

## Introduction

# Sound symbolism in the age of digital orality. A perspective on language beyond 'nature' and 'culture'

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### Abstract

*After recalling the main empirical evidence in favour of sound symbolism, this Introduction presents the contributions offered by the authors of this issue of Significances (Signifying). It then addresses some of the epistemological and metaphysical issues that a full integration of sound symbolism into language theory entails, particularly concerning the relationship between language and reality, and between nature and culture. Finally, it proposes to explain the centuries-old preference of scholars for the arbitrariness of the sign as an effect of the pre-eminent role that writing on paper has played in their pragmatico-cognitive experience of language up to the digital revolution.*

**Keywords:** iconicity; orality; writing; epistemology of language sciences; ecology of mind.

### Résumé

*Après avoir rappelé les principales preuves empiriques en faveur du symbolisme phonétique, cette Introduction présente les contributions offertes par les auteurs du présent numéro de Significances (Signifying). Elle aborde ensuite certains des enjeux épistémologiques et métaphysiques qu'une pleine intégration du symbolisme phonétique dans la théorie du langage comporte, concernant notamment le rapport entre langage et réalité, et entre nature et culture. Elle propose enfin d'expliquer la préférence pluriséculaire des savants pour l'arbitraire du signe comme un effet du rôle prééminent que l'écriture sur papier a joué dans leur expérience pragmato-cognitive du langage jusqu'à la révolution numérique.*

**Mots-clés:** iconicité ; oralité ; écriture ; épistémologie des sciences du langage ; écologie de l'esprit.

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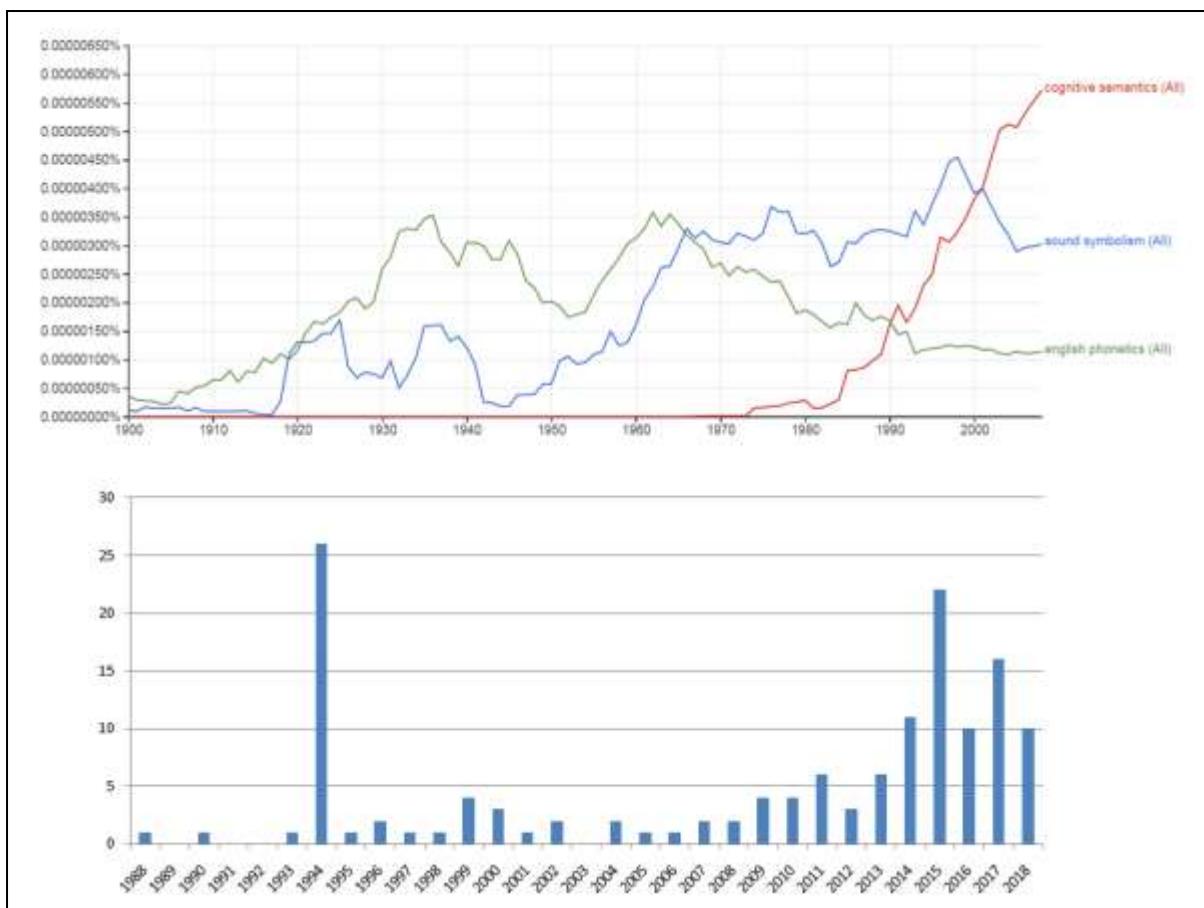
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## 1. Definitions

Over the past century, sound symbolism has become one of the most well-established language facts within disciplines that have adopted the methods of the natural sciences, while remaining one of the most controversial from the point of view of the human and social sciences. Often neglected and sometimes repressed by the mainstream of general linguistics, partly because of its apparent contradiction with the principle of the arbitrariness of the sign (Saussure 1916), it has sometimes been defended by minority or peripheral trends, for example within African, Amerindian and Australian ethnolinguistics, and within Japanese, Korean and Turkish national traditions.

