

The history of SPACE between science and ordinary language:

What can words tell us about conceptual change?

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Acknowledgements

A generous postdoctoral grant from the Cohn Institute for History and Philosophy of Science and Ideas at Tel Aviv University (TAU) enabled this research. I conducted the very earliest stage of the work while holding a postdoctoral position at the Minerva Humanities Center and the Edmond J. Safra Center for Ethics at TAU, which I would also like very much to thank. Participants in the workshop of the School of Philosophy, Linguistics and Science Studies in TAU under the direction of Professor Yossef Schwartz provided useful comments on an early draft. I reserve special thanks to Daniel Dovrat, Yiftah Elazar, Ori Belkind, Eyal Chowers, and Shaul Katzir for their perspicacious remarks and ongoing encouragement.

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Abstract

Lexical evidence reveals that ordinary notions of space underwent a dramatic change from the late seventeenth century into the first decades of the nineteenth century: the word's core meaning metamorphosed from INTERVAL to DIMENSION, revolutionizing relations between ordinary conceptions of time and space. Analyzing instances of the word in French over the years 1330–1835 indicates this conceptual change of SPACE was concurrent with growing interest in metaphysics and natural philosophy and echoed debates—provoked by Newton's *Principia* (1687)—over the precise nature of space. Employing both quantitative and qualitative methodologies, I show how changes in philosophical and scientific theory reshaped the general lexicon. I argue that ordinary lexical mechanisms largely determine the manner of science's dissemination into culture and propose a model accounting for such changes.

Keywords

Space; Scientific concepts; Conceptual change; Nomadic concepts; Ordinary language; Imaginary spaces

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1. Introduction

When the sixteenth-century French scholar Jean Nicot (1530–1604) defined space as “an interval of time and place between two ends,”¹ he captured well the ordinary sense of the word. As late as the seventeenth century, the French word ‘*espace*’ (from which the English word ‘space’ derives), mainly indicated interval: a period of time, or a certain distance or expanse, well-defined by its limits. This conception of space may seem baffling as it applied equally to what we nowadays call either “time” or “space” and in the same sense whether the demarcated portion concerned extent or duration. In other words, the premodern SPACE,² as recorded in early-modern Western European lexicons, differed surprisingly from our contemporary notion of space, commonly defined as “the unlimited expanse in which everything is located,”³ and generally understood as a dimension, or a set of

¹ “Espace [...] Est intervalle de temps et lieu entre deux extremittez” [Nic-1606: 254]

² As is customary in cognitive semantics, I use capital letters in referring to the concept’s content. Hence, ‘SPACE’ stands for “the conceptual content of the concept of space.” Single quotation marks refer to signifiers (‘space’ equals “the term space”). Terms in languages other than English appear in italics.

³ This definition is quite popular, as semanticists have already acknowledged (e.g. Melnik 2014, p. 31). See for example, Sensagent, s.v. “space,” accessed September 24, 2017, <http://dictionary.sensagent.com/space/en-en>.

coordinates in relation to which we situate objects and places and determine their respective locations.

Two sets of questions immediately arise: First, when did the ordinary notion of space change? Why and how did its main denotation transform from INTERVAL to DIMENSION, and what role did scientific theory play therein? Second, what can changes in the meanings of ordinary words such as ‘*espace*’ and ‘space’ reveal about conceptual transformation and how can lexical evidence for those changes illuminate relationships between science, ordinary language, and culture?

The concept of space played a crucial role in the evolution of physics and has therefore enjoyed honored status in the study of the history of science. In his seminal work *Concepts of Space* ([1954] 1993), documenting the history of physical theories of space from antiquity to the twentieth century, Max Jammer enhanced the role of SPACE as a key element in the history of modern science while demonstrating how science evolved within the backdrop of culture and theology. “It is my firm conviction,” he wrote, “that the study of the history of scientific thought is most essential to a full understanding of the various aspects and achievements of modern culture” (1993, p. ix). Interweaving epistemological, metaphysical, and theological interests, Isaac Newton’s concept of space represented for Jammer an exemplar of the palpable relationship between science and culture. In the following decades, Samuel Sambursky’s work on Neoplatonism (1977) and Keimpe Algra’s (1995) detailed examination of concepts of space in Greek thought bolstered our knowledge of earlier conceptions of space and their philosophical contexts.

Albert Einstein was probably the first to discuss the tension between scientific thought and “pre-scientific” concepts of space—inseparably connected with words

expressing sensible experience ([1934] 1999, p. 254). This tension between ordinary and scientific notions of space, reaching a climax with relativity theory, necessitated a philosophical investigation, maintained philosopher of science Dudley Shapere. “What are the relations,” asked Shapere, “between the uses of the terms “space” and “time” (or their formal analogs) in a scientific theory and certain ordinary uses of those terms?” ([1963] 1984, p. 140). Like Einstein before him, Shapere postulated that “scientific concepts are descended from ordinary ones” (Ibid., p. 139), which he considered as primitives evolving into scientific constructs. But what if conceptual evolution does not progress only in one direction and certain ordinary concepts in fact originate in scientific theory?

Whereas scholars of science have often highlighted the cultural and theological motivations behind scientific theories (along with Jammer 1993, Funkenstein 1986 is a notable example), the subtle yet profound implications of science on language and culture are only beginning to receive scholarly attention (e.g. Feingold 2004; Shank 2008; During 2016).⁴ In this essay, I contribute to that enterprise: To my knowledge, no systematic study has examined the ways in which scientific discourse entered the general culture and transformed the prevailing idea of space. Based on evidence from the French stretching from 1330 to 1835, I argue that beginning in the last decades of the seventeenth century

⁴ Enhancing the understanding of physical science’s triumph, Mordechai Feingold (2004) showed how Newton’s work spread and changed the eighteenth century’s ideals of knowledge. J. B. Shank (2008) studied Newton’s reception in France and the role of the raging “Newton Wars” in the French Enlightenment. In a similar effort to situate the cultural and philosophical significance of physics’ reception, Élie During (2016) analyzed Einstein’s polemic with Bergson following his 1922 visit to Paris.

and continuing through the eighteenth, natural philosophy stimulated a process of conceptual change metamorphosing the ordinary notion of space, changing the word's very meaning.⁵

Placing the tortured relationship between words and concepts at the heart of his theory of incommensurability, Thomas Kuhn regarded radical change in the signification of words as symptomatic of paradigm shift. "Two men who perceive the same situation differently but nevertheless employ the same vocabulary in its discussion," he wrote, "must be using words differently. They speak," he added, "from what I have called incommensurable viewpoints" (Kuhn [1962] 1996, p. 200). The term 'space' is a case in point: Pre-moderns did not mean it the way Moderns have, and these developments in ordinary language mirrored decisive conceptual changes in physical theory. "The proponents of competing paradigms practice their trades in different worlds" (Ibid., p. 150), asserted Kuhn, the differences between those "worlds" typically evident not in the use of *different words*, but rather in the use of the *same* words to express different concepts.

⁵ While lexical change is an ordinary phenomenon, the semantic transformation of 'space' is unusual. Lexical changes induced by external sources commonly take two principal forms: either the introduction of neologisms, often emanating from professional discourses (e.g. terms designating novel objects or technologies) or the adoption of novel denotations by existing word-forms. The latter more rarely results in radical semantic change and may be extremely long and gradual. 'Space' was an existing term indicating an ordinary and commonplace notion. Its meaning, however, radically changed through contact with specialized discourses and the effect of metaphysics and natural philosophy on the lexeme's semantics was profound and long-lasting.

Revolutions in words' denotations have been famously considered as evidence for conceptual change, and throughout the twentieth century different schools of the history of ideas applied lexical tools toward documenting and analyzing conceptual change. Reinhart Koselleck (1923–2006), founder of the influential German school of *Begriffsgeschichte* (conceptual history), recognized the value of lexical evidence while noting the profound difference between words and concepts. Distancing himself from philological practices and “histories of words,” he nonetheless acknowledged that “sociopolitical terminology” provided lexical evidence relevant to the “condition of social history,” such that concrete political situations “were registered through their linguistic traces” (Koselleck [1972] 2004, p. 76 and 79). More recently, Hon and Goldstein (2005, 2008) employed similar assumptions in exploring the history of mathematical and aesthetic concepts of symmetry. Lexical strategies, Hon and Goldstein suggested, are useful in tracing changes in scientific concepts and, applied to historical texts, may well spare the historian the perils of anachronism (2008, pp. 27–48).

