[691] François Grosjean, "The Bilingual Individual," *Interpreting: International Journal of Research and Practice in Interpreting* 2 (1997): 165.

and leisure domains, French in religion and politics domains, and both languages in work and education domains. The differential patterns of use of the language repertoire reflect the diverse domain-specific needs of bilinguals.

The studies on the bilingual brain reveal that bilinguality involves joint activation of both languages and the recruitment of executive control functions. In recent years, research in psycholinguistics and neurolinguistics has provided a better understanding of bilingual processing in the human mind/brain. In their review of studies on the bilingual mind using both behavioural and neuroimaging techniques, Bialystok et al. confirm that fluent bilinguals exhibit "some measure of activation of both languages and some interaction between them at all times, even in context that are entirely driven by only one of the languages."[692] In addition, they note that bilingual processing relies on not only linguistic functions but also non-linguistic functions, such as executive control generally responsible for resolving competition and directing attention. When both languages are activated, the executive control system located in bilateral frontal regions appears to inhibit the non-target language and enable the bilingual to attend to the target language.[693] Bialystok et al. also suggest that prolonged bilingual experience can change the anatomical structures and the cortical functional networks for facilitating information transfer between the hemispheres. These observations confirm that the bilingual experience of regulating attention to two languages reorganises specific brain networks, providing the basis for more efficient cognitive performance, including executive control.

Code-switching is another characteristic of bilinguality. When a bilingual speaker communicates with another bilingual, they seamlessly switch between their languages. C*ode-switching* is the process of alternating between two or more language varieties without pause

[692] Bialystok, Craik, and Luk, "Bilingualism," 241.
[693] Ibid., 242.

or interruption in the context of a single conversation or situation.[694] In linguistics, there are multiple types of code-switching depending on which grammatical units the alternations involve. *Inter-sentential switching* takes place outside the sentence or clause level (e.g. I don't know. *Danke*.); *intra-sentential switching* occurs mid-sentence or clause (e.g. I need to go to the *baño*); *extra-sentential switching,* also called tag-switching, involves switching a tag or slang phrase, word, or both from one language to another (e.g. I like chocolate, *pero* (but), I'm on a diet.); and *intra-word switching* is the mixing of two languages within a word (e.g. 반가워 친구들 s; -s added to show plurality). During code-switching, one language typically provides the grammatical framework, and the other language provides certain items to fit into the framework.[695]

In addition to switching between languages, bilinguals also apply some linguistic rules directly to another language. Generally known as *language transfer,* this phenomenon can occur at various linguistic levels, including morphology, lexicon, phonology and syntax. Some types of lexical transfer are *loan words*, which are words regularly adopted from one language to another in their unchanged, untranslated forms, and *loan translations,* which are words that are translated literally and word-for-word. Phonological transfer is probably the most common form of transfer where the bilingual uses the phonology of one language in the production of another language. The English word "idea," pronounced like the French word "*idée*" with the long "ee" sound, is an example of phonological transfer. Through the transfer process, one language of a bilingual individual exerts influence on other languages.

[694] Code-switching is sometimes referred to as code-mixing or borrowing. There are divergent theoretical perspectives in literature regarding the definition of these terms. For further discussion, see Maren Berg Grimstad, "The Code-Switching/Borrowing Debate: Evidence from English-Origin Verbs in American Norwegian," *Lingue e Linguaggio* (2017), https://doi.org/10.1418/86999.
[695] Li Wei, "Dimensions of Bilingualism," in *The Bilingualism Reader*, ed. Li Wei (London: Routledge, 2007), 15.

1.4 Advantages and disadvantages of bilingualism

Bilinguals exhibit some advantages as well as disadvantages on multiple levels. On the level of cognition, bilingualism involves higher executive control functions, including inhibition, multi-tasking, and sustained attention. Other research findings on bilingualism reveal that bilinguals are better at learning foreign vocabulary via the dominant language, protecting the brain against cognitive decline, and postponing the onset of symptoms related to dementia.[696] There is some research suggesting the link between bilingualism and creativity.[697]Although some criticise these studies for exaggerating the positive effect of bilingualism on executive control, researchers generally agree that bilingualism is a positive and desirable achievement.[698]

Besides these cognitive advantages, bilingual speakers also enjoy some social and cultural benefits. They are able to interact with diverse groups of people in different regions or countries due to their expanded language repertoire. Moreover, they develop an awareness of linguistic and cultural differences in various communities. Bilingualism is known to foster sensitivity and open-mindedness as well. There are also potential economic advantages to bilingualism. A bilingual person may have a broader portfolio of jobs available and be preferred in companies conducting international business.[699]

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[696] Cari A. Bogulski, Kinsey Bice, and Judith F. Kroll, "Bilingualism as a Desirable Difficulty: Advantages in Word Learning Depend on Regulation of the Dominant Language," *Bilingualism* 22, no. 5 (2019), https://doi.org/10.1017/s1366728918000858; E. Bialystok, "Bilingualism: Pathway to Cognitive Reserve," *Trends in Cognitive Sciences* 25, no. 5 (May 2021), https://doi.org/10.1016/j.tics.2021.02.003; Angela Grant, Nancy A. Dennis, and Ping Li, "Cognitive Control, Cognitive Reserve, and Memory in the Aging Bilingual Brain," *Frontiers in Psychology* 5 (2014), https://doi.org/10.3389/fpsyg.2014.01401.

[697] Bernhard Hommel et al., "Bilingualism and Creativity: Benefits in Convergent Thinking Come with Losses in Divergent Thinking," Original Research, *Frontiers in Psychology* 2 (2011), https://doi.org/10.3389/fpsyg.2011.00273; Marloes van Dijk et al., "Bilingualism and Creativity: Towards a Situated Cognition Approach," *The Journal of Creative Behavior* 53, no. 2 (2019), https://doi.org/https://doi.org/10.1002/jocb.238.

[698] Angela de Bruin, Barbara Treccani, and Sergio Della Sala, "Cognitive Advantage in Bilingualism: An Example of Publication Bias?," *Psychological Science* 26, no. 1 (2015): 106, https://www.jstor.org/stable/24543854.

[699] Wei, "Dimensions of Bilingualism," 20-1.

Despite these apparent cognitive, social, cultural, and economic advantages, bilinguals also have some disadvantages. Various studies confirm that language processing is more costly for bilinguals. Bilinguals experience more difficulty retrieving a common word and possess a higher risk for language interference and language error.[700] Moreover, compared to monolingual speakers of each language, bilinguals generally have weaker verbal skills and smaller receptive vocabulary in each language.[701] On the social level, bilinguals who use a stigmatised language variety may experience social discrimination or disadvantage. Some bilinguals struggling between two linguistic cultures may develop insecure identity. Indeed, bilinguals face some inconveniences, but the general attitude towards bilingualism in the globalising society is becoming more positive.

1.5 Becoming a bilingual speaker and a translator

Bilingualism emerges when two or more language varieties are in sustained contact, meaning two or more codes are used regularly by an individual or a linguistic community for communication. Therefore, creating an environment where different language varieties are in contact is the key to developing bilingualism. For some individuals, a bilingual environment is established from birth because they are born and raised in communities or homes where more than one language is used. Others become bilingual by learning a second language after acquiring the first language. When someone moves to a region or a country that speaks another language, goes to school or work requiring to use a second language, or meets a partner who speaks a different language are instances where two languages are in sustained contact. Additionally, positive attitudes towards other languages and cultures can increase the

[700] Bialystok, Craik, and Luk, "Bilingualism," 241.
[701] Ibid., 240-1.

opportunities for language interaction. Whether bilingualism develops early or later in life, regular and continued use of two or more language varieties is vital for preserving bilingualism.

Given the ability to speak two or more languages, a bilingual speaker can be asked to translate from one language to another. But are bilinguals naturally good translators?[702] Translation work is indeed something that all bilinguals do every day in the mind, but this does not mean that they are apt translators. In fact, written or oral translation requires special skills; simply being bilingual does not automatically engender such expertise.

Not all bilinguals are proficient at translating because they have varying degrees of language competence. Since bilinguals use their languages for different purposes and domains of life, one language can be more dominant than the other. Also, specific modalities can be practised more often than others. Another reason for the difficulty in translation is that the bilinguals may not be familiar with particular concepts and jargon used in the discourse. Furthermore, the lack of cultural knowledge is another obstacle to translation. Bilinguals must have pragmatic competence and a deep understanding of the cultures of the languages in order to translate and interpret the highly nuanced, culturally embedded expressions. Considering these constraints, it is difficult for bilinguals without much training to translate or interpret from the source language to the target language with high quality and accuracy.

So, what are the specific qualifications for a proficient translator? First, one must have an excellent command of the languages involved in translational activity. If the translator does not have an exceptional grasp of the source and the target domain, they will not be able to present the most appropriate translation equivalents fit for the context. While translators necessitate high language proficiency, they need not be balanced bilinguals in all language modalities. Depending on the mode of language required for communication, the translator

[702] While the word "translator" typically denotes someone who interprets written text and "interpreter" for those translating spoken language orally, the term "translator" used in this thesis refers more generally to those who convert messages from a source language into a target language regardless of the written or oral mode.

may need excellent reading and writing skills but not equivalent mastery of speaking and listening skills. Alternatively, during speech translation, the translator must have distinguished proficiency in listening and speaking but not in reading or writing modalities. Furthermore, translation activities occur via passive reception of the source language and active production of the target language. Translation thus requires a high level of language competence in two languages, albeit in particular language capabilities.

Another attribute of a skilful translator is the detailed knowledge of the subject in both languages. Translators work in various fields, some general and some specific. When they are required to translate highly specialised texts or speech, they need to have general knowledge of the discourse topic as well as advanced knowledge of the subject in question. Without such understanding, translating various subject-specific words and expressions will be impossible. Furthermore, effective translation activity necessitates familiarity with the appropriate sociolinguistic register used in the field.

The third qualification is competent interpretation and judgment skills.[703] Any translational activity aims to convey the original meaning from the source language to the target language. However, all meanings from the source language may not feature readily in the grammatical or lexical structures of the target language. In order to prevent the messages from being lost in translation, translators must first expound the meaning in the original text or speech and then find suitable translation equivalents and word order in the target language. Thus, they must be experienced in judging when to paraphrase and when to metaphrase in order to relay the same thought during translation.