However, the new millennium seems to be witnessing a change in the situation. While cognitive sciences continue to explore the topic, traditional linguistics of *langue* based on the arbitrariness of the sign seems to have lost its pre-eminence within the language sciences and is now part of a more diversified ecosystem, where pragmatics and cognitive semantics, NLP and corpus linguistics, sociolinguistics and the linguistics of speech, no longer necessarily make arbitrariness their unquestionable horizon, nor consequently the motivation of the sign their founding epistemological taboo. On the contrary, firmly rooted in the general problem of the embodiment of cognition, language approaches that take into account sound symbolism, once condemned as 'naturalistic', are now constantly opening up new horizons of research (see Figure 1).

Our hypothesis is that this change of perspective is not a contingency but reflects long-term dynamics of modern culture that are now being achieved. These terminal accelerations concern the relationship that humanity has both with its physical environment (nature), disrupted by two centuries of industrial revolution as it has never been since the Palaeolithic agricultural revolution, and with its psychological environment (culture), transformed in two decades by the most profound change in language technology it has ever seen since the invention of writing. The representation that science offers us of language, this natural and cultural behaviour that our species wanted to make the flag of its own specificity, can only evolve suddenly within the framework of such an acceleration, and it is now doing so, also in the field of the theory of the sign. Our ambition is to shed light on the transformation underway in this last area.



**Figure 1** Historical frequency of the expression "sound symbolism" in different types of English publications. At the top, the relative frequency of "sound symbolism" (in blue) in books published between 1900 and 2008, compared with that of other expressions of language science, "cognitive semantics" (in red) and "English phonetics" (in green), according to Google N-Gram Viewer. It can be seen that the use of the term becomes widespread in the late 1960s and remains relatively stable until today, fuelled mainly by research in the cognitive sciences. Below, the absolute frequency of "sound symbolism" in linguistic studies published between 1988 and 2018 and listed in the Brill Linguistic Bibliography. The median goes from about 1 new study per year in the 1990s to 8 new studies per year in the 2010s. The isolated peak in 1994 corresponds to the publication of the collective volume edited by Hinton *et al.* (1994), who played a pioneering role in the field.

This Introduction aims, on the one hand, to recall the now abundant evidence of the existence and non-marginal role of sound symbolism in languages, in order to introduce and put into perspective the original contributions that make up the issue and, on the other hand, to outline the framework for a theoretical discussion on the epistemological, metaphysical and political implications of this type of research, particularly concerning the relationship between language and reality and between nature and culture.

To this end, we will adopt a broad definition of "sound symbolism", inspired by the one proposed by Hinton, Nichols and Ohala in their Introduction to *Sound Symbolism* (1994), and including in brief any form of motivation of the relationship between the phonological signifier of a word (or set of words) and its meaning, its concept or referent, whether it is an iconic motivation (that is by similarity) or indexical motivation (by proximity), imitative (onomatopoeic) or synesthetic (ideophonic), imagic (sensitive, or directly emerging from the syntagmatic axis) or diagrammatic (abstract, or emerging from the analysis of paradigmatic

axis; see Nobile 2014a). Despite some shortcomings, this broad sense has many advantages, including flexibility, which is essential in a field that still largely remains to be explored, and which already includes a range of remarkably diverse phenomena in the world's different languages. In particular, Hinton and her colleagues distinguish, first, a "corporeal" sound symbolism, including interjections and prosody facts (for example, in French, the labial articulation of *pouah!* "ugh!" tends towards the outside and the nasal one of *miam!* "yummy!", inwards; while the pitch of the injunctive sentences tends towards the low and that of the interrogative sentences towards the high); secondly, an "imitative" sound symbolism, including onomatopoeias and words of onomatopoeic origin (e. g. *meow*, *toc toc toc*, *tinkling*, *clapping*, *drum*, *bomb*); thirdly, a "synesthetic" sound symbolism, including ideophones and expressive words (e. g. in French *zig zag*, *bric-à-brac*, *dondon* "chubby", *gnangnan* "namby-pamby", etc.); and fourthly a "conventional" sound symbolism, including particularly phonesthemes and other forms of diagrammatic iconicity whose motivation does not appear to be definitely linked to universal synesthetic mechanisms (for example, in French, 28 out of 35 verbs starting with *fl-* have a meaning related to the idea of a fluid movement, such as *flairer* "to smell sth", *flamber* "to blaze", *flâner* "to stroll" ou *flotter* "to float"; see below).