This type of work, stressing the empirical utility of lexical evidence, presupposes stark asymmetries between concepts and words: Words are considered as useful historical evidence as if they were inert artifacts reflecting conceptual realities; concepts are typically considered as possessing a genuine ontological status, while words merely serve as their name tags. In reality, however, it is unclear how we may demonstrate the existence of concepts, ascertain their unity across time, or pinpoint their trajectories apart from words. What we can observe empirically moving between scientific discourse and the ordinary lexicon are words, not concepts. Building on theories of conceptual nomadism in science (Stengers 1987a) and concepts in philosophical translation (Cassin 2004a), I argue that

Chalozin-Dovrat, Lin (2019). The history of SPACE between science and ordinary language: What can words tell us about conceptual change?. *Perspectives on Science* 27(2), 244–277. <http://doi.org/10.1162/posc_a_00307>

lexical mechanisms may explain convincingly what “moves” or “relocates” when scientific concepts such as SPACE enter general culture. According to my model, words actively propagate conceptual elements in unintended ways.

The main body of this essay (Section 2) presents a study of the conceptual change of SPACE based on lexical data and lexical methodologies. Discussing my findings (Section 3), I will lay out reasons why lexical tools are indispensable for understanding conceptual change, and why the word/concept nexus is key to understanding conceptual nomadism between regimes of knowledge and across the boundaries of science. The way science disseminates in a culture, I argue, relates inextricably to the ways in which ordinary lexicons operate.

2. From INTERVAL to DIMENSION: retracing revolutions in the concept of space

2.1. What does it mean to approach the history of SPACE from a lexical angle?

Anyone who has dealt with historical texts knows well the experience of realizing that some familiar terms apparently held quite different meanings for past readers. Thus, conceptual change typically reveals itself in the changing relationships between words (i.e. terms or signifiers) and concepts (i.e. ideas or signifieds). These transformations, however, are seldom sudden (on a diachronic scale) or clear-cut (on a synchronic scale). The lexicon changes perpetually but usually in an extremely slow and fuzzy manner. Therefore, the semantic configuration of a word—the array of its denotations in a certain period and the semantic relationships between these different denotations—is not always easy to define, especially not for later readers.

In some cases, lexicographical works—lexicons, dictionaries and encyclopaedias—can suggest important clues. In the early nineteenth century, the *Dictionnaire de l'Académie française* redrafted its account of the notion of space: While the first five editions of the official lexicon, published from 1694 to 1798, reproduced the original entry for ‘*espace*’ with only minor alterations, the sixth edition (1835) contains a wholly rewritten entry. According to the new definition, SPACE, now primarily understood “in its abstract sense,” signified “indefinite extent.”⁶ But what had ‘*espace*’ meant before? How had it acquired its “abstract sense” and when exactly did that happen?

With these questions in mind, I first examined what ‘*espace*’ had meant earlier, at the dawn of the French national language, in the historical variety known as Middle French (in use from the fourteenth century to the beginning of the sixteenth, see subsection 2.2). Absent standard lexicographical evidence for comparison, I attempted to reconstruct the premodern notions of the term through quantitative analysis of 600 occurrences in a corpus of fourteenth–fifteenth-century texts provided by the DMF database.⁷ I then corroborated these findings with the earliest sixteenth-century monolingual dictionaries (Estienne and Nicot). Together, these sources illustrate the uses of the word between 1330 and 1606, enabling an outline of the premodern lexical grid: a semantic configuration that appears surprisingly foreign today.

⁶ See note no. 19.

⁷ The DMF (*Dictionnaire du Moyen Français*, 1330–1500) is the French national project of digitization and study of Middle French texts. This research employed the DMF 2015 collection, Base des Intégraux, <http://www.atilf.fr/dmf>.

The prototypical use of the term signifying some interval of either time or distance, I dubbed the premodern lexical grid ‘SPACE-INTERVAL’. Clearly, not all occurrences of the word ‘*espace*’ signified interval, the term ‘SPACE-INTERVAL’ representing a grid of different significations characteristic of the premodern period (as opposed to any one specific denotation). Thus, the notion of lexical grid allows me to subject the somewhat vague idea of conceptual change to the more precise instruments of lexical analysis: I can now illustrate how gradual change in a very large number of occurrences ultimately grows into significant conceptual transformation, finally replacing the premodern SPACE-INTERVAL grid with a novel array of denotations.⁸

I now had to find out how SPACE-INTERVAL changed, took on new meanings and mutated into the modern phase of the ordinary notion, which I named ‘SPACE-DIMENSION’. While quantitative analysis could detect the prototypical use of the word before the seventeenth century, it could not parse the reasons behind the change. Hence, I searched for meta-lexical evidence indicating how contemporaries viewed the term during the decisive period of conceptual change. Lexicographical works can provide

⁸ The notion of lexical grid does not refer to any specific source but draws on long-term research in cognitive semantics, specifically on the application of prototype theory (Rosch 1978; Lakoff 1987) to lexicology (Geeraerts 1997, 1999). Lexical grids are like hypothetical pictures based on empirical data, dissolving together numerous “snapshots” of a notion’s semantic configuration, effectively summarizing the typical uses of the word over decades. At the core of the grid we can find the prototypical signification of the word, corresponding to its most frequent sense, which is, most often, also the one linking together the greatest number of related terms.

such evidence as they summarize their authors' lexical ideologies: their ideas about words and their meanings (see subsections 2.3 and 2.4).

Lexicographers indeed provided important evidence documenting the change, but they did not tend to comment on it explicitly. The change, however, was substantial: When used in a sentence, the typical denotations of the two historical grids, i.e. SPACE-INTERVAL vs. SPACE-DIMENSION, signify significantly different things. This may be visible in their relation to the notions of TIME and DURATION: while the premodern SPACE-INTERVAL most often referred to a well-defined period of time (e.g. “the space of two days”) or to a particular temporal notion (such as DELAY), as a rule SPACE-DIMENSION does not denote temporality at all. In fact, SPACE-DIMENSION is largely distinct from TIME, and the two concepts often appear as a complementary pair of analogous—yet strictly dissimilar—dimensions. For this reason, concurrent use of the terms ‘space’ and ‘time’ may lead to anachronistic misunderstandings and confusion, as is evident in the common French phrase “*temps et espace*” (“time and space”): Moderns generally understand it as “the two abstract dimensions in relation to which the order of events and the position of objects is determined;” however, set in the context of the premodern semantic grid of SPACE-INTERVAL, it typically meant “time and opportunity.” The use of the term ‘*espace*’ to denote opportunity was in fact common and mirrored by the English expression (now obsolete) “to have/give [someone] space” meaning to have or to give someone the time or the opportunity needed to accomplish

something.⁹ Whereas denotations have significantly shifted with time, it is important to note that today we may still use ‘space’ to mean an interval of time (e.g. “in the space of two days”). In other words, INTERVAL remains on the periphery of the grid while no longer its prototypical signification.

Lexical grids, such as SPACE-INTERVAL and SPACE-DIMENSION are useful abstractions. However, the semantic reality of concepts is far messier, and conceptual change does not present itself neatly to the researcher’s eye. In the next subsections, I describe what we see when we investigate the diverse types of data, and how I extracted the transition from SPACE-INTERVAL to SPACE-DIMENSION from actual texts.

2.2. Characterizing the SPACE-INTERVAL grid (1330–1606)

The word ‘space’ is hardly new: it originated from an Anglo-Norman noun, a variant of the Old French ‘*espace*’ itself deriving from the Latin ‘*spatium*’. The French and the English lexemes¹⁰ share therefore the same source and manifest similar semantic traits. They also share similar paths of semantic change. Thus, when speakers of French and English employed the word as late as the mid-eighteenth century, they did not intend the same notion we do today but had quite another in mind: an interval of duration or distance,

⁹ See for example, OED Online. July 2018, s.v. "space, n.1," accessed September 16, 2018, <http://www.oed.com/view/Entry/185414?rskey=JvzWt1&result=1>.

¹⁰ Lexemes are the distinct semantic units which compose the lexicon. A lexeme (like the verb ‘eat’) may appear in different inflectional forms (e.g. ‘eat’, ‘ate’, ‘eaten’, ‘eating’), and in that sense lexemes are similar to the sets represented by headwords in a dictionary.

an occasion, a moment, or a certain lapse of time. More rarely, they meant extent—the property of matter to occupy place and to leave room when removed. According to my findings, the three clusters of meaning most typically associated with the ordinary premodern notion of space were: INTERVAL, TIME, and EXTENT.

2.2.1. *The Sources*

I determined the identity of the SPACE-INTERVAL lexical grid on the basis of two different analyses. The first was a quantitative analysis conducted on the original corpus of the DMF database,¹¹ including 219 texts (5,805,036 words) dating from 1330 to the first years of the sixteenth century. It yielded 600 occurrences of the term '*espace*', out of which ninety-one appeared within Nicole Oresme's translation of Aristotle's *De caelo*.¹² The remaining 509 occurrences, harvested from 108 texts by sixty-four different authors, required manual evaluation including syntactic and semantic tests.¹³ This collection of texts

¹¹ See note no. 7.