Finally, an effective translation demands apprehension and respect for both languages' cultures. Since the linguistic community's traditions, beliefs, values, and group consciousness

[703] Here, the noun “interpretation” does not refer to the process of orally transferring spoken language but the act of explaining the meaning of or rendering clearly or explicitly.

are ingrained in language, translation calls for a profound understanding of linguistic cultures. Without cultural knowledge, the translator cannot accurately translate poetics, aesthetics, jokes, puns, idioms, and cultural references.

Considering these four prerequisites for translation, being a translator is not an easy task. Indeed, rigorous training will be needed to master the art of translation. Maria Frank and Humphrey Tonkin describe translators as "mediators of cultures, enablers, but also gate-keepers."[704] Using their highly proficient languages, translators mediate between the cultures of different linguistic communities, enabling cross-community dialogues and gatekeeping to prevent miscommunication or misunderstanding. Thus, as Grosjean rightly puts it, "It takes more than having two hands to be a good pianist. It takes more than knowing two languages to be a good translator."[705]

2. Bilingualism in science and religion

Under the framework of the "language" metaphor, various concepts related to bilingualism map onto the domains of "science" and "religion." Since bilingualism deals explicitly with the relationship between two languages, the "language" metaphor with emphasis on bilingualism augments the knowledge of the complex interactions between science and religion.

2.1 Characterising a bilingual in science and religion

People considered bilingual in the languages of science and religion are those who are able to use the linguistic codes and constructs from both science and religion to communicate with others and interact with the world. Societal bilingualism in science and religion is the state of

[704] Humphrey Tonkin and Maria Esposito Frank, *The Translator as Mediator of Cultures*, Studies in World Language Problems, (Amsterdam; Philadelphia, PA: John Benjamins Pub., 2010), VIII.
[705] François Grosjean, *Life as a Bilingual: Knowing and Using Two or More Languages* (Cambridge: Cambridge University Press, 2021), 307.

a community that uses the languages of science and religion to carry out various communicative functions.

Those who are bilingual in science and religion have varying degrees of competence in their languages. The environment is one of the most important contributing factors to the wide range of proficiency in each language because different countries and societies have different views and attitudes towards science and religion. For instance, according to Ecklund et al., European countries like France and the United Kingdom show a considerably lower level of religiosity compared to the United States.[706] They also state, "science infrastructures also vary across regional contexts, particularly in terms of geographic concentration of research and development (R&D) expenditures."[707] The status of science and religion in a particular country or region affects how much one has access to and interacts with science or religion and, therefore, how many people become bilingual in science and religion.

In present-day society, a significant number of people identify themselves as a scientist and religious adherent. In Ecklund et al.'s study looking at the religiosity of scientists around the world, they found around 30 per cent of scientists in the UK, the US, and Hong Kong report themselves being slightly religious, and more than half in countries such as India, Italy, Taiwan, and Turkey.[708] Regarding scientists who pray or attend religious rituals regularly, countries like the UK, the US, Italy, and Taiwan ranged from 10 to 17 per cent, while India and Turkey had about half of the scientists praying regularly and 30 per cent attending services.[709] Interestingly, more than a third of the scientists in the UK, the US, and Hong Kong, more than half in Italy and Taiwan, and more than 84 per cent in Turkey and India identify with some religious affiliation.[710] Ecklund et al. explain that the significantly higher proportion of

[706] Elaine Howard Ecklund et al., "Religion among Scientists in International Context: A New Study of Scientists in Eight Regions," *Socius* 2 (2016), https://doi.org/10.1177/2378023116664353.
[707] Ibid., 2.
[708] Ibid., 4.
[709] Ibid.
[710] Ibid.

scientists associating with a particular religion does not necessarily mean they are active religious adherents but instead suggests the influence of cultural tradition or religious backdrop. Nonetheless, such findings suggest that self-reported identity as a scientist and religious person can be a measure of bilinguality in science and religion.

Since bilingualism is not a categorical variable, other factors besides self-identification can contribute to understanding the bilingual experience in science and religion. According to Gigi Luk and Ellen Bialystok, bilingual experience is a dynamic process with multiple influencing factors.[711] They report that the quality of language measured using self-reports and standardised measures and the quantity of managing two languages, meaning bilingual usage on a daily basis, significantly influence the bilingual experience.[712] When applying these features to science and religion, a combination of self-identification as a scientist and religious adherent, proficiency in speaking the scientific and religious language, and frequent use of both science and religion represent a realistic bilingual experience in science and religion.

2.2 Types of bilinguals in science and religion

The classifications of individual bilingualism can be transferred to the domains of science and religion and provide a helpful understanding of the various types of bilinguals in science and religion. First, bilinguals in the languages of science and religion are more dominant than balanced. Regardless of the languages spoken, unbalanced bilinguals are much more common than balanced bilinguals. And this observation is also accurate for bilinguals in science and religion. Mastery of the language of science or the language of religion is a difficult task. Developing fluency in science or religion requires a full-time profession or fervent zeal for the

[711] Gigi Luk and Ellen Bialystok, "Bilingualism Is Not a Categorical Variable: Interaction between Language Proficiency and Usage," *Journal of Cognitive Psychology* 25, no. 5 (2013), https://doi.org/10.1080/20445911.2013.795574.
[712] Ibid.

subjects. So, a balanced bilingual would most likely be someone who is a professional scientist and, at the same time, a zealous religious adherent. But a great majority of bilinguals in science and religion would be more proficient in one language than in the other.

Regarding the age of acquiring languages, the bilinguals in science and religion are more sequential than simultaneous. As young children grow up, they develop language skills, logical reasoning, and abstract thinking. If parents are very religious and expose their children to activities that promote scientific thinking, children can be bilingual in science and religion from an early age. However, most children acquire the language of science through formal education. Schools teach scientific constructs, methods, values, and complex reasoning through lessons, experiments, and activities. The language of religion, on the other hand, is acquired at any stage in life. While there are still debates about the naturalness or innateness of god-belief, young children raised in religious households can learn the language of religion from an early age. Some people acquire the religious language later in life after a religious conversion. Considering that most people learn science during the years of formal education but attain the language of religion at any age, more people would describe their bilinguality as sequential than simultaneous.

Bilingualism in science and religion can be circumstantial or elective, depending on the regional context. Bilinguals in a religious society receiving formal science education will learn the languages of science and religion not by choice but by living in that particular setting. Someone in a religious country without formal education choosing to pursue a career in science or a scientist in a secular society converting to a specific religion would be examples of elective bilinguals in science and religion.

The bilinguals in science and religion take additive or subtractive typologies depending on which varieties of science or religion they use. For instance, if a bilingual born in a fundamentalist Christian household, believing in 7-day creationism, enrolled in the university

to study evolutionary biology, their first language of religion, especially on the young earth creationist view, will wane during their studies. An example of additive bilingualism is Peter Toon, discussed in Chapter 2, drawing on Thomas Kuhn's concept of normal science to understand doctrinal development. In subtractive bilingualism, there is usually a conflict between science and religion. However, the relationship between science and religion in additive bilingualism is independent or complementary.

2.3 Features of bilinguality in science and religion

Among various features of individual bilingualism, the complementarity principle is most relevant to the discussion on the science-religion interface. The complementarity principle underscores that bilinguals use their languages for different purposes, in different domains of life, and with different people. The bilinguals in science and religion likewise communicate with the languages of science and religion for diverse purposes and contexts.

To illustrate how the languages of science and religion occupy different areas of life, I present myself as an example. Being a DPhil student in the Faculty of Theology studying science and religion, I use both the languages of science and religion to conduct research and write the thesis. When I attend church services, I only use the language of religion to learn about God and interact with other church members. When meeting friends from university who studied biology and became doctors, I resort to the language of science to discuss some health issues and medical interventions. At home, I mostly use the language of religion to talk about spirituality, personal values, and directions in life. Therefore, in various domains of life, I discern which language is most appropriate to carry out the necessary communicative function for the specific audience and context. Thus, the languages of science and religion for me occupy different domains of life.

The notion of two languages always jointly activated in the brain is another topic applicable to the science-religion relationship. For many bilinguals in science and religion, the two areas do not appear completely independent. Indeed, there are some contexts where only one language is required, as suggested by the complementarity principle. However, the broad, overarching worldview constructed in tandem by the languages of science and religion is always present, guiding the bilingual's expressions, understandings, and experiences in life.

When bilinguals in science and religion are brought together, perhaps for a science and religion conference, the bilinguals freely switch between two languages, drawing ideas from both science and religion and making the connection between the two fields of interest. Unlike other language pairs where instant intra-sentential switching is possible, mixing the languages of science and religion occurs at a slower pace and inter-sententially. The points of mixing two languages of science and religion are the potential areas for dialogue or even integration between science and religion.

2.4 Advantages and disadvantages of bilingualism

Just as the ability to speak two different languages yields many benefits along with some disadvantages, bilinguals in science and religion have gains and losses. One of the most significant benefits of being bilingual in science and religion is having an expanded language repertoire. Since bilingual speakers operate with two sets of lexicons, they not only express a wide range of thoughts but also organise the world around the various conceptual constructs of each language. Two languages complement each other by offering different mental categories for structuring thoughts and experiences. For example, when describing taste, the Korean language proposes the word "고소함 (gosoham)," referring to some combination of nutty, meaty, toasty, and earthy flavour. But this taste category does not exist in English. Therefore,

knowledge of both Korean and English allows the bilingual speaker to conceptualise and describe more tastes than monolinguals.

The bilingual speakers in science and religion utilise both scientific and religious constructs to understand and represent the world. Consider the idea of "unknown." As mentioned in Chapter 4, the language of science provides constructs like "wave-particle duality," "uncertainty," and "probability," disclosing the property of physical entities possessing both wavelike and particle-like characteristics at the subatomic scale and the inherent uncertainty in measuring a variable of a particle. The language of religion presents constructs, such as "mystery," "hiddenness," and "revelation," to convey truths that had been hidden in God, now revealed to those under the veils of faith.