From a semiotic point of view, sound symbolism is often classified among the phenomena of iconicity, Peirce's category (1885, 1903) indicating a relationship of similarity between the sign and the represented object, introduced in linguistics by Jakobson (1965). Linguistic sound symbolism (or phonetic symbolism) covers all phenomena of iconicity at the phonological level (thus excluding those that take place at the morphological, syntactic or textual levels, such as phenomena of order, dependence or emphasis). Among the facts of phonological iconicity that are part of sound symbolism, we can also distinguish, still according to Jakobson and Peirce's categorization, "images" (like most onomatopoeias), "diagrams" (most phonesthemes) and "metaphors" (like most ideophones; see Nobile 2014a for a more detailed analysis). It should be noted, however, that the expression "sound symbolism" (and "phonetic symbolism") may also refer to two classes of phenomena which, by definition, do not fit into phonological iconicity in the narrow sense. The first is represented by the phenomena of indexical sound symbolism, where motivation depends more on a proximity relationship than on similarity, and is therefore better classified as a Peircian index than as an icon (for example, interjections such as *pouah!* vs. *yummy!* seen before, which seem to indicate by their articulation a direction towards the outside or inside of the body; or cases of articulatory self-reference of the phonatory organs such as the nasal /n/ in *nose*, the dental /t/ in *tooth*, the "guttural" /g/ in *gullet* etc.; or other cases of articulatory self-reference such as *gargle*, *spit*, *blow*, *sniff*; or cases of pronominal deixis like *tu* "you" and *vous* "you, pl.", articulated more forward than *je* "I" and *nous* "us"; see below). The second class of phenomena included in sound symbolism and not strictly related to phonological iconicity is represented by the phenomena of "poietic" or enactive sound symbolism, in which motivation does not depend so much on the similarity or proximity of the signifier to a given meaning, but rather on its ability, true or presumed, to shape the latter in its own image in the mind of the speaking subject, a property well known by anthropologists because it is traditionally highlighted in inspired language (poetic, prophetic and oracular language ; enchantments, mantras, ritual songs, and so on).

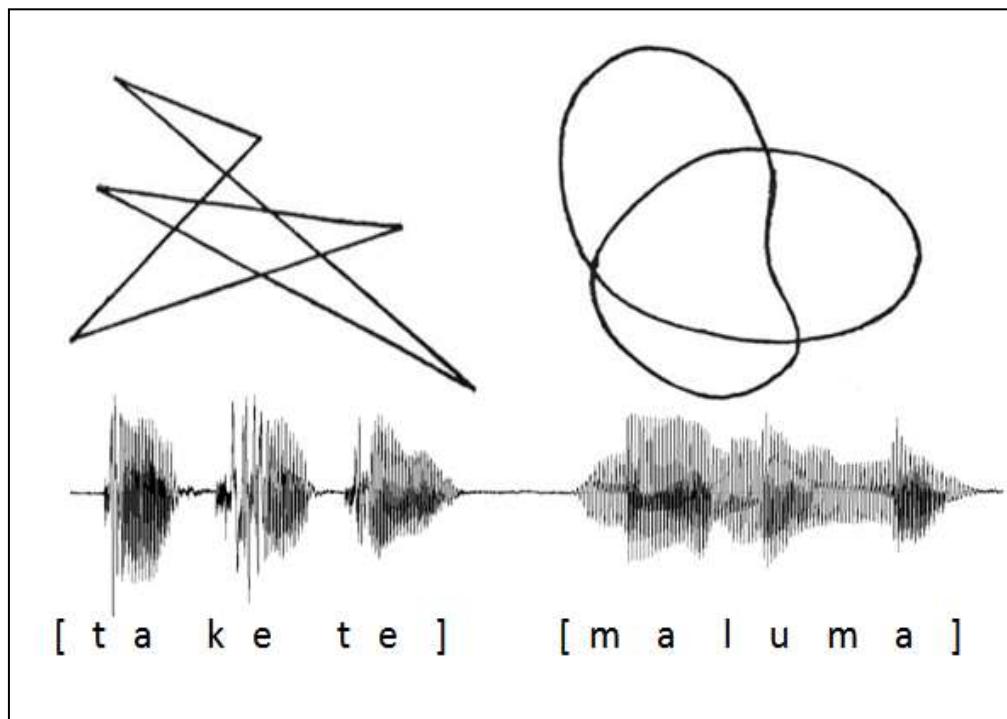
## 2. Evidence

From the point of view of the methods derived from the natural sciences, the existence of sound symbolism is firmly demonstrated by two fundamental types of empirical evidence: experimental and descriptive evidence.

## 2.1 Experiments

The experimental evidence comes mainly from psycholinguistics and cognitive neuroscience. They attest, on the behavioural and neurophysiological level, respectively, to the sensitivity of the human cognitive system to the correspondences, most often synesthetic or cross modal, between the acoustic and articulatory properties of speech sounds on the one hand and, on the other hand, the sensory or psychological properties of the realities to which these sounds refer.

The first experimental psychology research in this field dates back to 1929. This is the year in which the *experimentum mentis* of the American naturalized German psychologist Wolfgang Köhler and the results of the experience of the German-born American linguist Edward Sapir are published simultaneously and independently in the United States. The first suggests in his book *Gestalt Psychology* (1929: 242-243; 1947: 254-255) the existence of a synesthetic correspondence between the pair of pseudo-words *baluma* vs *takete* (*maluma* since the 1947 edition) and a pair of shapes, one rounded and the other spiky (see Figure 2). Experimentally verified by Charles Warren Fox in 1935, this Köhler's intuition represents the beginning of research on shape sound symbolism. The second demonstrates in his article "A study in phonetic symbolism" (1929) the correspondence between the vowels degree of aperture in pseudo-words like *mal* vs *mil* and the perception of their "greatness" or "smallness" by speakers; this is the beginning of research on size sound symbolism. After these first results one must mention at least the important work of Sapir's disciple, Stanley Newman (1933), who demonstrates that the size effect {large vs small} can also be obtained by coupling pseudo-words differentiated by [back vs. front] or [long vs. short] vowels or even by [voicing vs. voiceless] consonants, and that the same pairs of pseudo-words, with a few exceptions (long vs. short), also tend to produce a luminosity effect {dark vs. bright}; this is the starting point for research on shine sound symbolism (see Nobile 2014b for more details).