¹² Oresme translated the work (known in English as "On the Heavens") into Middle French at the request of Charles V (1377). Due to the exceptional nature of the text—a philosophical translation from Latin (the original Greek text dates to 350 BC)—the general quantitative results, which sought the ordinary use of the word in Middle French, omitted these occurrences.

¹³ Most of the occurrences call for simple syntactic and semantic tests. To give only a few examples, INTERVAL is easily discernable through idiomatic expressions such as *espace+de+temps* (55/509) or *espace+de+[Numeral adjective]+[Nominal unit of duration/distance]* (213/509) (e.g. "[l']*espace de trois jours*"). When occurrences relate to the temporal realm, the distinction between INTERVAL and TIME requires more refined judgments on the degree of abstraction involved. In comparison to the bounded,

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included literary works (e.g. Christine de Pisan’s writings) and more mundane chronicles (such as the *Registre criminel du Châtelet*). Accordingly, and within the familiar limitations of such databases, the occurrences of ‘*espace*’ seem to represent well the common use of the word in Middle French.

I then juxtaposed these quantitative findings with the work of the very first French lexicographers. When used critically, lexicographical works can inform us about contemporaneous users’ perceptions of the lexicon (Sarfati 1995). Between 1536 and 1606, a consecutive series of lexicographical works led from the Latin lexicons and the Latin-French bilingual dictionaries to the composition of the first monolingual vernacular dictionary (Wooldridge 2010). Scholarly consensus acknowledges this acclaimed lineage—running from the numerous editions of Robert Estienne’s dictionaries to the *Thresor* of Jean Nicot—as the first consistent and reliable source about the history of the French lexicon (Brunot 1909). I examined the entry *Espace* in four key editions of this series. The first of these, the second edition of the *Dictionarium seu Latinae linguae Thesaurus* (1536), (hereafter Thes-1536) represents Estienne’s effort to provide a reliable lexicon of Classic Latin, destined for students at a time when the French vernacular had started to consolidate its status as a formal written language. A couple of years later,

well-defined portion represented by INTERVAL, TIME signals a higher degree of abstraction. Such subtle differences are discernable through criteria such as discrepancies between prepositioned adjectives (42/509) and adverbs (25/509) (e.g. “*long espace*” [=INTERVAL] vs. “*trop d’espace*” [=TIME]). Occurrences denoting EXTENT were most usually obvious through context (provided by lexemes positioned within -6/+6 slots). When in doubt (4/509), the analysis favored EXTENT, due to its rarity and to the import of that unexpected rarity for the general argument herein presented.

Estienne published a bilingual dictionary, the *Dictionarium latinogallicum* (DLG-1538), and in the following year he re-edited it as a *Dictionaire François-latin* (DFL-1539), essentially an inversion of the Latin-French dictionary.

In 1539, Francis I of France had mandated the use of French in all judicial and notarial acts (the Ordinance of Villers-Cotterêts), and so Estienne's project took an unintended turn, becoming the basis for a much-needed monolingual dictionary. A series of re-editions of these three dictionaries finally yielded Nicot's *Thresor de la langue francoyse* (Nic-1606)—the first lexicon for a burgeoning national language, the *François*. In the process, entries changed through copying, recopying, revision, and emendation from one edition to the other. In a way, then, Nicot's *Thresor* summed-up a whole century of lexicographical work.

2.2.2. *The Findings*

The main sense of the premodern term '*espace*' (and the most common one in the DMF database, at more than 65%) is INTERVAL: a period, a length of time or distance, or, as Nicot's *Thresor* neatly defines it, "an interval of time and place between two ends."¹⁴ The dual nature of the concept, applicable to both duration and location, had already drawn the attention of previous lexicographers. "*Spatium* is said not only of place but also of time," emphasized Estienne in his Latin dictionary,¹⁵ and added the term '*Espace*' in the

¹⁴ See note no. 1.

¹⁵ "Spatium, Spatii, nō solū de loco dicitur, sed etiā de tēpore. Espace." [Thes-1536: 1529]

vernacular to make his point clear. However, the word’s main use was to designate temporal relations; more than 95% of the occurrences signifying INTERVAL refer to temporal intervals, and, overall, more than 91% out of the 509 occurrences refer to different ideas of temporality.

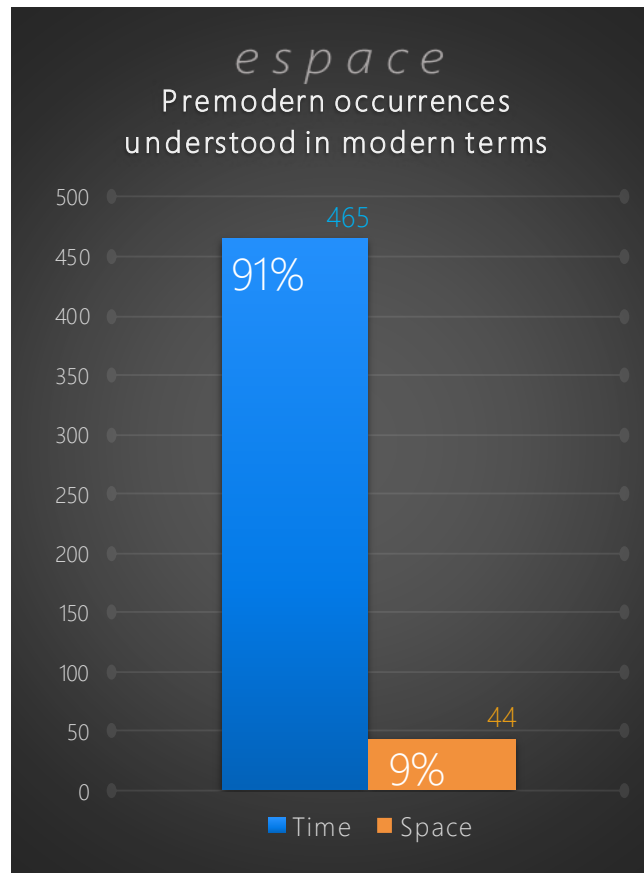


Fig. 1. ‘Espace’: Premodern occurrences understood in modern terms. More than 91% (465/509) of the occurrences correspond to the modern notion of time; less than 9% (44/509) correspond to the modern notion of space.

The second sense (28.4%) of premodern ‘*espace*’ evokes more abstract ideas of TIME, standing for a general notion of time or duration or referring to more specific ideas of temporality, such as OCCASION, OPPORTUNITY, or LEISURE—time free of labor.

A common idea of time is one of DELAY, especially in the negative;¹⁶ hence, 'espace' often appeared negated, indicating WITHOUT DELAY and IMMEDIATELY.

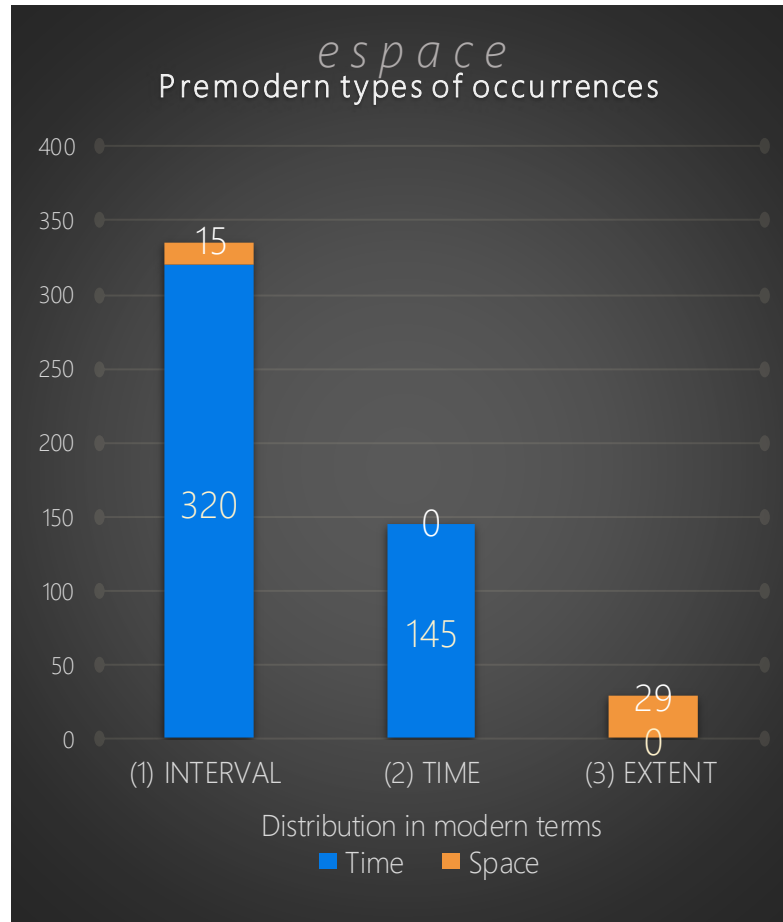


Fig. 2. 'Espace': Premodern types of occurrences. More than 65% (335/509) of the occurrences signified INTERVAL (mostly temporal intervals); 28.4% (145/509) evoked different notions of TIME, and only 5.6% (29/509) denoted EXTENT.