So, when bilinguals in science and religion say something is "unknown," they can resort to the scientific constructs to convey a lack of accuracy, the limit in knowing the actual state, and approximation to the probable truth. Using the Christian constructs, they can also point to what lies beyond finite intelligence, truths that transcend knowability. The understandings of "unknown" presented by the scientific and religious constructs operate on different levels of reality—science in the physical realm, religion in the metaphysical realm. As a result, bilingual speakers have a broader and richer conceptualisation of the concept of "unknown" than monolinguals.

As the example of "unknown" demonstrates, bilinguals in science and religion have distinct languages directing attention to different parts of reality. The ability to use both science and religion, therefore, grants not only diversified expressions about the world but also an expanded worldview. As Josh Reeves points outs, people trained to navigate between scientific

and religious frames of reference "are ones who can offer imaginative renderings of the larger world picture."[713]

Bilinguals in science and religion also benefit from experiencing cultures of both science and religion. Language reflects the history and culture of its users because language shapes culture, and the shared experiences of culture, in turn, change the language. For example, words like "howdy," "reckon," and "ain't" signify the Southern American culture. Also, interpreting inside jokes, puns, and idioms would be impossible without cultural knowledge. Accordingly, the language of science reveals the scientific community's traditions, habits, and values, and the language of religion exhibits the religious community's theologies, standards, and cultures.

Being bilingual in science and religion implies having apprehension and respect for the cultures of both science and religion. A bilingual speaker acknowledges the norms of objectivity, honesty, openness, accountability, and communalism when discussing specific properties of nature. When engaging in Christian discourse, a bilingual speaker pays attention to the traditional values and practices and the communally endorsed ways of life. Since language is intrinsically connected to culture, bilinguals in science and religion naturally immerse themselves in the cultures of science and religion and gain membership in scientific and religious communities. Therefore, bilinguals enjoying the bicultural experience of science and religion have more awareness of the similarities and differences between science and religion and more openness towards interactions with other areas of understanding reality.

While bilinguals in science and religion enjoy certain benefits, they may also suffer from some disadvantages. Empirical studies in linguistics show that bilinguals face a higher risk of language interference and language error because they have to constantly manage

[713] Josh Reeves, "Methodology in Science and Religion: A Reply to Critics," *Zygon* 55, no. 3 (2020): 835, https://doi.org/10.1111/zygo.12630.

between two different languages and decide which words and phrases are appropriate for a given context. Moreover, the task of juggling between two languages is cognitively demanding. Similarly, bilinguals in science and religion have a broader pool of mental constructs to process thoughts and experiences. But during this process, they may encounter points of conflict between science and religion that can threaten the stability of their worldview. Working out how to understand contentious issues and revising the worldview to accommodate new understandings may be daunting and disheartening. The burden of the inner struggle may be the cost that bilinguals in science and religion must bear.

2.5 Becoming bilingual in science and religion

Bilingualism emerges when two or more languages are in contact. Regardless of whether the sociocultural context or personal choice motivated one to use two languages, bilinguals consider their languages essential parts of their identity. To become bilingual, one must be exposed to both languages and use them continually, albeit for different purposes and situations. In contemporary Western society, only a limited number of contexts allow people to become bilingual in science and religion.

The educational setting is one potential area where people can acquire the languages of science and religion. In secondary schools, science is one of the mandatory subjects. On the other hand, religion is not generally a part of the school curriculum. A study by Billingsley et al., interviewing 61 students in seven schools in England, reported that students perceive a firm boundary between science and religious education lessons.[714] Although the interactions between science and religion as subjects of instruction are scarce in the formal education setting, some forms of religious expressions, such as prayer, wearing clothing or jewellery with

[714] B. Billingsley et al., "How Students View the Boundaries between Their Science and Religious Education Concerning the Origins of Life and the Universe," *Science Education* 100, no. 3 (May 2016), https://doi.org/10.1002/sce.21213.

religious symbols, are still common in US public schools.[715] These reports suggest that government-run academic institutions do not sponsor direct science-religion interactions, but they can remain a space where individual students explore the science and religion relationship on a personal level.

While science-religion interactions at the subject level are rare phenomena in the formal state education system, religiously affiliated schools are potential candidates for science-religion-integrated education. However, even these schools have a rigid line between the study of science and the study of religion. According to a survey investigating science education in 119 Catholic secondary schools in the United States, only 6% answered "very much," 43% "somewhat," 33% "a little," and 19% "not at all" on the question of whether the school deliberately tries to integrate science in all academic classes.[716] This result contrast with 99% of schools intentionally incorporating the teachings of the Catholic Church in all academic courses and six in ten principals considering their school to offer a cohesive curriculum combining science, technology, engineering, and math (STEM) with the arts.[717] Since religiously affiliated schools divide science and religious education, this academic setting does not provide an optimal environment for bilingual development.

Unlike secondary education, tertiary education presents the arena for fostering bilingualism in science and religion. Many academic institutions worldwide now offer an interdisciplinary course of study designed to understand and engage in issues at the intersections of science and religion. At the undergraduate level, institutions such as the University of London and Thomson Rivers University in Canada offer courses for undergraduate students. These courses aim to overview the rich history of the relationship

[715] Ira C. Lupu, David Masci, and Robert W. Tuttle, *Religion in the Public Schools*, Pew Research Center (2019), https://www.pewresearch.org/religion/2019/10/03/religion-in-the-public-schools-2019-update/.
[716] Florence Emurayeveya and Mark M. Gray, *Science and Religion in Catholic High School*, Center for Applied Research in the Apostolate (Washington, D.C., 2018), 2, https://cara.georgetown.edu/Publications/ScienceCatholicHS2018.pdf.
[717] Ibid.

between science and religion and discuss specific instances of perceived conflicts between science and religion. In some universities, such as Samford University or the University of Northwestern-Saint Paul in the US, students opt for a major or minor concentration in Science and Religion by taking courses related to the subject. Other institutions offer Science and Religion degrees at the graduate level. For example, the University of Edinburgh provides a one-year master's taught program and three-year doctorate research programs in Science and Religion. Other smaller academic institutions, such as Graduate Theological Union or Bethany Theological Seminary, also run certificate programs in Theology and Religion.

In the academic setting, higher education is the optimal environment for allowing science and religion to come in contact and foster bilingualism. Proficiency in science and religion at the academic level requires years of study in areas including, but not limited to, history and philosophy of science, history and philosophy of religion, history of science and religion, psychology of religion, and science, technology, and society. Since the formal education sector imparts basic knowledge and skills, it is unfit to provide the opportunity to gain specialised and comprehensive knowledge of science and religion necessary for understanding the complex science-religion relationship. Therefore, higher education institutions create the context for students to gain a profound understanding of science, religion, and their relationship, conduct interdisciplinary research and become bilingual in science and religion.

Outside of schools, organisations promoting the science-religion interface are another source for fostering bilingualism in science and religion. The John Templeton Foundation, founded in 1987, facilitates a dialogue between science and religion by funding about $150 million per annum for interdisciplinary research that brings religion, science, and philosophy together. The Faraday Institute for Science and Religion and the Ian Ramsey Centre for Science and Religion (IRC) are interdisciplinary institutions supporting research on religious beliefs

and concepts in relation to the sciences. There are also Christian-based organisations devoted to encouraging faith-science interactions. The BioLogos Foundation, founded by Francis Collins, is dedicated to science education within Christianity. The American Scientific Affiliation (ASA) is a group of Christians aimed to integrate and communicate properly researched science and theology to Christian and scientific communities. Christians in Science is a UK-based Christian affiliation to develop biblical Christian views on nature. The central goal of these organisations is to facilitate interaction between science and religion and educate people to participate in the bilingual discourse.

In addition to these organisations, some publications and conferences offer communication outlets for bilinguals in science and religion. The Institute for Religion in an Age of Science (IRAS) publishes a quarterly peer-reviewed academic journal called *Zygon: Journal of Religion & Science*. ASA also issues a quarterly peer-reviewed journal, *Perspectives on Science and Christian Faith*. The European Society for the Study of Science and Theology (ESSSAT) hosts conferences every two years, inviting scholars interested in exploring the relationship between natural science and theology. The Science and Religion Forum (SRF) have annual meetings offering opportunities to relate scientific understanding and religious thought. The scholarly publications and conferences allow communication between bilinguals who are highly proficient in both languages. In these platforms, the bilinguals establish standards of bilingual practice, generate shared values, and build a tight bilingual community of common interests.

While some publications target scholars, other organisations aim to reach a wider audience through non-academic discussions on the interface between science and religion. For instance, Christian Evidence is the British Christian apologetic website, which contains the "Science" section dedicated to posts on topics intersecting science and Christianity. Premier, a UK Christian media organisation, produces video series like the Big Questions Online,

presenting conversations exploring science, faith, and philosophy. ASA's *God and Nature* magazine publish essays, stories, poetry, and artwork by anyone interested in science and the Christian faith. These examples of non-scholarly resources welcome the general audience to science-religion conversations and help people gain competence in both languages.

Having examined the specific areas and situations where science and religion interact, how does someone acquire these languages and become bilingual? As mentioned, most bilinguals in science and religion are sequential bilinguals who learn one language after another. Since the first language is established as the dominant language of use, the acquisition of the second language shifts the functions, roles, and use of the first language. The experience of executive control working hard to regulate the two jointly activated languages can be cognitively taxing. As bilinguals repeatedly use both languages for communication, they develop strategies to efficiently switch between the two languages, draw in concepts from both languages to interpret the world, and configure which language efficiently carries out different cognitive tasks. Through the sustained use of both languages, a bilingual no longer feels burdened by two languages. Many bilinguals consider the process of becoming bilingual an empowering experience.

When Ian Barbour proposed his typologies of conflict, independence, dialogue, and interaction to describe the interactions between science and religion, he placed them in a chronological sequence. He saw that the science-religion interaction tends to proceed from conflict to independence, to dialogue, and finally to integration.[718] However, the "language" metaphor looking at bilingualism proposes an alternative understanding.