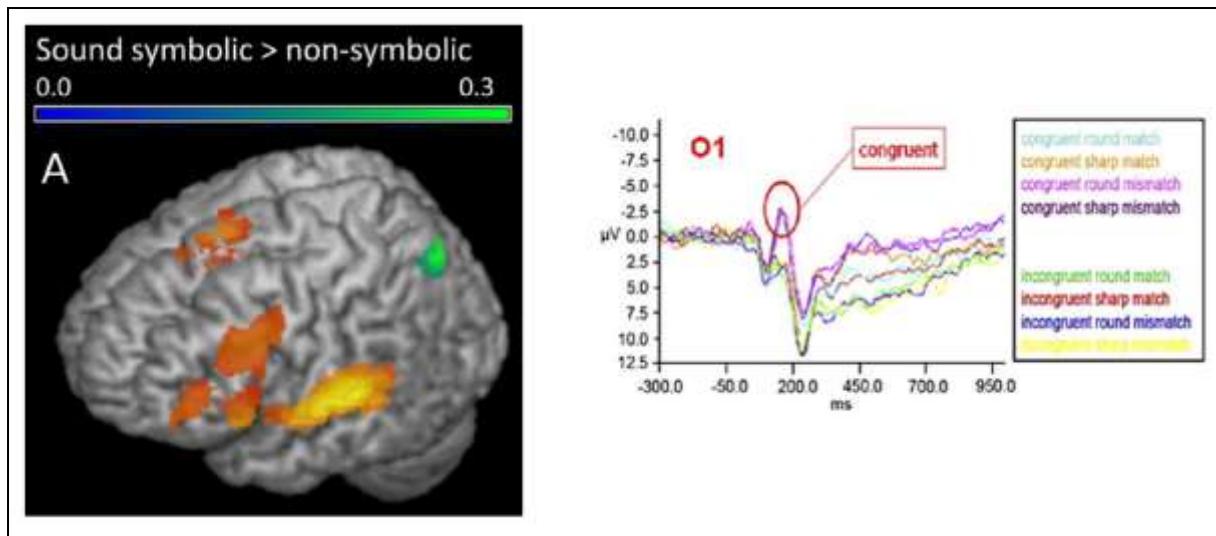


**Figure 2** Acoustic oscillogram analysis of the pseudo-words *takete* and *maluma* used by Wolfgang Köhler (1947) in his seminal experiment on shape sound symbolism. Because of its voiceless plosives, the sound of *takete* is discontinuous, as are the lines of the figure with which it is associated, while that of *maluma* is continuous thanks to its sonorants, as are the lines of the other figure (Nobile 2015).

In the 90 years since these beginnings, experimental research on sound symbolism has expanded and consolidated remarkably. It explored the different sensory modalities and dozens of different phonological systems. It has also multiplied its approaches and modernized its methods.

Initially, for example, R. Davis (1961) reproduced Köhler's experience with Swahili speakers in Tanganyika and confirmed the expected result. Later Taylor and Taylor (1962) tested the Sapir protocol with English, Japanese, Korean and Tamil speakers, who were questioned not only on the size but also on the activity, temperature and sweetness of the pseudo-words, and they found a partial inter-linguistic variation in the results. In France, Maxime Chastaing (1958, 1962, 1964, 1966) confirmed most of Newman's results by also adding a test on the strength, hardness and roughness of /r/, as opposed to the weakness, softness and smoothness of /l/, at same time that Jean-Michel Peterfalvi (1964, 1965, 1966, 1970) replicated Köhler's experience, while retracing a history of research on sound symbolism and proposing psycho-physiological explanations of the main results (cf. Nobile 2014b for a critical analysis of his contribution). For his part, Bernard Lyman (1979), by inaugurating a new subfield of research, was able to associate about thirty complex feelings with Köhler's two figures (and thus indirectly with the pseudo-words *maluma* vs *takete*): calm, eternity, friendship, happiness, home, love, sadness and wisdom were thus associated with the rounded figure, while anxiety, anger, courage, excitement, fear, frustration, hostility, nervousness, resentment and worry were associated with the sharp figure.