Finally, other uses of 'espace' denoted EXTENT (5.6%): expanse, amplitude, breadth, or the measurable surface of a body, and, more generally, the characteristic of

¹⁶ The term appears in expressions such as: "sanz espace", "sanz plus d'espace" or "aucun(e) espace" (in the negative sense).

matter of having volume and occupying place. While the modern notion of space relates directly to the idea of extent—of which it is clearly the abstraction—in Middle French it was but one of several significations associated with the term and not the most common.

2.3. Documenting conceptual change : The *Dictionnaire de l'Académie française* (1694–1835)

The evolution of the French lexicon in modernity is exceptionally well-documented and easy to follow, due chiefly to the unusual linkage between the French language and the French state (Mazière 2000). In fact, as early as the seventeenth century, the French Crown had entrusted the lexicon of standard French to the keeping of a formal body: the French Academy. Established by a royal decree, the Academy had published its first dictionary in 1694 and has overseen the revisions of each consecutive edition through the present day.

Since each of the nine editions of the *Dictionnaire de l'Académie française* took the previous one as its starting point, this official documentation of the national language furnishes an exceptionally reliable record of the lexical norm and its developments. Clearly, modification of an entry cannot provide accurate information about the word's actual use, but it may serve as evidence of awareness of change, indicating the observation, assessment, and recording of a specific lexical change.

Comparing the entries for '*espace*' in consecutive editions of the Academy's dictionary yields most interesting findings: Whereas in the first five editions (1694, 1718, 1740, 1762, 1798) only very minor changes arise, by the dictionary's sixth edition (1835) the entry was completely altered, the modern idea of space clearly articulated. The entry's

modification for the 1835 edition indicates that the premodern notion of space, represented by the SPACE-INTERVAL semantic grid, was subject to sweeping changes, expressing important transformations in the accepted forms of knowledge. These changes are especially visible through the Scholastic notion of imaginary spaces, pushed into an accelerating process of scientification and secularization.

2.3.1. The first edition's entry (1694)

Initially, the first edition of the Academy's dictionary appears to hark back to the definitions of '*espace*' found in Estienne and Nicot's dictionaries more than a century earlier. However, indications of the great transformations ahead are already detectable at the end of the seventeenth century. "*ESPACE*," determined the Academy, "is the extent of place from a certain limit to the other." Only in the entry's second paragraph—following a list of examples referring mainly to material extent (e.g. "empty space, occupied space")—it adds: "also said of the extent of time."¹⁷

Three of the major semantic trends that would allow the modern notion of space to emerge are already apparent: (1) The dissociation between temporal and locative uses; (2) The waning of the notion of interval; and (3) The predilection for locative uses rather than temporal ones. These three phenomena are visibly interrelated: to start with, the sharp separation between the two uses of the term, the temporal and the locative, overrides the

¹⁷ "Estenduë de lieu depuis un certain terme jusqu'à un autre (...) *espace vuide, rempli*. (...) / Il se dit aussi, De l'estenduë du temps." [1st Acad-1694, "Espace"]

concept of interval and gradually depletes it. In retrospect, while the first edition's definition of '*espace*' seems to preserve the idea of INTERVAL, in fact it already dispossesses it of its most distinctive trait: the premodern indifference to the time/space divide.

2.3.2. *Imaginary spaces (1694–1835)*

Beginning in the first edition (1694), the authors of the entry referred to the Scholastic notion of imaginary spaces. The term 'imaginary space' (in the singular or the plural) originated in Aristotle's argument against the feasibility of extracosmic void space. The line of reasoning, as later disseminated in the Latin West, rejected the possible existence of extracosmic infinite void but accepted that the faculty of imagination could conceive infinite space beyond (*extra*) the world (*cosmos*) (Grant 1981, 1996). From the late thirteenth century on, the context changed and considerations of imaginary spaces generally concerned divine power: The question became whether such boundless empty space could possibly exist independently of God, whether or not it was created by Him, or associated in some way (as a property or attribute) with God's omnipresent immensity. Such speculations characterized the conventional discussions and debates on the theme, and within these discursive conventions, the term 'imaginary' associated with the Aristotelian reasoning. According to Grant (*Ibid.*) from the sixteenth century on the notion of imaginary space played a vital role in the intellectual evolution that would lead to Newton's concept of infinite space.

In line with this use of the term '*espace*' in the scholastic tradition, the entry resumes in a third paragraph: "Philosophers name *Imaginary Spaces* this void that they

envisage outside the boundaries of the world.”¹⁸ The Academy's special awareness of the philosophical discourse would soon prove timely: The metaphysical and physical debates about the nature of space revolutionized the idea of space and even the very meaning of the word. The second and third editions of the *Dictionnaire de l'Académie française* (1718, 1740) preserved the same definition of imaginary spaces. While during the first half of the eighteenth century this reference to *scholastic sapientia* still seemed appropriate, the fourth edition (1762) omitted the term “Philosophers” altogether and the tone changed significantly: “*Imaginary Spaces* designate spaces that do not exist,” observed the entry's editors, “and which were believed to exist outside the boundaries of this world.” By the fifth edition (1835), the Academy did away with these vestiges of the speculative tradition and the entry of ‘space’ became a frontline of scientification: From now on, it was to become a sign and a mark of the modern *true knowledge*, designed according to the example of physical science.

2.3.3. *The fifth edition's entry (1835)*

“In its abstract sense”, opens the fifth edition's entry on ‘*espace*’ (1835), “the word indicates indefinite extent. *Time and space*.” However, “in the ordinary use,” it comments, “it almost always refers to limited extent, and usually a superficial one.” In a second paragraph, the authors specify: “It is sometimes said in an absolute manner, either in the singular or the plural, of this scope that embraces the universe. *The celestial bodies rotate*

¹⁸ “Les Philosophes appellent, *Espaces imaginaires*, Ce vuide qu'ils s'imaginent hors de l'enceinte du monde.”

[1st Acad-1694, “Espace”]

in space.” The third paragraph succinctly mentions the temporal use, and the last two paragraphs relate to the term ‘imaginary spaces’, now dismissed as “spaces created by imagination, outside of the real world, in order to place in them chimeras.”¹⁹

As we can see, by 1835 two major semantic processes were complete: the prioritization of the locative senses of the term ‘*espace*’ and the regression of the notion of interval (previously the predominant sense of the SPACE-INTERVAL grid). The most important novelty of the sixth edition’s entry, however, was the rise of an abstract notion of space. Describing it as “indefinite extent” (“*L’étendue indéfinie*,” §1),²⁰ the entry seems to connote Descartes’s use of the word, and his distinction between the notions of INDEFINITE and INFINITE EXTENT. In a well-known passage from the “Replies to the First Objections” to the *Meditations on First Philosophy*, Descartes associated the term ‘indefinite’ with things to which we discern no limit, such as the extension of imaginary spaces. Conversely, the term ‘infinite’ strictly designated, according to him, that thing “in which no limits of any kind are found,” and thus applied only to God (Descartes 2006, p. 65, §113). This passage became canonical, probably following Victor Cousin’s edition of Descartes’s works (1824) and Cousin’s subsequent ascending career as a philosophy

¹⁹ “(§1) Dans son acception abstraite, ce mot exprime L’étendue indéfinie. *Le temps et l’espace*. (...) Dans les applications usuelles, il désigne presque toujours Une étendue limitée, et ordinairement superficielle (...) / (§2) Il se dit quelquefois absolument, tant au singulier qu’au pluriel, de Cette étendue qui embrasse l’univers. *Les corps célestes roulent dans l’espace*. (...) / (§3) Il se dit aussi de L’étendue du temps. (...) / *Espaces imaginaires*, Espaces créés par l’imagination, hors du monde réel, pour y placer des chimères.” [6th Acad-1835, “Espace”]

²⁰ The entry’s paragraphs are marked “§1”, “§2” and so on.

professor.²¹ By the 1870s, this passage featured as the first example to the headword '*indéfini*' in Émile Littré's popular dictionary [Littré-1874, "Indéfini"].