Instead of going through the trajectory from initial competition to peaceful integration, the two languages of a bilingual speaker have occasions of conflict, independence, dialogue, and integration present throughout the process of becoming bilingual. The executive control

[718] Barbour, *Issues in Science and Religion*.

managing which language is expressed and which is suppressed corresponds to the conflict typology. When two directly competing understandings of science and religion are presented, the bilingual assesses which view aligns better with their values and inhibits the other. The independence typology resembles the complementarity principle. Bringing in my personal experience, I prefer to pray and calculate in Korean but give presentations in English. Similarly, the bilingual speaker can choose science to understand the natural world but pick a religion to find meaning in life and construct a coherent worldview. The dialogue category correlates to code-switching, the process of alternating between two language varieties. Code-switching between science and religion occurs when the bilingual identifies possible areas of fruitful exchange of ideas. The final typology of integration mirrors the phenomenon of intra-word switching that fuses parts of the different language codes to produce a hybrid word conveying a new meaning. Scientific and theological thoughts can merge to form an entirely different, enriching understanding. Given that bilinguals exhibit aspects of conflict, independence, dialogue, and interaction when acquiring and processing two languages, the "bilingualism" metaphor suggests that the science-religion interaction appears multiform depending on which context one investigates.

2.6 Bilinguals in science and religion: John Polkinghorne and Francis Collins

Who are the people bilingual in science and religion? In the earlier discussion, someone is characterised as bilingual in science and religion if they identify themselves as both a scientist and religious person, use science and religion on a daily basis, and demonstrate proficiency in communicating in science and religion. Throughout history, people have shown bilinguality in science and religion. While their bilinguality varies depending on their historical context, they exhibit the same zeal for understanding the world using the languages of science and religion.

In the 21st century, bilingual speakers in science and religion are dispersed worldwide in various fields of study and sociocultural settings. To provide a concrete illustration of the bilinguals in science and religion, I introduce John Polkinghorne and Francis Collins as exemplary figures.

John Polkinghorne is often described as a "theoretical physicist" and "Anglican priest." As these titles suggest, he was a professional scientist and an ordained priest. Polkinghorne was born in 1930 in Somerset, England, to a devout Anglican family.[719] He regularly attended religious services and matured his faith over the years. Polkinghorne excelled in mathematics from a young age and entered Trinity College, Cambridge, in 1949, reading mathematics. At Cambridge, he joined the Christian Union of Universities and Colleges Christian Fellowship (UCCF). In 1956, he earned a doctorate in quantum field theory, supervised by the Nobel laureate Abdus Salam in the research group led by Paul Dirac. After graduation, he accepted a series of academic appointments in the United States and Scotland, returned to Cambridge in 1958, and eventually became a professor in mathematical physics.

During his 25 years of working as a scientist, he made outstanding contributions to theoretical physics. He worked on the analytic and high-energy properties of Feynman integrals and the foundations of the scattering matrix (S-matrix).[720] He also researched elementary particles and played a role in explaining the behaviour of the quark, the smallest fundamental particle of matter. He created a mathematical model for calculating the paths of quantum particles and was recognised with his selection as a Fellow of the Royal Society in 1974.[721]

Five years later, at the age of 48, he concluded that his theoretical research had come to an end. He resigned his professorship and began to train for the priesthood. He became a

[719] J. C. Taylor and D. A. Wilkinson, "John Charlton Polkinghorne Kbe. 16 October 1930—9 March 2021," *Biographical Memoirs of Fellows of the Royal Society* 72 (June 1, 2022): 295, https://doi.org/10.1098/rsbm.2021.0044.
[720] Robert John Russell, "In Memoriam: John C. Polkinghorne, 1930–2021," *Theology and Science* 19, no. 3 (2021): 184, https://doi.org/10.1080/14746700.2021.1944491.
[721] Ibid.

priest in the Church of England in 1982 and served two parishes in the south of England. He returned to Cambridge some years later as Dean of Chapel at Trinity Hall. In 1989, he became the President of Queen's College, Cambridge and held this position until his retirement in 1996.

During his time in Cambridge, Polkinghorne published numerous popular and academic books and articles and gave lectures to promote the discussion of science and Christian theology. Some of his seminal works regarding science and religion include *One World: The interaction of science and theology* (1986), *Science and Creation: The search for understanding* (1988), *Science and Providence: God's interaction with the world* (1989), *Science and Christian Belief* (published in North America as *The Faith of a Physicist*) (1994), and *Belief in God in an Age of Science* (1998).[722]

In science and religion, he made significant achievements in establishing natural theology as the bridge between science and religion.[723] He especially paid attention to the ordering of the world, revealed in the anthropic principle, as support for the Christian belief in God. He also transferred the theological concept of the Trinity to understanding the human experience of the world.[724] Polkinghorne took the position as the founding president of the International Society for Science and Religion (ISSR). He was made a Knight Commander by Queen Elizabeth II in 1997 and was awarded the 2002 Templeton Prize for his compelling works in science, religion, and theology.

Throughout his life, John Polkinghorne was truly bilingual in science and religion. Not only himself but also others identified Polkinghorne as a scientist and a Christian. In terms of the quantity of managing two languages, he used two languages daily. In an interview, he mentioned, "Christianity had always been central to my life," and "I do have an everyday sort

[722] Taylor and Wilkinson, "John Charlton Polkinghorne Kbe."
[723] J. C. Polkinghorne, *One World: The Interaction of Science and Theology* (London: SPCK, 1986).
[724] John Polkinghorne, "Physics and Metaphysics in a Trinitarian Perspective," *Theology and science* 1, no. 1 (2003), https://doi.org/10.1080/14746700309645.

of experience of worship and prayer."[725] When he was a theoretical elementary particle physicist or a vicar in a parish, he used both languages to understand and engage with the world. He also relied on both languages to interact with scholars in science, religion, theology, and philosophy, as well as the public audience. Furthermore, Polkinghorne not only used the languages regularly but also acquired high proficiency in both. He had 25 years of scientific research experience, received rigorous training to be an ordained priest, worked as a vicar for five years, and conducted research on the interface between science and religion for over 17 years. He actively promoted bilingual discourse between the scientific and Christian communities. Thus, Polkinghorne is an epitome of a bilingual speaker in science and religion.

Francis Collins is another example of a bilingual in science and religion. Collins is usually referred to by the title "physician-geneticist." Born in 1950, Collins is an American physician-geneticist who discovered the genes responsible for genetic disease and led the Human Genome Project, which mapped out the entire human genome. He received a B.S. in chemistry from the University of Virginia in 1970 and a PhD in physical chemistry at Yale University in 1974. He also earned an M.D. from the University of North Carolina at Chapel Hill in 1977. Collins became an elected member of the National Academy of Medicine, the National Academy of Sciences, and the Institute of Medicine. Collins served as the director of the National Institute of Health (NIH) from 2009 to 2021 and was awarded the Templeton Prize in 2020. Currently, his lab conducts research on genetic disorders to understand gene function and ultimately identify new therapeutic opportunities.

While Colllins has various public titles including scientist, director, and member, he also has another epithet: "Christian." Collins, during an interview in 2004, stated that he became a Christian at 27 during his residency as a medical student.[726] In the hospital, he

[725] Lyndon F. Harris, "Divine Action: An Interview with John Polkinghorne," *CrossCurrents* 48, no. 1 (1998): 4, 14, http://www.jstor.org/stable/24460653.
[726] "Other Voices," interview by Francis Collins, *The Question of God*, 2004, https://www.pbs.org/wgbh/questionofgod/voices/collins.html.

encountered patients at the end of their lives, relying on faith as a source of strength and comfort. He was intrigued, unsettled, and challenged by the level of faith demonstrated by these patients. After a great deal of struggle trying to make sense, he accepted the existence of God and became a Christian. Since his conversion, Collins has advocated that the Christian faith is compatible with science. In 2006, he wrote *The Language of God,* outlining his journey to the Christian faith and demonstrating a complementary relationship between science and religion. He also founded BioLogos in 2007 to provide a forum for discussing issues at the intersection of faith and science. Today, he actively participates as a member of the International Society for Science and Religion.

Although Collins did not earn a theology degree or receive training for ministry like Polkinghorne, Collins is still regarded as a bilingual in science and religion for the following reasons. First, Collins self-identifies as both a scientist, particularly a geneticist, and a Christian. Second, he uses the language of science and religion frequently. He uses the language of science for conducting research in his lab, providing advice to the president, and delivering lectures to the general public about health issues. He uses the language of Christianity when attending live stream worship services or engaging in prayer. He uses a mix of both languages to address the audience in BioLogos or the Veritas Forum interested in exploring the science-religion interaction. Finally, he is proficient in both languages. His lifelong career as a world-renowned scientist holding high leadership position demonstrates his scientific language competence. While Collins may not have the level of proficiency in religion that Polkinghorne possessed, Collins is still a devout Christian actively expressing and living out his faith and is capable of engaging in academic and non-academic discussions about the science-theology interface. Therefore, Collins is another bilingual in science and religion who benefited from using two languages to experience reality.

3. Translation between science and religion

Through the lens of the "language" metaphor, the occasions when science and religion interact in modern society are when two different linguistic communities try to communicate with each other. Communication, the transmission of information, is possible if and only if the two communities have some shared, common linguistic elements. If two languages, like Italian and Spanish, belong to the same language family and are somewhat similar, the language users can use mutually intelligible codes to transfer messages.[727] The communities can communicate with each other using similar elements, although limited in what can be transmitted. But if the languages are very different, as in the case of science and religion, trying to convey meaning directly from one community to another may be extremely challenging, if not impossible.

The field of science and religion are in dire need of translators. Since science and religion have different lexicon, methodologies, practices, and cultures, their languages are not mutually intelligible. In particular, areas traditionally identified as "conflict," such as the origin of life and climate change, are often plagued by misunderstandings. Scientific and religious communities misinterpret and draw invalid conclusions about what the other party says based on their limited linguistic and cultural knowledge. But miscommunication between science and religion be resolved with the help of competent translators who have a good command of both languages. They can accurately comprehend jargon, subtle nuances, and contextual references employed by science and religion and promote effective cross-discipline dialogue.

Translators are also needed in situations where the professional community of scientists or theologians relay their technical understandings to a broader, non-scholarly audience. Since the intended recipients are not equipped with the technical knowledge of the subject of

[727] In his study looking at the vocabularies shared by well-established subjects, Benjafield identifies mathematics, physics, chemistry, and biology to share the most number of words. Since these subjects share many words, the communication between them is much easier than with another subject that does not share much vocabularies. See Benjafield, "Vocabulary Sharing among Subjects Belonging to the Hierarchy of Sciences," 1979.

discourse, they need someone who can interpret the scholarly message in non-specialist terms. Without the translator's help, the general audience may misinterpret what the community of scientists or theologians are saying.