On the threshold of the new millennium, Richard Klink (2000) has provided one of the most significant applications of sound symbolism in marketing, Susan Parault and Paula Schwanenflugel (2006) have tested its applicability to the field of language learning and Mutsumi Imai *et al.* (2008), and Katerina Kantartzis *et al.* (2011) have shown its significant role in children's language acquisition. Research on sound symbolism then moved into the sensory domain of tastes and aromas [see Luca Nobile and Jordi Ballester (2017) for a detailed overview]. For example, Julia Simner *et al.* (2010) and Anne-Sylvie Crisinel *et al.* (2012) have shown that sweetness tends to be associated with high, rounded, low-pitched vowels (/o/, /u/) and continuous, sonorant, low-pitched consonants (/m/, /n/, /l/), while sourness and saltiness are rather associated with low, high-pitched vowels (/a/, /e/) and high-pitched, rough, discontinuous consonants (/k/, /t/, /r/). Another sensory domain recently explored was that of gestures and actions. For example, Maurizio Gentilucci and Michael Corballis (2006) have shown that speakers tend to pronounce the vowel /a/ more open when they grasp (or see grasp) larger objects, and pronounce it more closed when they deal with smaller objects. On the other hand, Noburo Saji *et al.* (2013) have shown that the opposition between voiced consonants (/b/, /d/, /g/, low-pitched) and voiceless consonants (/p/, /t/, /k/, high-pitched) is associated with the difference between a heavy, slow gait and a light, fast gait, both among Japanese and Anglo-Saxon speakers (while on other properties the two languages differ). The most recent studies also attempt to differentiate the phonosymbolic values of different distinctive features. For example, Luca Nobile (2015), after analysing the acoustic properties of pseudowords *maluma* and *takete* (see Figure 2), showed that their consonant features can react differently to different types of figures, while Klemens Knoeferle and his colleagues (2017) showed that vowel features react differently to different types of phonetic symbolism: both size and shape sound symbolism are related to the frequency of the F2 formant (i.e. the place of articulation of the vowels and their lip rounding); only the size sound symbolism, however, is also related to the duration of the vowel and the frequency of the F1 formant (i.e. the degree of aperture).



**Figure 3** Neurophysiological correlates of sound symbolism. On the left, the left superior parietal region (in green) identified by Kate Pirog Revill et al (2014) through the fMRI, which fires distinctively when a sound-symbolic correspondence is perceived between the phonological signifiers of an unknown language and their meanings. On the right, the electonegativity peak detected in the occipital lobe by Vanja Ković et al. (2010) using the EEG when subjects perceive a sound-symbolic correspondence between pseudo-words and congruent figures.

Over the past decade, there has also been experimental evidence of a neurophysiological nature, i. e. based on direct observation of brain physiology and no longer only on the behaviour of individuals (see Figure 3). In particular, Kate Pirog Revill and her colleagues (2014) were able to identify through fMRI (functional Magnetic Resonance Imaging) a region of the cortex that is activated distinctively when Anglo-Saxon speakers perceive foreign language antonyms as sound-symbolic (the left superior parietal area, within BA7), as well as a subcortical region that is activated in proportion to individual sensitivity to sound symbolism (the underlying left superior longitudinal fasciculus). In turn, Vanja Ković and colleagues (2010) have shown by the EEG (Electro-Encephalogram) that when individuals perceive a sound-symbolic congruence between a pseudo-word and the shape of a figure, the visual cortex records a negative electrical peak between 140 and 180 milliseconds after the presentation of the shape (a too rapid reaction to be attributed to conscious activity, thus reflecting a possible preconscious sound symbolic association).

## 2.2 Descriptions

Descriptive evidence attests to the existence of sound symbolism, not through the observation of individuals' cognitive systems, but through the analysis of the lexical repertoire of languages. It is traditionally provided, on the one hand, by anthropolinguistics and ethnolinguistics (particularly in the African, Amerindian, South-East Asian and Oceanian domains) and, on the other hand, by a number of national or regional linguistic traditions (Anglo-Saxon, Japanese, Korean, Turkish, Basque, etc.). Recent research based on computerized corpora now makes it possible to specify, consolidate and generalize, more and more frequently, this traditional knowledge.

Unlike experimental research, descriptive research on sound symbolism is very ancient. It can even be said that Western linguistic thought begins with a research of this type: the one that Plato had Socrates detail in the *Cratyle* at the beginning of the 4th century BC (421c-427d). Defended later by Epicurus in his *Letter to Herodotus* (75-76) against the conventionalist

Aristotle of *De Interpretatione* (16a), this approach remained widely practiced in antiquity, for example by the Roman scholar Nigidius Figulus (in Gellius, *Noctes atticae*, X, 4), mainly through the teaching of the Stoics, whose ideas were reported to us by Augustine of Hippo in his *De Dialectica* (ch. 6 and 7) towards the end of the 4th century AD.

At the height of medieval scholasticism, Henri de Gand (*Summa quaestionum ordinariarum* ch. 73, in Rosier 1995) takes up and perfects Augustine's imitative theory in order to oppose it both to Thomas Aquinas Aristotelian conventionalism, which is about to become the official theory of the Church, and to the mystical theories of heretics and cabalists, in particular that of Abraham Aboulafia's "prophetic" *qabbalah* (see Scholem 1946).

In modern Europe, descriptive research on sound symbolism, always opposing both mystical theories such as Jakob Böhme's (1635) and conventionalist theories such as Locke's one (1690), marks some of the decisive steps in the constitution of national linguistic-grammatical traditions: John Wallis (1653) and Hensleigh Wedgwood (1845, 1866) in England, Leibniz (1710, 1712, 1765) and Humboldt (1822, 1836) in Germany, Giambattista Vico (1744) and Melchiorre Cesarotti (1785) in Italy, Charles de Brosses (1765), Charles Nodier (1808, 1834), Abel François Villemain (1835) and Honoré Chavée (1849) in France, Mikhail Lomonosov (1748) in Russia and even Akira Suzuki (1816) in Japan are only the most significant figures in this inexhaustible investigation of the imitative virtues of language.