In the second paragraph, the authors indicate an even more abstract sense of the word, designating "this scope that embraces the universe." Used in "an absolute manner" with the definite article ("*dans l'espace*," §2; "in space"), this additional nominal abstraction brings us one step closer to the contemporary concept, in its sense of "outer space". Characteristic of the SPACE-DIMENSION grid, this modern use of the term no longer relies on the Cartesian vocabulary. In fact, its propagation was most probably due to the triumph among French academics, from the 1750s on, of the Newtonian concept of absolute space (Shank 2008). However, the vibrant scientific wars between Cartesians and Newtonians in eighteenth-century France have left no trace here. The ordinary concept seems to contain this important (and at times highly volatile) transition in the history of natural philosophy and to incorporate it within the new semantic grid. The result is an important shift in the semantic grid of the concept as a whole. Most importantly, EXTENT replaced INTERVAL as the most salient sense of the term and, consequently, notions related to EXTENT, such as INDEFINITE, LIMITED or INFINITE EXTENT, have replaced those associated with INTERVAL, such as DURATION and DISTANCE. In fact,

²¹ Victor Cousin (1792–1867) was a French philosopher and an influential figure in the nineteenth-century French higher education system. 1828 saw him reinstated at the Sorbonne at the request of the Ministry of Public Instruction. Occupying a professorial position, Cousin reshaped the academic education of philosophy, rendering it extremely popular. His approach to the history of philosophy left its mark for generations to come.

as is already clear in the 1835 entry, DISTANCE had disappeared almost completely from the modern grid, only a few forlorn expressions of DURATION (§3) remaining as relics of the premodern SPACE-INTERVAL grid.

With the notions of indefinite and infinite extent now central to the modern SPACE-DIMENSION grid, SPACE gradually transformed from a concrete INTERVAL into an abstract DIMENSION. SPACE understood as INTERVAL was fundamentally bounded, defined by limits (the bounds of duration or place). In acquiring its novel sense as DIMENSION, SPACE had turned into that which determines limits, defines positions and places. Thus, the relations between the concepts of time and space changed fundamentally as well: whereas SPACE had once indicated a measure or portion of TIME (when not simply a synonym of it), the two were now independent, parallel dimensions (“Time and space”).

The mutations of the Scholastic notion of imaginary spaces suggest that the change in the signification of SPACE was most likely related to profound transformations in the “regime of truth” (Foucault 1977). Thus, the alterations in succeeding entries probably reflect growing semantic pressures as the scientification of SPACE rendered the term problematically polysemous, mixing “real” and “fictitious” attributes. On the one hand, the concept stood at the center of a promising scientific revolution, but on the other, it still related to an old form of knowledge whose authority was now in question. Resolving this ambiguity entailed a compensatory split dividing the Scholastic notion between two apposite domains: SCIENCE and FICTION. SCIENCE moved to the core of the new modern SPACE-DIMENSION grid, linking it with astronomy (§2), and “outer space.” Another aspect, however, relied on a modern understanding of the term ‘imaginary’, and

was coupled with FICTION and “chimeras” (§4). As a result, the Scholastic notion of imaginary spaces changed its meaning: It transformed from a trademark of learned speculation to a deceitful creature of imagination.

2.4. Dating the change and explaining it: *The Furetière* and *The Trévoux* (1690–1771)

The dictionaries of the French Academy provide important evidence about the metamorphosis of the ordinary notion of space, but they do not disclose why and exactly when this conceptual change occurred. What could have provoked such a profound semantic transformation and when did it occur? Should we deduce from the Academy's account that the transition between the premodern SPACE-INTERVAL and the modern SPACE-DIMENSION grids took place between 1798 and 1835?

Another series of dictionaries (Turcan 2009) may shed light on these questions: Furetière's *Dictionnaire universel* and the *Dictionnaire de Trévoux* (1690-1771) together constituted an important vehicle in the propagation of the French Enlightenment. A study of the eleven consecutive editions of this influential lexicographical work suggests that the motivation behind the semantic transmutation of SPACE-INTERVAL into SPACE-DIMENSION arose from a growing exchange between the general lexicon and the philosophical discourse.²²

²² For the notion of motivation in semantics, see for example Cuyckens et al. 2003.

2.4.1. The *Furetière* (1690–1702) and The *Trévoux* (1704–1771)

Antoine Furetière's *Dictionnaire universel* (hereafter *The Furetière*) was first published in 1690,²³ four years before the Academy's Dictionary, and enjoyed wide and prolonged commercial success (Roy-Garibal 2006; Ost 2008). The dictionary's name remains forever tied to the scandal that surrounded its publication: Furetière was originally an Academy member, deeply involved in the Academy's decades-long effort to compose the first official French dictionary. Following an acrimonious public dispute with his peers, Furetière lost his perpetual position in the Academy and published his own dictionary in Holland, in contravention of the Academy's Royal privilege. Furetière's dictionary was, and still is, considered the most complete lexical œuvre of that time (Quemada 1967; Wesemael 2010). Due to its author's interest in philosophy and his ambition to cover terms of the sciences and the arts comprehensively, *The Furetière* is also deemed a precursor of the Enlightenment encyclopedic tradition (Rey 2006).

In 1704, only three years after the publication of the *Furetière*'s thoroughly corrected and augmented second edition (1701), a slightly different version of it appeared in the independent principality of the Dombes (today's south-east France). Printed in the town of Trévoux, this edition of the dictionary was soon surnamed *The Trévoux*. The first *Trévoux* was practically a word-to-word copy of the *Furetière*'s second edition (Le Guern 1983). According to Macary (1973), we should understand this blatant literary theft in light

²³ Published posthumously in 1690, *The Furetière* was antedated by a tentative abbreviated version issued in 1684 by Furetière himself under the name *Essais d'un dictionnaire universel*. The *Essais* was not considered an item in the series and did not devote an entry to '*Espace*'.

of the historical context: neither dictionaries enjoyed the Royal privilege (reserved for the Academy), and were not legally publishable in France. Therefore, *The Furetière* was printed in Holland and soon identified with its Protestant editor, Basnage de Beauval. The *Trévoux*, for its part, which was published anonymously, has been customarily attributed to the group of Jesuits that issued the *Mémoires de Trévoux*, a journal of literary critique. In fact, in one of the *Mémoires* volumes the editors announced their intention to print an edition of the *Dictionnaire universel* differing from the Dutch one, “entirely purged of all that was introduced to it that was contrary to the Catholic Religion.”²⁴ The later editions of the *Trévoux* were no longer exclusively in the hands of a Jesuit editing board, and ultimately the *Trévoux*'s 1771 edition—the dictionary's last and most accomplished version—was printed some years after the Jesuit order was already banished.

2.4.2. SPACE is a metaphysical term (1690)

In clear contrast to the Academy's first edition (1694), the first edition of the *Furetière* (1690) opened its definition of ‘*Espace*’ as follows:

ESPACE, sub. masc. generally signifies infinite extent of place. The Divine power fills up an infinite *space*, it can create several worlds in that *space*: this is what the Theologians call *imaginary spaces*, not in order to say that they subsist only in our imagination, for they are real and actual (...)²⁵

²⁴ Cited in Macary, 1973, p. 153; Le Guern, 1983, p. 52.

²⁵ (§1) “ESPACE. subst. masc. signifie en general, Estenduë infinie de lieu. La puissance divine remplit un *espace* infini, elle pourroit creer plusieurs mondes dans cet *espace* : c'est ce que les Theologiens appellent *espaces imaginaires*, non pas pour dire qu'ils ne subsistent que dans notre imagination, car ils sont reels &

Furetière only addressed the term's use in ordinary language in a second paragraph, specifying its particular use in relation to “a determined place, extended from one point to another, whether it is full or void.” The third paragraph mentions the temporal sense of the term, (“an interval of time”), while the fourth paragraph focuses upon the concept of visual interval as it figured in the military domain (“regimented intervals that must be between lines and rows of soldiers”) and in the fields of writing and print (“the small pellets that are put between words to separate them from each other”).