Bilinguals in science and religion, who have proficiency in both languages, could be possible candidates for translators. However, as noted previously, not all bilinguals are good translators because bilinguals have different degrees of competence in their languages. Revisiting the bilinguals of science and religion, John Polkinghorne is a balanced bilingual equally proficient in both languages, but Francis Collins does not have the same level of proficiency in Christianity compared to science. Moreover, Polkinghorne, a prolific writer and speaker in science and religion for academics and a general audience, is a productive bilingual in both languages. Collins also actively discloses his thoughts, beliefs, and experiences through both languages, but his engagement with the academic theologians may be more sedentary than productive. For instance, if Collins is asked to translate the scientific meaning of the word "unknown" to theologians, he may not have enough practice delivering the original meanings from science to academic theologians using their constructs. On the other hand, he may be highly adept in translating the other direction, from theology to science, since he has more experience producing in scientific language. Since bilinguals have varying levels of competence and habits of language use, not all bilinguals can translate for scientific and religious communities.

Additionally, bilinguals are not automatically efficient translators because the translation work requires special skills, knowledge, and cultural competence only attained through training. Suppose communication occurs between two science variants, such as biochemistry and astrophysics. In that case, the translator can work with the shared elements and have a much easier time arranging appropriate translation equivalents to transfer an accurate message from one to another. However, the language of science and religion are

ontologically distinct entities with different linguistic components, structures, communities, cultures, and worldviews. Accordingly, the thoughts and experiences transmitted by each language are peculiar and somewhat incommensurable. There is no structural alignment between the two languages or similar patterns of use. Thus, it is the translator's task to analyse the meaning from the source language and translate it into the target language with attention to context. When considering the inherent difficulty in translation between science and religion, not all bilinguals are fit for such demanding work.

Then, what are the qualifications for a proficient translator in science and religion? First, a translator in science and religion needs an exceptional grasp of both domains. Due to the technicality of science and religion, one must comprehend the general history, traditions, habits of practice, norms, and cultures embedded in the two languages. Furthermore, they need a broad understanding of the various constructs used by scientific and religious communities. Without extensive knowledge of the linguistic components, the translator will struggle to convert messages from the source to the target language.

The second qualification for translators is the ability to interpret a specialised area of discourse. The various scientific and religious communities speak in a particular variety of science and religion. For instance, Polkinghorne is proficient in the theoretical physics register and Anglican dialect, and Collins communicates best in the genetics register and evangelical Protestant dialect. Since the specific language variants contain jargon and unique traditions, the translator must address the subject-dependent linguistic features when interpreting.

In addition to the general and specific knowledge of the subject, translators in science and religion need to hone their interpretation skills, judging when to paraphrase and metaphrase. Not all meanings produced by the language of science or religion are translatable to the other language. Consequently, the translators must interpret the meaning and paraphrase it in a way communicable in another language. Additionally, translators in science and religion must

consider who the target audience is and decide whether to adopt a professional scholarly lingo or a laymen's lingo. Thus, a translator must acquire a finely tuned sense of discerning which interpretation skills are required for the specific translation context. Otherwise, things will be "lost in translation" or subjected to mistranslation.

Lastly, a competent translator must be bicultural. Since language reflects the culture, tradition, and value of the linguistic community, translation requires awareness of the cultures of both languages. The translators do not necessarily have to be a part of the linguistic communities of each language. Still, they need deep cultural knowledge to interpret the subtle differences in the nuance, underlying assumptions, intentions, and other culture-embedded references. When translators in science and religion meet these four qualifications, they can safeguard against mistranslation and mediate fruitful dialogues between science and religion and with the general public.

Alister McGrath is a good example of a competent translator for science and religion. As a theologian, Anglican priest, scientist with a doctorate in molecular biophysics, and retired Andreas Idreos Professor in Science and Religion at the University of Oxford, he is equipped with the depth and breadth of knowledge in both science and religion and intimate familiarity with both cultures. As a prolific writer, he engages with a wide range of issues at the intersection of science and religion and interacts with an international audience from diverse backgrounds. Given his qualifications, he can serve as a translator, facilitating the discussion and bringing the scientific and religious communities together. With the help of bicultural translators in science and religion, such as Alister McGrath, the borders between science and religion will open up, accommodating fruitful conversations between the two.

Language is a complex medium that transmits value-laden, worldview-reflecting, and culturally-embedded information. The interlocutors must consider not only the content but also the pragmatic aspects of discourse to comprehend fully what is being communicated.

Considering the complexity of language discourse, the field of science and religion necessitates more competent translators who can facilitate enriching discourse between science and religion.

4. Building a bilingual community

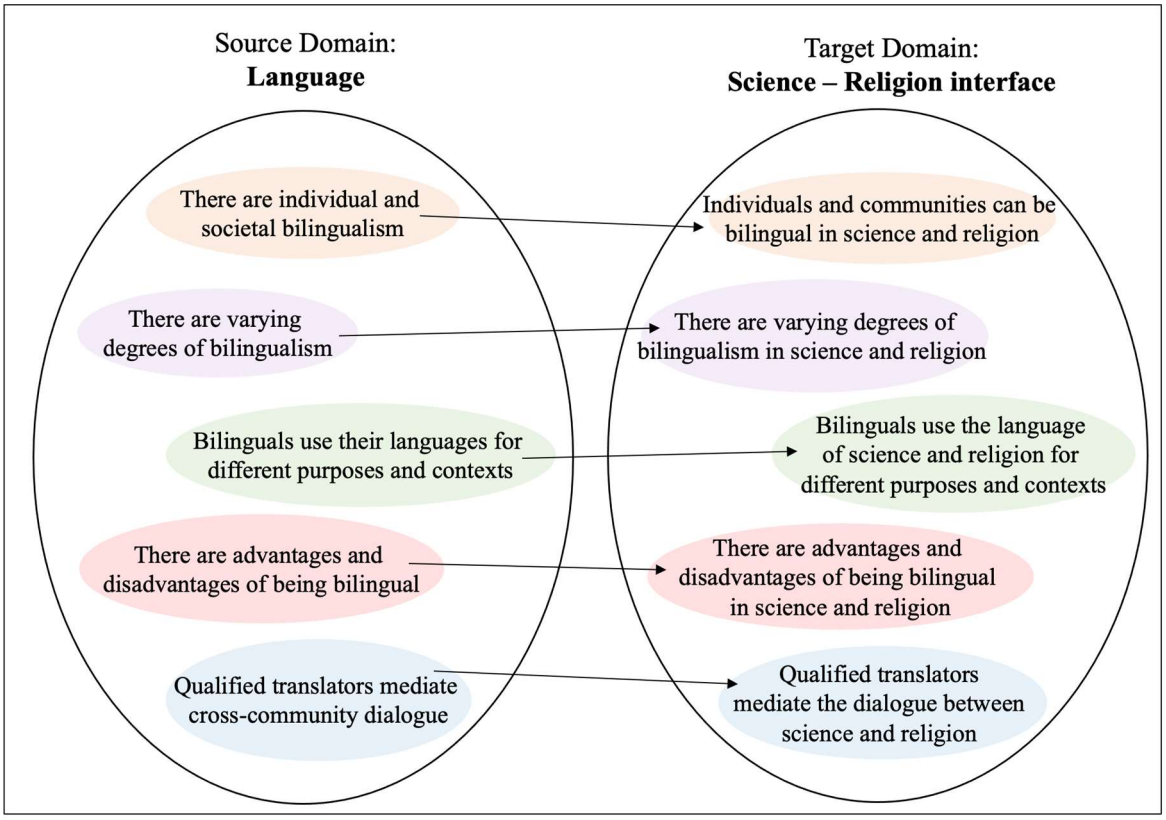

Figure 23: Cross-domain mapping of bilingualism onto science and religion

In this chapter, the "language" metaphor presented the concept of bilingualism to investigate the science-religion relationship, as illustrated in **Figure 23**. Bilingual speakers use two different languages to express their thoughts and experiences. For bilinguals, their languages are never entirely separate or in conflict; both languages are jointly activated in the brain but regulated so that each language can be used for different purposes and contexts. Under the "language" metaphor, science and religion are two languages of a bilingual speaker. There may be instances of conflict where one language system inhibits the expression in another language. Nevertheless, both languages are fully integrated, complementing each other and helping the

speaker communicate a wide range of ideas. The two languages are equally important in structuring the bilingual speakers' thoughts and experiences. Consequently, the dynamic relationship between the two languages of bilinguals models the interaction between science and religion.

In contemporary society, the drive for the specialisation of knowledge is segregating the fields of science and religion. Furthermore, the rise of secularisation in the Western world is driving the scientific and religious communities away from each other. Yet, the bilinguals, who are members of both scientific and religious communities, are trying to bridge the gap by promoting conversations between science and religion. At the forefront of the science-religion interface, bilinguals advocate that the interdisciplinary dialogue between the two fields benefits society.

There are many advantages of being bilingual in science and religion. First, bilinguals have an expanded language repertoire to discuss the multidimensional, dynamic, and complex world. They have two sets of mental constructs to structure their experiences of the world, thus acquiring a comprehensive and coherent worldview. In addition, bilinguals in science and religion show openness towards new changes and cultural awareness. They recognise and appreciate others' values, beliefs, and traditions. Hence, bilinguals in science and religion enhance positive interactions between science and religion.

In the past two decades, scholars in this field have been seeking new ways of engaging in science-religion discourse. In *New Directions in Theology and Science: Beyond Dialogue,* Peter Harrison and Paul Tyson explain that there are important factors that are now being considered in light of the lessons of history and anti-essentialism.[728] First, noting that the past conversations tended to reduce science and religion to their propositional contents, they argue

[728] Peter Harrison and Paul Tyson, "Introduction," in *New Directions in Theology and Science: Beyond Dialogue*, ed. Peter Harrison and Paul Tyson (London: Routledge, 2022).

that the future direction in the science-religion dialogue focuses on the practical features of science and religion and the broader way of life. Second, they espouse the trend of reversing the imbalance of power between science and religion and encouraging two-way exchange of ideas. Third, they indicate that there is a need for moving beyond the universal, trans-historical categories of "science" and "religion" and recognising the multiplicity of science and religion. Finally, they present history as a rich resource for expanding the scope of understanding about science, religion, and their relationship.