The beginning of the contemporary age can be located, for this type of research (as for the rest of linguistics) in the last third of the 19th century, when the general domain of *imitation* and *analogy* (18th century keywords) begins to integrate into dominant scientific paradigms, that of historical grammar first, then that of general linguistics, while giving rise to more circumscribed and precise concepts such as those of *sound symbolism* (Gabelentz, 1891[1901: 328], Jespersen, 1922: 396, Hjelmslev, 1928: 171), *iconicity* (Peirce 1885, Jakobson 1965), *expressiveness* (Grammont 1901, 1933: 403), *phonesthesia* (Firth 1930) and *ideophony* (Doke 1935), in addition to *onomatopoeia* and *interjection*, terms well known since antiquity.

Ideophones are lexical forms that function as empowered onomatopoeias representing by their sound not only environmental sounds but also non-sound phenomena, such as colours, shapes, tastes, smells, gestures, feelings or trajectories (as in French *zig zag*, *bric-à-brac*, *chichi* "fuss", *dondon* "chubby" or *gnangnan* "namby-pamby"). Relatively rare in Indo-European languages, they are numerous and frequent in many languages without writing (Amerindian, African, Australian languages, etc.) as well as in the oral or poetic varieties of several literary languages (Japanese, Turkish, Korean, etc.), where they generally play a role of adjectives or adverbs. The works of Bernhard Schlegel (1857), Harry Peck (1886), William Aston (1894), Diedrich Westermann (1907) and Louis Hjelmslev (1928: 171-189) contain the first scientific descriptions of ideophony, before Clement Doke (1935) defined and popularized the term, and the field matured with the syntheses of William Samarin (1965, 1971), Gerard Diffloth (1972), George Childs (1994) and Shoko Hamano (1998), then with the great collective works published by Erhard Voeltz and Christa Kilian-Hatz (2001) and, more recently, by Kimi Akita and Prashant Pardeshi (2019). Today, among the most active researchers we can mention at least Mark Dingemanse (2011, 2012, 2018) for African studies and Kimi Akita (2009, 2011, 2012) for Japanese.

Phonesthemes, on the other hand, are consonant or syllabic groups of sub-morphemic level that tend to associate with similar meanings within a language, without this semantic connotation necessarily being explicable by a universal synesthetic link. One of the most frequently cited examples is the initial cluster *gl-* in English (*glare*, *glance*, *glitter*, *glitter*, *glimmer*, *glimpse* etc.), referring to a movement of light or sight in 50% of the cases, which represents a frequency significantly higher than random. Similarly, if we take all 35 French verbs in *fl-* we can easily

see that at least 28 of them (80%) share the reference to a fluid type of movement (that is aerial, light, flexible, often cyclical or unstable), as is the case for *flageller* "flagellate", *flageoler* "wobble", *flairer* "pick up the scent of", *flamber* "burn", *flamboyer* "blaze", *flâner* "saunter", *flatter* "flatter, stroke", *fléchir* "bend", *fleurir* "flower", *flipper* "freak out", *floconner* "fall in light flakes", *flotter* "float", *fluer* "flow", *flûter* "play the flute, drink". Now, even if it were assumed that such a connotation usually characterises an half of the French verbs (which obviously means overestimating it by a wide margin), there would be less than one probability per thousand ( $p < 0.001$ ) that, in the case of the /fl/-verbs, this percentage rises to 80% by pure chance. On the other hand, the articulatory and acoustic properties of the /fl/ cluster constitute a plausible motivating factor, given that the voiceless fricative /f/ is one of the most suitable to represent an light aerial noise (with /s/) and that the lateral approximant /l/ is in turn one of the consonants that exert the least resistance to the passage of air. To verify, it will be sufficient to compare this dominant connotation of /fl/-verbs with the profoundly different connotation of /fr/-verbs, which are often characterized, on the contrary, by an idea of movement with friction, rigidity or rupture: *fractionner* "fractionate", *fracturer* "fracture", *fragiliser* "weaken, make breakable", *fragmenter* "fragment", *franchir* "cross", *frapper* "strike", *frauder* "fraud", *frayer* "open sth up", *freiner* "brake", *frelater* "adulterate", *frictionner* "rub", *frigorifier* "freeze", *frotter* "rub, scrape", *frustrer* "frustrate". This connotation adapts well to the acoustic and articulatory properties of /r/, a voiced fricative ([ʁ]) sometimes realized as a vibrant ([R]), characterized by a rough psychoacoustic profile (Zwicker and Fastl 1999: 257). Although the word *phonestheme* was introduced by Firth (1930), the phenomenon has always been well known by Anglo-Saxon grammarians, since Wallis (1653: XIV) up to Bloomfield (1933). Among recent works one can cite Bowles' (1995, 1998) and Bottineau's (2008) detailed qualitative analyses, Hutchins' (1998) phonesthemes recognition tests, Bergen's (2004) experimental demonstration of their preconscious and quasi-morphological cognitive treatment, Philips' (2008 and 2011) study of their diachronic behaviour and Otis' and Sagi's (2008), Abramova's and Fernandez' (2016) and Kwon's (2017) quantitative analyses on large computerized corpora. The study of phonesthemes is not limited to English: Abelin (1999), for example, have studied them in Swedish, Blust (2003) in the Austronesian languages and Bohas and Dat (2007) have identified equivalent structures in Semitic languages.