The Furetière was known for its interest in metaphysics, which may explain the decision to place the philosophical notion before the ordinary use. The ordering of the definitions within the entry clearly reflects philosophical considerations rather than actual use (or rate of occurrence, as we would call it today). This sort of orientation made Furetière's reputation as a pioneer of the encyclopedic genre. However, in the case of SPACE, a taste for metaphysics also entailed a judgment as to the semantic configuration of the term, and Furetière opted for the ultra-modern INFINITE EXTENT (§1), rather than LIMITED EXTENT (§2) or the more mundane INTERVAL (§3–4). Notwithstanding Furetière's preferences, the choice is revealing: it may indicate a “missing link” between the premodern and the modern construals of SPACE, suggesting we should perhaps seek this missing link, from SPACE-INTERVAL to SPACE-DIMENSION, in metaphysics.

effectifs (...) / (§2) se dit en particulier d'un lieu déterminé, étendu depuis un point jusqu'à un autre, soit qu'il soit plein, soit qu'il soit vuide. (...) / (§3) se dit aussi d'un intervalle de temps. (...) / (§4) se dit à la Guerre des intervalles reglez qui doivent estre entre les rangs & les files des soldats rangez en bataille. (...) On le dit aussi dans l'écriture. (...) Et en Imprimerie on appelle *espaces*, les petits plombs qu'on met entre chaque mot pour le separer des autres.” [1st Furetière-1690, “Espace”]

2.4.3. Transition between regimes of knowledge (1690–1762)

The Furetière's first edition (1690) confirms the semantic processes observed in the Academy's dictionaries: (1) The strict separation between temporal and locative uses; (2) The decline of the notion of interval; (3) The predilection toward locative uses rather than temporal ones; and (4) The rise of a more abstract notion of containing space, described as either indefinite or infinite extent. Since the *Furetière* and *Trévoux* series from the outset situated the notion of *espace* in the discursive environment of metaphysics, they were also able to anticipate the semantic shift and relate to it. Whereas the Academy's dictionaries only registered the change in 1835, associating it with astronomy, the *Furetière* and *Trévoux* dictionaries documented the process in the making and tied it to metaphysical concerns. Most importantly, owing to their particular interest in metaphysics, the *Furetière* and *Trévoux* series testify to the vital part played by SPACE in the transition between regimes of knowledge from the late seventeenth century and through the eighteenth.

Starting with the second edition of *The Furetière* (1701), the consecutive entries of '*Espace*' recorded a slow transition from a Scholastic style of metaphysics into a more modern approach to philosophical investigation. Both the *Furetière* second edition (1701) and the *Trévoux*'s first edition (1704) preserved the original 1690 entry. However, two additions are notable. As early as 1701, the second paragraph received a supplementary citation by John Locke, explicating the idea of LIMITED EXTENT. According to this

passage, extracted from Locke's *Extrait/Abregé* (Locke 1688),²⁶ 'espace' is an abstract notion that refers to the distance between two bodies, regardless of the material nature of the interval. The first edition of the *Trévoux* (1704) also added a long paragraph at the end of the entry, referring to the use of the term in Geometry. Pretending to fill in the scientific lacunas of the *Furetière* (Wesemael 2010), the *Trévoux*'s paragraph expounded on specialized terms, such as 'espace parabolique' and 'espace conchoïdal', disseminated among the rising educated public of the Enlightenment.

These trends of scientification occurred alongside gradual secularization. Hence, in the *Trévoux*'s 1721 edition, the expression "the Divine power" gave way to the more vague "the Divine immensity," allowing the discussion to roam from God to space, while the authority of "Theologians" was now complemented by that of "Philosophers."²⁷ By the eighth edition, in 1762, no reference to God or to theologians remained whatsoever, and the sentence read: "Philosophers call *imaginary spaces* those spaces beyond the world which are not filled with any real body".²⁸

²⁶ Locke's *Extrait* (later titled "Abregé") is a summary of the *Essay concerning Humane Understanding* ([1689] 1700). Published in Holland in 1688, a year before the publication of the first edition of the *Essay* in English, the *Extrait*'s translation into French was almost certainly supervised by Locke himself (Walmsley 2012).

²⁷ "L'immensité divine remplit tout *espace*. Les Théologiens & les Philosophes appellent *espaces imaginaires*, des *espaces*, qui ne sont remplis d'aucun corps réel, mais qui peuvent recevoir & contenir tous les corps que Dieu voudra créer." [2nd *Trévoux*-1721, "Espace"]

²⁸ "Les Philosophes appellent *espaces imaginaires*, des *espaces* au-delà du monde, qui ne sont remplis d'aucun corps réel" [8th *Trévoux*-1762, "Espace"]

2.4.4. SPACE is at the center of a philosophical controversy (1771)

The encyclopedic style of the entry reached its apogee with the last edition of the *Trévoux* (1771), focusing on the philosophical context of the concept. Paraphrasing the article on the metaphysics of space from Diderot and D'Alembert's *Encyclopédie* (Formey 1755), it adopted the original author's polemical presentation of the history of the notion of space.²⁹ The term has long been subject to debate, maintained the *Trévoux*, and "Philosophers, ancient as well as modern, have given the word very different and often quite opposite definitions."³⁰ One camp in the controversy, explains the entry, holds that space depends on the bodies; it is an abstraction of the mind that fades away when bodies are destroyed. However, the other camp upholds that "space is an absolute, real being, distinguished from the bodies placed in it."³¹

As a matter of fact, the concept of space stood at the center of a series of philosophical controversies and was one of the major topics preoccupying philosophers throughout the

²⁹ Johann Heinrich Samuel Formey (1711–1797), the author of this article, was a Prussian intellectual, perpetual secretary of the Academy of Berlin, and one of the first initiators of the *Encyclopédie* (Moureau 1987). His entry on "*espace*", probably written by 1747 at the latest, focuses on the Leibniz-Clarke correspondence (Clarke & Leibniz 1717).

³⁰ "Les Philosophes tant anciens que modernes ont donné de ce mot des définitions fort différentes & souvent tout opposées." [9th *Trévoux*-1771, "Espace"]

³¹ "Les uns prétendent que l'*espace* n'est rien sans les corps, ni même rien de réel en lui-même, en sorte qu'en détruisant les corps, il en reste plus d'*espace* qui n'est qu'une abstraction d'esprit. D'autres prétendent que l'*espace* est un être absolu, réel, distingué des corps qui y sont placés (...)." [Ibid.]

eighteenth century. Instigated by Newton's *Philosophiæ Naturalis Principia Mathematica* (1686/1687), these debates first concerned Newton's critique of Descartes's *Principia Philosophiæ* ([1644] 1647). Descartes had identified space with extension and perceived it as an attribute of matter (Jammer 1993). His ideas and terminology were deeply ingrained in French culture, and remained widespread long after Newtonian physics took over. Whereas Newton's *Principia* had been published almost a century earlier, the debates between Cartesians and Newtonians were very much alive in France up until the mid-eighteenth century and kept on agitating not only a restricted community of experts but much wider circles as well (Shank 2008).

However, the idea that space was a mathematical abstraction or, conversely, that it was real and absolute, arose out of a more recent dispute: that between Leibniz and Clarke. The correspondence documenting this debate (1717) became "the most frequently cited of all eighteenth-century philosophical controversies" (Alexander 1956, p. vii), and it revolved, among other things, around the nature of space. Challenging Clarke and Newton, Leibniz opposed the very idea of absolute, infinite, and eternal space and insisted that space was merely relative, an abstraction of coexisting physical relations. The history of philosophy has registered this controversy as one between two cursory conflicting positions, opposing the advocates of relative space (Leibnizians) with the adherents of absolute space (Newtonians). Apparently, *The Trévoux* arbitrated for the victorious second camp but did so while preserving the Cartesian terminology of "indefinite extent" and, in the same breath, paid tribute to its scholastic heritage:

In any case, it may be said that space is generally an indefinite extent, an immense fluid in which we may conceive that the bodies can be placed. In scholastic terms, [it is] the ability to receive and contain the bodies.³²

2.5. Summary of the findings

Lexical and lexicographical evidence dating from 1330 to 1606 has allowed us to sketch the SPACE-INTERVAL grid: the typical semantic configuration of the premodern ordinary concept of space. At the kernel of the semantic grid we find INTERVAL characterizing more than 65% of the ordinary corpus occurrences. The notion of interval referred either to periods of time (>95%) or to distances. Different ideas of time, such as abstract DURATION or OCCASION, OPPORTUNITY, LEISURE, and DELAY, represent another 28.4% of the corpus. The remaining 5.6% refer to EXTENT. As a whole, 91% of the occurrences represent what we today call TIME, and only 9% correspond to ideas subsumed under the modern notion of space.

The first edition of the *Dictionnaire de l'Académie française* (1694) suggests that, by the late seventeenth century, the notion of interval remained central but the premodern indifference to the time/space divide was fading away. Three semantic processes were already underway: (1) The dissociation between temporal and locative uses; (2) The waning of the notion of interval; and, (3) The predilection toward locative uses rather than

³² “Quoi qu’il en soit, on peut dire que l’espace en général, est une étendue indéfinie, un fluide immense dans lequel on conçoit que les corps peuvent être placés. En termes de l’école la capacité de recevoir et de contenir les corps.” [Ibid.]

temporal ones. The sixth edition of the dictionary (1835) announces the advent of an abstract notion of containing space in the form of indefinite or infinite extent. The entry confirms that by the first decades of the nineteenth century the SPACE-INTERVAL grid had completed its transmutation into the SPACE-DIMENSION grid: EXTENT had moved into the center of the grid while INTERVAL drifted out to the periphery. INDEFINITE and INFINITE EXTENT started to take their modern sense of DIMENSION (“Time and space”) and assumed the most dominant position. The dictionary’s authors associated the novel abstract idea of space with science and astronomy. Parallel processes of scientification and secularisation are apparent through the changing definitions of the notion of imaginary spaces. While the first edition (1694) respected the Scholastic sense of the term, by the fourth edition (1762) the authors had begun to undermine it. Finally, in the sixth edition (1835), as the physical sense of SPACE was disengaging from the metaphysical one, the notion of imaginary spaces was presented as purely fictitious.