The bilinguals in science and religion are the ones who can take account of these points raised by Harrison and Tyson and produce refreshing responses. Josh Reeves states, "Science and religion scholars, who have been trained to move easily between scientific and religious frames of reference, are ones who can offer imaginative renderings of the larger world picture."[729] Although Reeves does not explicitly refer to these scholars as "bilingual speakers," the scholars that Reeves allude to are the bilinguals in science and religion, who are able to switch quickly between the two languages and integrate the two to produce original expressions of thought. Bilinguals are equipped with the knowledge of two languages and the knowledge of both cultures. They consider their languages equally important in shaping their experiences and identity. Compared to monolinguals, they are more likely to be open to exploring novel avenues of engagement between science and religion and see a wider scope of reality.

The concept of bilingualism, therefore, suggests a new paradigm in the science-religion field. Rather than regarding the scholars of science and religion as outside observers, the "language" metaphor considers them active participants in the bilingual discourse. If the scholars are seen as bystanders, they take on the third-person point of view and examine the science-religion interface simply as an object of investigation. When looking at science and religion from a distance, they are prone to ignoring the particularities and diversities and

[729] Reeves, "Methodology in Science and Religion," 835.

essentialising "science" and "religion." They may not be fully aware of how their expectations, opinions, or prejudice influence the way they perceive the science-religion relationship. Alternatively, by treating the scholars of science and religion as interlocutors, they adopt the first-person point of view. The science-religion discourse is no longer some subject of study but an activity that they participate in. The scholars acknowledge that their conversations are coloured by their diverse perspectives, values, and background. In order to hold a constructive science-religion discussion, they are reflective of themselves and the situation. Who are my conversation partners and audiences? How do I contribute to the discourse considering my background and past experiences? What questions are of interest to me and why? What are my expectations and goals? What is at stake? These are a few questions that the participants consider to minimise miscommunication. The "language" metaphor, therefore, presents the science-religion interaction as a bilingual discourse and transforms the view of science and religion from abstract, essentialist, and propositional categories to contextual, diverse communicative practices embedded in the broader way of life.

If we incorporate the concept of bilingualism into the study of science and religion, the next task will be building and strengthening the bilingual community. This can be achieved by increasing opportunities where the language users of science and religion come into contact. Rather than promoting separation between the disciplines of science and religion, we can encourage scientists, theologians, philosophers, and other scholars to collaborate on interdisciplinary projects that enhance communication among them. We can additionally strengthen educational programs that help people see the benefits of participating in the science-religion dialogue.

Much of the areas of debate in science and religion, such as creation, abortion, and climate change, have been plagued by the difficulty of communication between the interlocutors. The scientific and religious communities, deeply engrossed in their own

linguistic culture, have failed to understand each other because they do not speak the same language. But if we build a larger bilingual community, we will have more people capable of understanding different sides of the debate, welcoming other opinions, and recognising subtle nuances. Some bilinguals can even serve as translators to assist with overcoming prejudices and biases that impede inter-community discourse.

While the "language" metaphor in this chapter focused mainly on bilingualism, we can also explore the notion of multilingualism. There are other languages besides science and religion that can join the interdisciplinary conversation. The new set of linguistic elements outside science and religion will become resources for other imaginative interdisciplinary discussions and push the boundaries of thought. The multilingual discourse will also produce rich, vibrant pictures of reality. Considering these potentials, the "language" metaphor, particularly the concept of bilingualism, is a valuable contribution to the field of science and religion.

Conclusion: Science and Religion are Languages

Since its emergence in the 1960s, the interdisciplinary field of science and religion has been grappling with the questions of what science and religion are and how these two interrelate. Although the field has moved on from a simplistic characterisation of science and religion as theoretical, fixed entities and characterising the science-religion interaction in terms of a perennial or essential conflict, understanding the concepts of science, religion, and their dynamic interaction with attention to their history, diversity, and contextuality has continued to be a challenge.

This thesis introduced an original, innovative metaphor—that science and religion are languages—not only to conceptualise the science-religion phenomenon without committing an essentialist fallacy but also to propose practical advice to foster a community open to interdisciplinary discussions between science and religion. Using the classification of metaphors introduced by various studies in cognitive linguistics, the "language" metaphor was identified as *conceptual, novel,* and *deliberate*. By being *conceptual*, the metaphor employed a concrete domain of experience, "language," to express and understand more abstract domains of "science" and "religion." As a *novel* metaphor, it juxtaposed "science" and "religion" with the concept of "language" to embark on a new approach taken in the field of science and religion. Finally, as a *deliberate* metaphor, there was an intentional shift of attention from complex concepts of "science" and "religion" to an unrelated but familiar notion of "language" for comparison.

Given that conceptual, novel, deliberate metaphors are processed by mapping aspects of the source domain onto the target domain, the "language" metaphor selected several key features in the domain of "language" and transferred them onto the domains of "science" and "religion." Given the scope of the thesis, the domain of "science" was limited to natural

sciences, and "religion" was confined to Christianity, the most widely practised religion in the world today.

This thesis aimed to evaluate whether the "language" metaphor, which involves a specific way of processing, provides a helpful framework to explore and talk about science, religion, and their complex relationship. Each chapter was designated to individual topics in linguistics, testing the utility and usability of the "language" metaphor (see **Figure 24**). In a way, each chapter functioned to show real-time processing of the "language" metaphor and reveal its meaning.

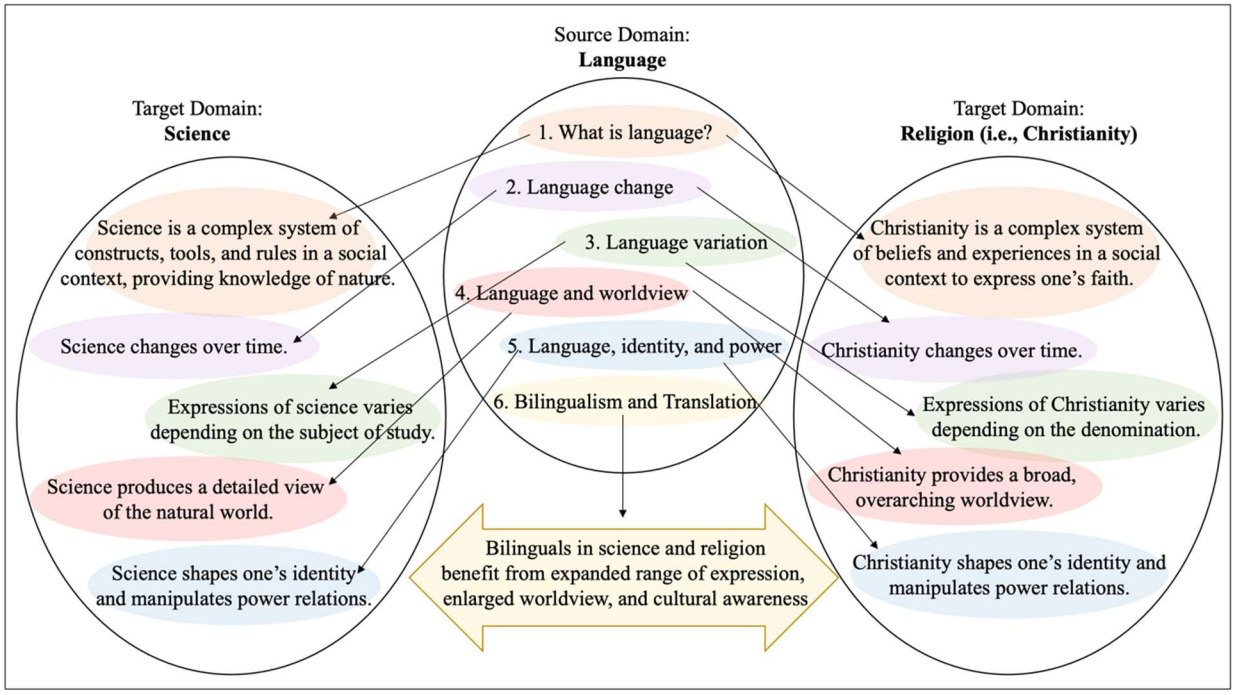

Figure 23: Summary of the "language" metaphor cross-domain mapping

In Chapter 1, assessing the utility of the metaphor began by proposing a working definition. Language, for this thesis, was defined as follows: *a system of symbols and rules used in a social context to carry out communicative functions.* Here, the definition highlighted three essential features of language: (1) language is a complex system made up of symbols and rules to convey meaning; (2) language is a social phenomenon; and (3) language communicates emotion, information, opinion, and attitude and influences social relationships. When mapping

the systematicity of language onto science and religion, science was seen as a system comprised of scientific constructs, tools, and methods that work together to transmit information about the physical world; religion was another system of theological constructs, doctrines, and rituals used to express faith. When transferring the social aspect, science was regarded as a social enterprise with dynamic networks and connections interacting with its context. Christianity was treated as a social, communal experience emphasising relationships and context-sensitivity. The emphasis on function revealed the role of science and religion in society.

Chapter 2 dealt with the property of language changing over time. Until now, the field of science and religion has battled against the misrepresentation of science and religion as static, context-independent concepts. But through the "language" metaphor, science and religion were seen as languages that evolved in all respects to meet the needs of their respective linguistic communities. Science has seen to transform in all areas, including its methods, theories, predictions, and findings, as well as its values and social impact. There were both continuity and discontinuity in science. In the case of Christianity, despite the emphasis on the timeless character of God, Christian theology, doctrine, and practice have changed over time. Since Christian communities in the past had values, needs, or outlooks on life that differed significantly from those of contemporary Christian communities, Christians, over the years, had to adjust their doctrines, theologies, and practices to appeal to the changing society. The "language" metaphor, thus, was able to accommodate and illuminate both the actuality of change in science and religion and why these changes occur.