Of course, interjections, onomatopoeias, ideophones and phonesthemes, while representing the most recognizable forms of sound symbolism, do not exhaust the typology of phenomena. Actually, any linguistic form or structure is likely to be analysed from the point of view of its phonological motivation (provided, of course, that appropriate demonstration methods are put in place). Among the most studied general facts are, for example, deictics, diminutives and self-referential articulatory phenomena. A case of pronominal indexical motivation is the fact that in most languages the second person (*tu*, *vous*) tends to be articulated further in front than the first person (*je*, *nous*; cf. Wichmann *et al.* 2010 and Nobile 2011 and 2012; as well as, well before them, Nigidius, in Gelle, *Noctes Atticae*, X, 4; de Brosses 1765: 271 and Villemain 1835: xxvi-xxvii). On the other hand, diminutives tend to prefer higher-pitched phonemes than augmentatives (cf. Jakobson 1965, Ultan 1978, Haynie *et al.* 2014, Nobile 2010) and the names of phonatory organs tend to use articulations produced by these organs (cf. Urban 2011; and before him De Brosses 1765: 247-251 and Nodier 1808: xviii-xix). More generally, recent studies on large corpora show that, as a whole, etymologically independent words tend to be phonologically more similar when they are semantically similar, whether analysed within a language (English in Monaghan *et al.* 2014) or over hundreds (Dautriche 2016) or thousands of different languages (Wichman *et al.* 2010, Blasi *et al.* 2016). In addition, this general trend towards phonological iconicity is significantly greater in the lexicon learned orally in early childhood than in the lexicon learned in school and adulthood through reading and writing (Monaghan *et al.* 2014, Perry *et al.* 2015, Massaro and Perlman 2017; see Figure 5 below).

### 3. Contributions

The articles collected in this issue come from the international conference *Sound Symbolism and Crossmodal Correspondences*, held in Paris, Sorbonne University, on May 4 and 5, 2017.

Philippe Monneret proposes a theoretical perspective on sound symbolism, conceived as part of his theory of analogy. In his view, in contemporary international research, sound symbolism is often categorized in terms of a Peircian-Jakobsonian inspired semiotic theory and conceived as a phonological form of iconicity. Philippe Monneret proposes to adopt a different perspective and to conceive it first of all from the point of view of the analogical cognitive operations that are set up to experience them.

Fanny Boudier conducts a quantitative analysis of monosyllabic verbs in French in search of a type of conventional sound symbolism that she calls "systematicity" (and that one could also call "diagrammatic iconicity"). She studies the phonological distribution of transitive, intransitive and dual-use verbs and obtains several significant results, the most important of which is the preference of initial sonorants (nasals, laterals, semiconsonants and vowels) for transitive verbs. She also shows that this result is part of a trend towards a systematic relationship between phonological structures and grammatical structures that is well attested in other languages.

Chris Smith aims to evaluate the influence that the sound symbolic value of the English phonestheme *fl-* (traditionally associated with a more or less fluid, confused or chaotic movement), may have had in diachrony on the semantic change of the words that contained it. Her analysis suggests that the current phonestheme is the result of a historical convergence between several etymologically independent lexical bases, whose meaning has tended to approach each other because of the sound symbolic attraction of the signifier.

Nezihe Zeybek studies the relationship between vowel alternation and semantic alternation in Turkish ideophones. After having illustrated the main phono-morphological characteristics of the Turkish ideophonic system, she distinguishes between external vowel alternation (which take place between two different words) and internal alternation (which take place within the same word, reduplicated). In the first case, the phonological opposition between [open vs. closed] and [high-pitched vs. low-pitched] vowels usually represents semantic oppositions such as {large vs. small} or {strong vs. weak}. In the second case, the alternation between different vowels within a reduplicated ideophone usually represents irregularity, imperfection or inconvenience.

Sandra Madureira, Mario Augusto de Souza Fontes and Zuleica Camargo present a broad overview of research on sound symbolism by illustrating research that is sometimes little known to the French-speaking public. After having distinguished between sound symbolism and phonetic metaphors (Fonagy), the authors discuss four types of physiological "codes" that can operate as sound symbolic signifiers: the frequency code (Ohala), the effort code, the breathing code and the sirenian code (Gussenhoven). In relation to these four dimensions of expressiveness, the authors attempt to define a typology of the main articulatory gestures involved.

Ekaterina Quantin-Voronova illustrates little-known aspects of Stanislav Voronin's (1935-2001) phonosemantic theory, focusing in particular on the notion of *kinema*, the gestural unity that the Russian linguist places at the base of sound symbolic correspondences between articulatory gestures and other bodily gestures, whether they are experienced or observed, emotional or motor. After retracing the author's highly elaborate system of conceptual dichotomies developed to categorize human gestuality, Voronova reproduces and comments on a number of examples from English.

Andrea Picciuolo explores the perlocutionary use of sound symbolism in a shamanic song of the Guna Amerindian people, the *Muu Igala*, aimed at treating pregnancy pathologies. According to Lévi-Strauss, who conducted a study on it, the mobilization of mythical archetypes by the structure of the song would be supposed to mobilize the patient's psychic structure and, in this way, reflect its effect on the physiology of her body so as to ensure healing. Picciuolo tests the hypothesis that this crossmodal interaction between psychology and physiology includes one between signified and signifier of the text.

#### **4. Prejudices**

It must now be noted that, despite the scope and reliability of the available empirical research, and despite the millenary prestige of the philosophical tradition that precedes it, the question of sound symbolism remains poorly tolerated in several linguistic departments, particularly in France. To give an idea of the extent of this, it will suffice to recall a brief anecdote going back to the time when we were preparing our conference.