The Furetière and *The Trévoux* series (1690–1771) corroborate these growing trends of scientification and secularisation. However, they also indicate that the popularization of natural philosophy and the deliberate introduction of metaphysical content into the ordinary lexicon started much earlier, most probably in the last decades of the seventeenth century. The evolution of the entries in *The Furetière* and *The Trévoux* over the eighteenth century suggests an affinity between the growing interest in natural philosophy and the propagation, through ordinary language, of a secularized notion of infinite space. Thus, the rise of new forms of knowledge and the triumph of Newtonian mechanics became inscribed deep into the heart of culture, whence it could disseminate most effectively: within the lexicon.

3. How science changes culture: a lexical approach

The above lexical findings establish the conceptual transformation of SPACE and allow us to reconstruct its metamorphosis from SPACE-INTERVAL into SPACE-DIMENSION. The findings also strongly indicate that important epistemological developments in metaphysics and natural philosophy, involving imperative trends of scientification and secularization, motivated this conceptual revolution in ordinary language. We find evidence for such external pressures on the ordinary lexicon in the accounts of lexicographers, explicitly situating the concept within contemporaneous discussions of metaphysics and natural philosophy. By referring their readers to such sources of authority, lexicographers not only substantiated their modern construal of the concept but also associated the word with philosophy and science for generations to come. Thus, the authors of *The Trévoux's* 1771 edition, who inherited from their predecessors a predilection toward metaphysics, reproduced the *Encyclopédie's* philosophical analysis, reframing the concept of space through the Leibniz-Clarke controversy. More than sixty years later, authors of the Academy's 1835 edition were particularly sensitive to the novel idea of absolute space, construed as an abstract dimension ("time and space") or as an astronomical realm ("in space")—ideas clearly emanating from Newton's works. Both dictionaries shaped their accounts in light of contemporary philosophical discourse, gradually de-theologizing the notion of imaginary spaces and progressively constricting the applicability of Scholastic ideas.

It is evident that metaphysics and natural philosophy exerted growing influence upon various cultural agents throughout the eighteenth century and that encyclopedias and Chalozin-Dovrat, Lin (2019). The history of SPACE between science and ordinary language: What can words tell us about conceptual change?. *Perspectives on Science* 27(2), 244–277. <http://doi.org/10.1162/posc_a_00307>

dictionaries played an important role in disseminating scientific ideas to wider publics (e.g. Darnton 1979; Turcan 2009). It is unclear, however, which specific scientific ideas contributed to shaping the novel ordinary concept of space or how we should ascertain the precise relationships between scientific and ordinary concepts of space. It seems only reasonable to begin this quest by identifying, within the findings, those scientific theories of space that were most salient at the time, and then seek evidence whether it was these specific theories and not others that shaped popular ideas about space. However, attempts to isolate lexical evidence and to juxtapose it with specific scientific theories of space have borne little fruit: The dictionaries regularly fuse Cartesian vocabulary (e.g. ‘*étendue indéfinie*’) with Newtonian-like ideas of infinite space; they have difficulty getting rid of Scholastic notions (such as imaginary spaces); and they all tend to mix diverse significations of the term, endorsing premodern and modern components side-by-side. While there are strong indications that historical changes in scientific ideas had crucial effects on the evolution of the ordinary notion of space, the use of the term in ordinary language is not reducible to any particular philosophical doctrine. The ordinary conception of space was never “Cartesian,” nor did it at any point turn strictly “Leibnizian” or “Newtonian;” ultimately, evidence from lexical diachrony does not line up neatly with evidence from the history of science.

This incongruity should not surprise us: obvious discrepancies and tensions between philosophical and ordinary concepts of space are already manifest in premodern and early modern texts. Considering only one example, Oresme’s translation of Aristotle’s *De caelo*, mentioned above (see subsection 2.2), frequently employs the word ‘*espace*’ (91 occurrences) in all senses common to the period: INTERVAL, TIME and EXTENT

(Oresme [1377] 1968). However, in contrast to the pattern we have identified in ordinary language, Oresme's philosophical translation often also employs the term to signify EXTENT or INFINITE EXTENT³³—the second being a denotation utterly absent from the ordinary language corpus. A strong bias favoring DISTANCE and EXTENT is also evident in the first French translation of *Principia Philosophiæ* (authorized by Descartes himself in 1647), wherein 'espace' refers frequently to distance, geometric interval, or various notions of extent.³⁴ In fact, the word principally designates here extent or "spatial" intervals in the modern sense of the term (as opposed to time and temporal intervals—the usual significations in the mundane corpus). The use of 'espace' in Descartes's work neither corresponds to the typical premodern use of the word in ordinary language, nor prefigures the modern semantic grid, as it does not refer to space as a dimension. Hence, we may reasonably assume that uses of the term in philosophical discourse before the mid-seventeenth century were not fully consistent with the time's ordinary lexicon, but amplified those areas of the premodern grid that would soon become vital for the emergence of the modern ordinary concept.

³³ See for example "[...] car hors le monde est une espace ymaginee infinie et immobile," translated by A. Menut as "beyond this world is an imaginary space infinite and motionless" (1968, p. 369).

³⁴ For "spatial" INTERVAL or DISTANCE between two points, see for example: "[...] supposer un espace extrêmement vaste **entre** le Soleil & les Etoiles fixes" (Descartes [1644] 1647, p. 152); In relation to geometric demonstrations, an interval or surface as in "l'espace CDE" (Ibid., p. 367); The notion of extent appears in various degrees of abstraction, such as "more/less space" ("occupent **plus d'**espace," Ibid., p. 308); "not enough space" ("qui n'ont **pas assez d'**espace autour d'elles," Ibid., p. 365); or "to occupy as much space" ("qui occupe **autant d'**espace," Ibid., p. 304).

Other examples show more principled incompatibilities between philosophical and ordinary concepts: Philosophical concepts are not reducible to lexical concepts, and the two may even be inconsistent, as major philosophical works have recurrently demonstrated. Locke's *Essay* (1975) provides interesting examples, showing that the lexical concept—the way Locke employs the word 'space'—is not fully congruent with his own explicit ideas about space. When Locke defines the “simple *Idea of Space*” he refers to the common sense of the word in the philosophical tradition—i.e. “spatial” interval, “a distance between Bodies [...] or between the parts of the same Body” (*Essay*, II.xviii.2). Thus, he primarily associates it with DISTANCE and EXTENSION (II.xviii.3). The *Idea of Space*, he specifies, is distinct from the *Idea of Infinity* and “we are carefully to distinguish between the *Idea* of the Infinity of Space, and the *Idea* of a Space infinite” (II.xvii.7). The first is the result of repetition—“Addition or Progression” of Ideas of concrete space which allow us to attain “the Thought of Infinity” through accumulation (II.xvii.6). The second, however, the *Idea* of an infinite Space or Duration, “is very obscure, and confused, because it is made up of two Parts, very different, if not inconsistent” (II.xvii.8).

Hence, Locke's *Idea of Space* seems to be in perfect agreement with those areas of the premodern grid denoting “spatial” INTERVAL, DISTANCE, and DEFINITE EXTENT. However, if we examine closely the *Essay*'s lexical concept of space, we may perceive that salient uses of the term—such as its occurrence within the recurring expression 'Idea of Space'—involve procedures of abstraction, leading us to conceive of SPACE as an abstract notion distinct from concrete descriptions of intervals, distances, and extents and to regard it as a concept: an epistemological object, a product of human understanding. While Locke's explicit conception of space did not largely deviate from

other common notions of space of the time, from a lexical view the way he used the term 'space' had two important effects: first, it abstracted the notion from immediate concrete references, and, secondly, it played a vital role in associating SPACE with the notion of faculty: something humans can do, the way humans understand. These two effects are interrelated: To acquire its epistemological connotation, the term had to undergo a significant degree of abstraction through repeated use of expressions such as 'The Idea of Space' (as opposed to "a space of two leagues" or "the space that lies **between** X and Y").