Chapter 3 evaluated the metaphor using the topic of language variation. There are countless variations of languages in the world because languages vary according to geographical location, social group, ethnicity, gender, and communicative situations. Similarly, science and religion exist in numerous varieties. Science comprises disciplines like chemistry,

biology, physics, and astronomy. Christianity also exhibited variances in theologies, doctrines, and practices based on the community of believers. For instance, Presbyterians, Catholics, and Orthodox Christians have developed specific terms and rituals that signify their unique denominational identity. Since the fields of science were divided according to a particular subject of study, the metaphor compared them to individual registers. As for religion, various Christian denominations were considered dialects of the Christian language. The test for variations in science and religion confirmed that neither science nor religion could be considered homogenous, essentialist entities. Instead, the "language" metaphor both disclosed and illuminated the complexity of the relationship between science and religion, offering a framework that can accommodate their variances.

In Chapter 4, the plausibility of the metaphor was assessed using the theme of a linguistic worldview. Many studies in linguistics establish that one's language organises their experience of the world in a particular way and influences the worldview. Science and religion, as two languages, also affect one's thoughts and perception of the world. Science, made up of constructs, rules, scientific tools, and values, provides different lenses to see the world. Scientific language speakers, accustomed to interacting with nature using scientific constructs presupposing scientific realism, perceive the physical world as real. With all its diversities, Christianity strives to view the world through the person of Jesus Christ and the story of God's salvific work. Christians also employ a set of doctrines and speech-acts to understand, interpret, and experience the world beyond the physical. The analysis from this chapter revealed that since the language of science and religion offer distinct worldviews, the ability to use both languages yields an expanded, enriching picture of reality.

The following assessment area outlined in Chapter 5 was the notions of linguistic identity and power. The case of the Korean language demonstrated that language enables people to shape their values and culture, express identity, and achieve social cohesion. The

Korean language was a vital tool for creating, sustaining, and replicating fundamental social inequalities; those in power used language to maintain their status and suppress others. Like the Korean language, science and Christianity entail a sense of belonging and some socioeconomic privileges for those who use the language. Scientists demonstrate their competence, performance, and academic influence by being proficient in the language of science. The particular scientific register a scientist employs also signifies their field of expertise. Furthermore, scientists in contemporary society exercise influence over political and economic decisions, such as the administration of the COVID-19 vaccine. Christianity as a language indicates one's membership in the community of Jesus' followers. In the first three centuries, Christians were subjected to persecution, but their language flourished and became an emblem of the Christian identity. The most interesting analysis came from examining the power relation between the language of science and religion. Just as the Japanese government tried to eliminate the Korean language as a strategy for assimilation, the advocates of scientism and fundamentalism pressed that their language should be the dominant language of expression for all reality. Under the "language" metaphor scheme, scientism and fundamentalism were seen as instances of linguistic imperialism.

In Chapter 6, the final trial on the "language" metaphor reviewed the topics of bilingualism and translation. People become bilingual when they are in regular contact with two languages. Some children become bilingual by growing up in a bilingual environment, while others learn one language after another through formal education or other means. Linguistics studies reveal that there are not only some cognitive benefits but also social, cultural, and economic benefits of bilingualism. The "language" metaphor showed that being bilingual in the languages of science and religion entails similar benefits. Those who communicate using science and religion have the advantage of thinking about and experiencing reality from multiple angles and dimensions, gaining insight into diverse cultures, relating to a

wider community, and heightening sensitivity towards cultural differences. The metaphorical comparison posed whether all bilinguals are good translators for mediating the dialogue between scientific and religious communities. In many ways, conflicts between science and religion stem from miscommunication due to personal bias or lack of understanding of the sociocultural context or subtle nuances. The metaphor asserted that there would be more avenues for interaction between science and religion with the help of adept translators who are able to transmit information accurately from one communicative milieu to another. The "language" metaphor suggested that increasing opportunities where members of the scientific and Christian communities actively interact will foster a vibrant bilingual community that uses the languages of science and religion to interact with the world.

Although the scope of this study limited the assessment to six features of the "language" metaphor, the discussion provided in the thesis sufficed to show the merits of this metaphor in presenting valuable insight into the complex concepts of "science," "religion," and their relationship. The "language" metaphor not only offered an exceptional framework guiding the conceptualisation process but also generated elaborate, anti-essentialist, multidimensional representations of science, religion, and their relationship. It advanced a more comprehensive, practical view than is possible using other models or metaphors of the past. Moreover, the novel and creative link between the familiar concept of "language" and the abstract concepts of "science" and "religion" opened new possibilities for human understanding. Given its explanatory success, intuitiveness, and practicality, the "language" metaphor generated a paradigm shift in understanding the science-religion interaction.

Potential contributions to the academy

The metaphor of science and religion as two languages makes significant original contributions to the field of science and religion and the wider academic world. First, the "language"

metaphor is truly an interdisciplinary project, drawing ideas from numerous fields of study. It introduces concepts of metaphor and its unique processing methods from psycholinguistics and cognitive linguistics. In addition, it explores major themes in general linguistics, sociolinguistics, historical linguistics, pragmatics, and philosophy of language to compile a comprehensive understanding of the "language" domain, which is then used to find correspondences in the "science" and "religion" domains. The "language" metaphor establishes connections between linguistics and many other disciplines, including science, religion, philosophy of science and religion, history of science and religion, sociology, science and technology studies, theology, and psychology of religion. Throughout the thesis, the "language" metaphor enabled us to explore a wide range of concepts, make new connections within and outside the traditional disciplinary boundaries, and construct a coherent, comprehensive system of understanding. The "language" metaphor clearly offers an important and productive framework for interdisciplinary research.

Second, the "language" metaphor provides a remedy to the problem of conceptualising science and religion, which has persisted in the field of science and religion. Since the 1960s, scholars interested in science and religion have asked what science and religion mean for them and how these two entities interact. During the past two decades, the field has realised that "science" and "religion" are not universal, trans-historical categories. The "language" metaphor reflects on these issues of complexity and essentialism and suggests a new way forward. The concept of "language" comprises mental, physical, and social aspects. For example, a simple utterance containing sounds and conveying meaning to another person is conceptual, physical, and social. Language is also integral to everyday life and necessary for communicating information, feelings, opinions, and attitudes. It facilitates interactions between people in any and every situation. Within the broad, general category of "language," many language varieties, including dialects and registers, are associated with specific linguistic

communities or context and power structures. In addition, the apparent advantages of being bilingual in two languages resemble the benefits gained by someone engaging in both scientific and religious discourses. Because the "language" concept is familiar to all people, understanding science and religion in relation to language is much easier than comparing them to a third-body problem, for instance. Thus, the "language" metaphor endows an extensive, anti-essentialist, original outlook drawn from everyday experience to perceive multiple dimensions of science, religion, and their interactions.

Third, besides understanding science and religion, the "language" metaphor presents a fresh, true-to-life, and comprehensive picture of the interactions between science and religion. Unlike the past models that treat "science" and "religion" as separate, universal entities and limit their relationship into specific metanarratives, the metaphorical view of science and religion as language helps to acknowledge the complex, context-dependent, and dynamic nature of the science-religion interface. The "language" metaphor shows that the relationship between science and religion has evolved over time with the shifting boundaries of "science" and "religion." It also demonstrates that there are multiple forms of interactions depending on the specific variations of science and religion involved and the sociopolitical context in which the interactions occur. In addition, the science-religion interaction is compared to the dynamic, fluid relationship between the languages of a bilingual speaker. Overall, the metaphor of language is an effective heuristic tool bringing out the intricacies of the science and religion interface and revealing variables that influence the relationship.

Fourth, the "language" metaphor places emphasis on the practical nature of science and religion. Various scholars in science and religion, such as Harrison and Reeves, have criticised that the past study of science and religion tended to revolve around the theoretical, propositional features and demanded a view of science and religion grounded in practice.[730]

[730] Harrison, "The Modern Invention of 'Science-and-Religion'."

According to Lakoff and Johnson, our concepts, including conceptual metaphors, "structure what we perceive, how we get around in the world, and how we relate to other people."[731] They argue that conceptual metaphors structure not only our thinking but also our activities. This is indeed the case for the "language" metaphor. Instead of offering a theoretical, general discussion, the "language" metaphor approaches the science-religion interaction as a part of lived experiences. It views the science and religion scholars as the interlocutors, the protagonists actively partaking in the discourse. Since the "language" metaphor allows scholars to approach science and religion not only as intellectual entities but also as social activities, they are more likely to avoid observer bias and notice how their backgrounds, cultures, perceptions, and intentions influence the discussion. The "language" metaphor also enables scholars to reflect on their competency in scientific and religious languages. As dialogue partners, scientists, theologians, philosophers, and other scholars ponder on which language they use to participate in the discourse and, if using both languages, what type of bilingual they are. This self-examination will help them avoid the common pitfall of overstating or undermining the legitimacy of science or religion. Moreover, the participants recognise that science and religion are equally important practices in shaping their understandings and experiences. Thus, the "language" metaphor brings to light the embeddedness of science and religion in the form of life and promotes robust and lively two-way discussion.

Fifth, the "language" metaphor, especially the notion of bilingualism, gives advice on supporting imaginative, fruitful science-religion discussions. The ever-increasing globalisation phenomenon encourages communication between people with different linguistic and cultural backgrounds while discouraging prejudice based on the language people speak. Consequently, contemporary society values linguistic differences as a way of appreciating diversity. We can apply this notion to the field of science and religion. Science and religion are two languages

[731] Lakoff and Johnson, *Metaphors We Live By*, 9.

with different communicative functions and linguistic communities. Yet, they are not entirely separate. For bilingual people in science and religion, the two languages are mixed in a way that enriches the experiences of the world. The field of science and religion can foster bilingual discourse by helping scientific communities and Christian communities learn each other's language. If this is not realisable, we can at least employ capable translators who are able to liaise between the scientific and religious communities. Using techniques and strategies from second language learning and translation, the field of science and religion can promote profitable dialogue between scientific communities and Christian communities. Also, when thinking of science and religion as languages, people can be more open to acknowledging the inherent limitation of their language in expressing and understanding all aspects of reality.

Finally, this thesis shows that the conceptual metaphor processing developed in cognitive linguistics is applicable to metaphors not only in the field of science and religion but also in other disciplines. In the field of science and religion, scholars can examine how old and new metaphors model the science and religion relationship using cross-domain mapping. In theology, the conceptual metaphor theory can be used to understand the metaphorical nature of theological language, especially the language about God. The human experience can be positioned as the concrete source domain to perceive and fathom the transcendent God. Furthermore, contextual theologians can develop new conceptual metaphors about God based on their experiences and transform the way they perceive and relate to God. Hence, the "language" metaphor proves to be an exemplar demonstrating the far-reaching implications of conceptual metaphor processing for the field of science and religion, theology, and interdisciplinary research in general.

Limitations of the metaphor

While the metaphor of language makes significant contributions to academia, some limitations exist. The foremost issue is in the inherent limit of a metaphor. Various similarities between language and science or language and religion have made the metaphorical construction possible, and this approach has successfully modelled science, religion, and their relationship. Despite the metaphor's apparent advantages discussed previously, the "language" domain cannot attend to all facets of science and religion because "language," "science," and "religion" are ultimately different. In the case of "science," language cannot address the progressive nature of science. There is no directionality or goal in the evolution of language. Language changes over time because the linguistic community and its context change. It is not possible to say that the past language is more primitive than the present language.

Science, however, is distinguished from language by its progressive nature. Although scholars have divergent definitions of progress, science has specific aims and strives for development. Hence, the notion of scientific progress is omitted in the metaphorical understanding of science as a language.

In the case of "religion," the "language" concept fails to depict the transcendental side of religion. Language is, after all, a human phenomenon. It is a system of arbitrary symbols shared by a group of people and depends on the sociocultural context. But this anthropic outlook of language maps only partially to "religion," particularly Christianity. The core belief in Christianity is the existence of the triune God, who enters into a personal relationship with his creation. God is both transcendent and immanent. Nonetheless, the "language" concept, which focuses on the physical realm, lacks any constructs that can deal with the spiritual reality. These are just a few examples showcasing the limit of the "language" concept in alluding to all features of science and religion. Therefore, as with all metaphors, the metaphor of language,

if stretched too far, can lose the potential to become an effective heuristic tool to understand science, religion, and their relationship and even lead to misunderstandings.[732]

Another constraint of this research is the use of Christianity as a representative religion. In this thesis, Christianity was selected because it is the most widely practised religion in the world, has a long tradition, and exists in multiple forms depending on the denomination and congregation. It also has both theoretical and practical sides that align well with various subtopics in language. Furthermore, Christianity possesses characteristics shared by other religions, such as supernatural beliefs, separation of the sacred and the profane, emphasis on ritual acts, adherence to a basic moral code, and the existence of a socially organised group sharing a particular worldview. Considering these premises, Christianity is an optimal choice for representing "religion" within the current scope.

Of course, Christianity cannot exhibit features specific to other religions. For example, Buddhism does not believe in a creator deity or a personal god and has no single authoritative book. Hinduism worships many gods, and there is no single story of creation. Although the unique characteristics of different religions cannot be modelled solely by the Christian language, this fact does not refute the effectiveness of the "language" metaphor. Instead, the strategic choice of Christianity adopted by this thesis is constructive because it leaves room for specialists in other religions to participate in evaluating how their religion is a language. Thus, the decision to confine "religion" to Christianity is not a demonstration of exclusivity or superiority of Christianity but rather a friendly, open invitation for other religions to join the discussion.

The limitations so far pertain to the theoretical dimension, but there is also a point of caution for the practical implications of the metaphor of language. This research mentions the

[732] Taylor and Dewsbury, "On the Problem and Promise of Metaphor Use in Science and Science Communication."

benefits of being bilingual, including an expanded worldview and openness to cultural differences. It also portrays linguistic pluralism in a positive light. Through the metaphor, the experience of learning the language of science or religion is considered preferable, and becoming bilingual in science and religion is profitable. Yet, everyone may not have such high regard for the ability to speak more than one language. For instance, someone who has dyslexia could have had painful memories of learning a language and, therefore, have an opposing viewpoint on building a bilingual community. Additionally, a bilingual person who experienced discrimination and alienation for using a particular language may consider the general experience of bilingualism antagonistic and show pessimism towards cross-community dialogue. Since individuals have different ways of processing and interpreting the "language" metaphor, the practical advice for the field of science and religion proposed in the thesis may not resonate with some audiences.

Directions for future research

This study has concentrated on only six language features that are relevant to the relationship between science and religion. It is hoped that future studies will be able to explore other linguistic topics. One possible area for further research is the issue of universal language, which refers to a hypothetical or historical language that is used and understood everywhere and by all or most participants. In linguistics, the Esperanto language was created in 1887 to function as the international auxiliary language. It was designed to be easy to learn and speak due to its logical and regular design. Since the scientific and religious communities sometimes suffer from miscommunication, a future research project might explore whether a universal grammar, if not a universal language, can be developed for science and religion. Universal grammar in modern linguistics, based on the work of Noam Chomsky, is a set of categories, mechanisms, and constraints innate to all human languages. Applying this concept to the field of science and

religion, future research might investigate the similarities between science and religion and attempt to disclose a common underlying mechanism generating scientific and religious thoughts and activities.

Another area for future research is the potential of a lingua franca or trade language for exploring the relationship between science and religion. Unlike a universal language, which is a supranational, artificial language, lingua franca is a natural language employed for communication between populations whose native languages are different. For example, English is the lingua franca of natural science. When this concept is mapped onto the field of science and religion, future research might examine whether the language of science, the language of religion, or another distinct language like mathematics or philosophy can function as a lingua franca. Although any one language may be insufficient to address all areas of science and religion domains, there can be specific discourse areas where one language excels in facilitating interdisciplinary communication.

When linguistic communities that do not share a common language come into contact, they can select the native language of one community as a lingua franca, but they can also deliberately develop pidgins and creoles to facilitate communication. A pidgin is a hybrid mix of two languages with simplified vocabulary and grammar designed out of contacts between two or more groups, and a creole is a stable natural language originating from a pidgin. Transposing these ideas to the field of science and religion could offer suggestions on what specific forms of language are optimal for facilitating meaningful dialogues between science and religion.

This study has provided a theoretical structure for viewing science and religion as languages. It used cross-domain mapping, identifying similarities and differences between the domain of language and the domains of science or religion. This project can develop into another interdisciplinary research, inviting comparative linguistics, cognitive linguistics, and

other related disciplines to provide an empirical analysis of the language of science and religion used in everyday life. These studies can reveal interesting patterns and enhance the current understanding of science and religion. Furthermore, they can proffer guidance on building a bilingual community based on objective empirical evidence.

So, what about those who lie outside the scientific or religious community? The primary audience of this study is the members of the scientific and religious communities. For monolinguals, the "language" metaphor invites them to go out of their comfort zone and interact with others who speak different languages. For the bilinguals, the "language" metaphor encourages them to continue practising their languages and encourages them to become translators facilitating fruitful cross-community conversations. The metaphor also offers a framework to enable those who are outside the scientific or religious community, other language users, to join the discussion, share their unique traditions, values, and cultures, and make the discourse more enriching. Through this process, we will be able to build a strong bilingual, if not multilingual, community.

In conclusion, the "language" metaphor offers important insights into the academic and wider cultural discussion of the science-religion relation. Unlike other existing metaphors or models of science and religion, this metaphorical framework provides a window to look at science and religion from multiple angles and levels (see **Figure 25**). It also provides a mental representation of the dynamic science-religion interface. Moreover, the "language" metaphor invites the audience to discover further levels of meaning. Hence, as this thesis has argued, the understanding of the complex relationship between science and religion presented by the "language" metaphor has much to commend it.

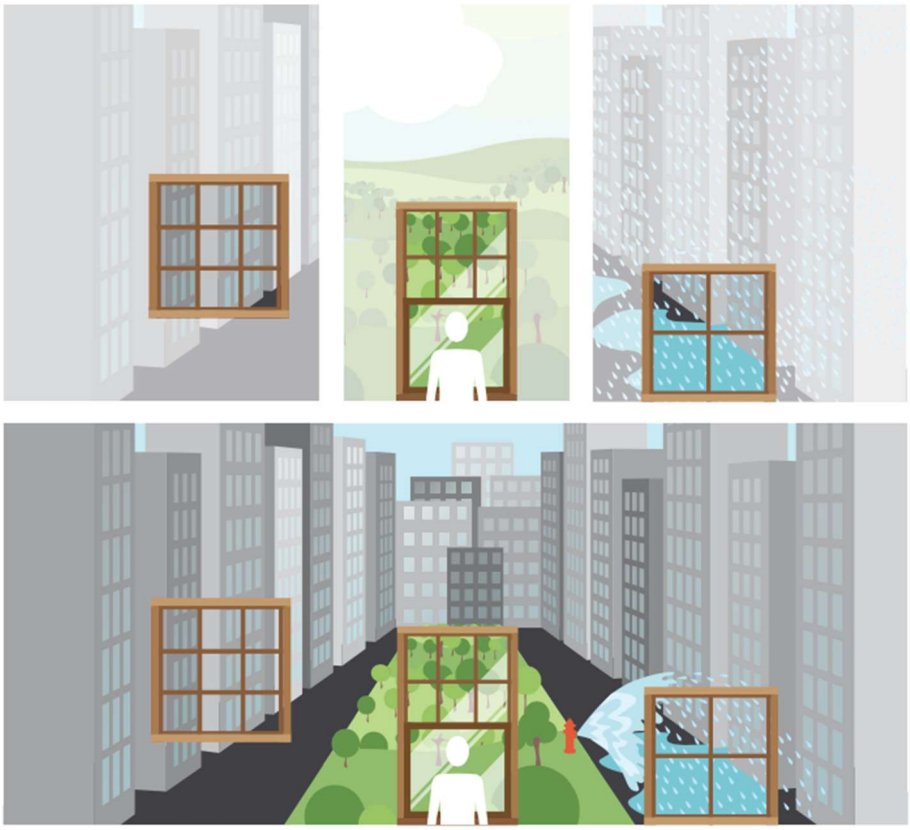

Figure 24: Metaphors are windows through which we view the world.
In the case of science and religion, the "language" metaphor provides a rich view of science, religion, and their interaction[733]

[733] Reprinted with permission from "Figure 3.1" by World Bank Group, 2015, Washington D.C.: World Bank Group. Copyright 2015 by International Bank for Reconstruction and Development / The World Bank

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