Writing at about the same time, Newton (1686/1687) blended old with new when he opened the *Principia* with the traditional use of the word 'space' signifying a bounded extent, a defined volume ("a space," translated from the Latin '*spatium*' and preceded by an indefinite article).³⁵ In his *Scholium to the Definitions*, however, Newton famously defined space in a novel way, revolutionizing relations between received ideas of place and space. Used in the absolute form ("Place is a part of space," with no article or adjectival phrase), this occurrence of the word 'space' is typical of the modern SPACE-DIMENSION grid.³⁶

³⁵ Newton's original Latin text reads: "Aer duplo densior **in duplo spatio** quadruplus est" (1686, p. 1). He revised it slightly in the second and third editions: "Aer, densitate duplicata, **in spatio etiam duplicato** fit quadruplus" (1713, p. 1; 1726, p. 1), translated by Andrew Motte (in the first English translation of Newton's *Principia*) as "Thus air of a double density, **in a double space**, is quadruple in quantity [...]" (1729, p. 1). The Cohen-Whitman edition reads: "If the density of air is doubled **in a space** that is also doubled, there is four times as much air [...]" (1999, p. 403).

³⁶ The original Latin text reads: "**Locus est pars spatii** quam corpus occupat, estq; pro ratione spatii vel absolutus vel relativus. Partem dico spatii, non situm corporis vel superficiem ambientem" (1686, pp. 5–6).

By the last decades of the eighteenth century, the lexical concept—the word’s usage and general understanding within and without philosophical discourse—had changed radically. When Immanuel Kant asserted in the first *Critique*: “Space is a necessary representation, *a priori*, that is the ground of all outer intuitions” ([1781] 1998, p. 175, A24),³⁷ semantic conditions were ripe for that sentence to be comprehensible: By then, ‘space’ often appeared in the absolute form signifying dimension (“space is...”; “space and time” vs. “the space between”; “a large space”), and those familiar with the conversations surrounding Locke’s work readily associated the concept with human cognition.

These examples from the history of philosophy illustrate how, toward the end of the eighteenth century, the ordinary concept of space grew very similar to key philosophical and scientific conceptions of space. This eighteenth-century trend drawing the ordinary concept of space nearer to scientific notions seems, however, more the exception than the norm. As premodern and early modern texts show, the discrepancy between scientific and

In the second and third editions Newton slightly revised the second sentence: “Pars, inquam, spatii; non Situs corporis, vel Superficies ambiens” (1713, p. 6; 1726, p. 7). Motte translated it as: “**Place is a part of space** which a body takes up, and, is according to the space, either absolute or relative. I say, a Part of Space, not the situation, nor the external surface of the body” (1729, p. 10). The Cohen-Whitman edition reads: “**Place is the part of space** that a body occupies, and it is, depending on the space, either absolute or relative. I say part of space, not the position of the body or its outer surface” (1999, p. 409). Note the further abstraction added by the Cohen-Whitman translation (*Cf.* “Place is **a** part of space / **the** part of space”).

³⁷ “Der Raum ist eine notwendige Vorstellung, a priori, die allen äußeren Anschauungen zum Grunde liegt” ([1781] 1902, A24).

ordinary concepts of space—the tension highlighted by Einstein and Shapere (See Section 1)—applied well beyond relativity theory. As a rule, specific scientific interests guided metaphysics and natural philosophy, directing them toward objects of inquiry often quite divergent from the experiential objects signified in ordinary language.

Whereas the disparity between scientific and ordinary concepts has been acknowledged in literature, the critical distinction between philosophical and lexical concepts generally remains a non-topic. As the above examples demonstrate, however, lexical and philosophical concepts do not always harmonize and the relationships between the two may play an important role in the propagation of scientific ideas. Possible discrepancies between philosophers' explicitly stated ideas and the way they use words serve to remind us that philosophical and scientific texts employ natural language and, therefore, may manifest certain phenomena such as polysemy and fuzziness, characteristic of ordinary discourse. In that sense, the tension between lexical and philosophical concepts is comparable to the exasperating gap between “what we meant to say” and the way we actually used words in ordinary discourse.

Philosophical concepts are richer than lexical ones, as they are embedded in theory and even seem to contain “mini-theories” (as was convincingly argued by Kuhn 1996 and Murphy & Medin [1985] 1999). It is questionable, however, whether the conceptual complexity that characterizes scientific theory actually “travels” along with scientific concepts as they make their way to other domains or into the ordinary lexicon. In other words, one may use the modern concept of space correctly without mastering Newton's theory of gravitation. In fact, it is doubtful that one needs any knowledge of Newton's theory to employ the ordinary concept in a satisfactory fashion. That being so, in what sense

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did scientific theory actually alter the ordinary concept? What in fact did “travel” or “relocate” from scientific theory into the ordinary lexicon?

In her seminal work on nomadic concepts, philosopher of science Isabelle Stengers theorized concepts’ propensity to travel across scientific disciplines and into the public sphere (Stengers 1987a). In their ideal form, argued Stengers, scientific concepts are free to move according to scientific interests, their mode of travel being viral: they *propagate epidemically*. According to Stengers, the notion of *propagation* is at once natural and social and thus conveys faithfully the realities of science. When successful, Stengers emphasized, conceptual propagation is not a metaphor but a rigorous scientific tool: it allows scientists to deploy new theoretical strategies creatively while relying on borrowed concepts (Stengers 1987b).

Whereas for Stengers the nomadic character of scientific concepts is unproblematic and unconstrained, Barbara Cassin highlights the impossibility of seamless conceptual transfer. According to Cassin, conceptual transpositions face severe restrictions due to the lexical nature of concepts and their contextual commitments. In an ambitious encyclopedic project titled the “Dictionary of Untranslatables”³⁸ Cassin and her associates attempted to zoom in into the lexical realities of concepts in transit and to explore the conceptual networks woven by philosophical translations. While concepts certainly carry meanings across languages, texts, philosophical doctrines, and theoretical contexts, philosophical

³⁸ Cassin’s ambitious project includes the efforts to translate the original *Vocabulaire européen des philosophies: dictionnaire des intraduisibles* (2004a) into different languages. In English, see: Cassin *et al.* 2014. For the rationale of the project, see: Cassin 2004b; 2014; 2016.

translations cannot but fail, asserted Cassin, as they underscore that in a concept which defies translation.

Neither Stengers nor Cassin, we should note, identified these elements which are capable of transposing through conceptual migrations—those “moving parts” dissociated from specific scientific theories which, while leaving behind the specificities of their initial philosophical contexts, are able to disseminate conceptual components and to “plant” them in new environments. The distinction between philosophical and lexical concepts may allow us to do precisely that: The evidence presented here suggests that lexical concepts—in this case the way philosophers used the word ‘space’—conveyed conceptual elements from scientific theories into the ordinary lexicon. I propose that we should think of philosophical concepts as possessing two major components: one is strongly entrenched in its semantic environment, i.e. the scientific or theoretical context. The second component, however, is lexical: it functions as it would in any other discursive environment and moves perpetually from one context to others as speakers use the word again and again in different circumstances. Thus, we can imagine that eighteenth-century readers of Locke or Newton employed the word ‘space’ just a bit differently than before whenever the word arose in their ordinary conversations with others who had never read Locke or Newton. When they did so, they did not necessarily communicate all the scientific and philosophical elements they had acquired through their readings; only the lexical component of the philosophical concept—the way they used the term—relocated into ordinary discourse. Thus, while lexical concepts emanating from philosophical discourse undoubtedly “adulterated” ordinary discourse with novel meanings, the SPACE-DIMENSION semantic grid

preserved only a little from the theoretical work that had enabled its emergence. It was enough, however, to revolutionize our world and the words we use to describe it.

4. Conclusion

This essay established that the ordinary concept of space changed drastically in a process that started in the late seventeenth century (before the 1690 *Furetière* first edition) and was complete by the early nineteenth century (before the 1835 Academy's sixth edition). Earlier occurrences of the term (1330–1606) permitted me to sketch a conceptual transition from INTERVAL to DIMENSION that revolutionized the relations between the concepts of time and space in ordinary language. The lexical evidence indicates that these changes associated with the propagation of an abstract idea of absolute and infinite space whose origin lexicographers attributed to metaphysics and natural philosophy.

While it seems evident that these semantic transitions related to the triumph of classical mechanics, it would be a mistake to identify the modern configuration of the ordinary concept with any particular scientific or metaphysical theory. I have proposed a more nuanced model to account for the impact of scientific theory on the ordinary notion of space, based on the distinction between philosophical and lexical concepts. According to this model, when motivated to do so lexical concepts have the ability to carry conceptual components out of specialized discourses such as metaphysics and natural philosophy and “inject” them into the general lexicon. Several important epistemological transformations—including the rise of the Newtonian conception of space, the emergence of new forms of knowledge, and the changing social roles of natural philosophy—spurred this semantic change, exercising strong pressures on the lexicon. Thus, the conceptual

transmutation of SPACE-INTERVAL into SPACE-DIMENSION signifies at once a semantic, an epistemological, and a cultural revolution. As scientific ideas often enter culture through language and lexical mechanisms prove to be significant factors in shaping the history of ideas, the lexical approach here proposed may hopefully prove useful in explaining other cases of conceptual change.

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