By the end of July 2016, Damian Blasi and his colleagues had published in the American *Proceedings of the National Academy of Sciences* a remarkable study on sound symbolism, demonstrating, through a vast quantitative analysis of almost all the world's languages (6452 languages), that the most common words in the lexicon tend to prefer similar phonemes, in different languages, to designate similar concepts (for example, the concepts of "red" and "round" tend to prefer, on a global scale, /r/, while the concepts of "bite" and "bone" tend to prefer /k/). At the beginning of the academic year, some of the most prestigious scientific journals (*Nature*, see Fitch 2016; *Scientific American*, see Pycha 2016) publish reviews praising the study. French radio station *France culture* does not escape the exercise and organises a programme entitled "Linguistics: languages would have many sounds in common" (16 September). In this program, after a short interview with one of the authors of the study, the floor is given to two famous French linguists who, without having read the article, relying solely on their personal feelings and the authority of Saussure (1916) and Jakobson (1960), reassure the general public by claiming that this is not the case. They also admonish the public for being wary of "this American desire to demonstrate a unique and divine origin of language because we are at the limit of ideology and science". Dumbfounded, I try to point out very politely, by a user comment on the programme webpage, that the study was not carried out in the United States, but in Europe, five authors out of six coming from European universities; that it is not based on creationist theories, but on quantitative data of unprecedented scope, from large computerized corpora; that it has been published by one of the best scientific journals in the United States, and that it has been positively reviewed by the most influential scientific journal on the planet ; and finally that, if we wanted at all costs to stick to the European authors of the last century, we could have quoted at least Saussure's notebook on anagrams (Starobinski 1971) and Jakobson's (1965) article "À la recherche l'essence du langage" which give a much more important place to phonological iconicity than that supposed by the interviewees. Unfortunately, the website administrator does not consider it appropriate for me to provide these details and deletes my comment several times. Thus, the French public in the language sciences has been prohibited by authority from accessing the new achievements of the discipline.

This episode provides an interesting insight into the mistrust that still prevails in some French linguistic circles regarding any possible questioning of the arbitrariness of the sign. One also sees, on the other hand, that this mistrust does not depend on a lack of empirical evidence in favour of the motivation of the sign, but on the simple perpetuation of an old epistemological prejudice that must now be brought to light in its structure and origins.

## 5. Naturalism

A good starting point for analyzing the prejudice of arbitrariness is Sylvain Auroux's introduction "Le paradigme naturaliste" to the thematic issue of the French journal *Histoire Epistémologie Langage* that he directed and entitled *Le naturalisme linguistique et ses désordres* (29/2, 2007). The author argues that the arbitrariness of the sign should not be considered as just another empirical observation, but as a fundamental postulate, whose role is not to describe particular facts, but to establish the epistemological framework of the human and social sciences:

The arbitrariness of the sign is not a proven fact, it plays the role of a principle of demarcation [...]. Arbitrary is not a fact, it is the theoretical principle at the origin of history and culture (Auroux 2007: 6-7).

Sylvain Auroux considers arbitrariness as the theoretical device that ensures the fundamental separation between the world of man and the natural environment, from which derives the academic and disciplinary separation between the human sciences and the natural sciences. Indeed, when we affirm that language is based on the unmotivated relationship between signifier and signified, we affirm that it is the place of an original and impassable separation between body and mind, the *res extensa* and *res cogitans*, the physiology and psychology of the human being. Thus, on the one hand, there would be the physiological experience of the sounds of language, which would be part of the sensory-motor functioning of the body and would obey the physical laws of nature, and on the other hand, the psychological experience of meaning, which would belong to the cognitive functioning of the mind and which, free from natural constraints, would obey the moral and rational laws of culture:

The sounds of language are *also* natural phenomena [...]. What makes something "natural" make sense? The naturalistic response is to argue that meaning is born from nature itself; the culturalist response proposes, on the contrary, that meaning comes from a specific order, foreign to nature [...]. Epigenetism [a theory proposed by S. Auroux] [...] can be considered as the conception of a clear demarcation between nature and culture and, consequently, of the autonomy of the social sciences (Auroux 2007: 8-10).

This sharp separation, making it possible to isolate a cultural sphere totally emancipated from nature, which the author brings back to the Enlightenment, appears to him as ethically and politically desirable because it would ensure the autonomy of the SHS in relation to the natural sciences. Unfortunately, it also leads to a dark and less desirable side, which closely resembles a "return of the repressed". Indeed, any questioning of this separation would entail, according to the author, the risk of contagion with a "naturalism" that he symmetrically conceives as being totally devoid of humanity, and which would have been typically embodied between the 19th and 20th centuries, by the emergence of racism and Nazism.

Of course, Sylvain Auroux seems to us to be right when he argues that the centuries-old debate on the nature of the sign is intrinsically linked to the fundamental postulates of our civilization, particularly with regard to the relationship between body and mind, nature and culture, observed object and observer subject, reality and language, i.e. those that could be called with Benveniste (1939) the "metaphysical" foundations of our civilization. It is also true that this debate has tended to reopen periodically, throughout history, whenever these assumptions of any discourse were shaken and redefined, particularly because of the evolution of language technologies (we will come back to this later). Even today, after all, to explore the apparently marginal question of sound symbolism is nothing but to explore the very possibility of a different foundation of our culture, defining otherwise its relationship to nature, reality and the body.

We do not underestimate, moreover, the political and cultural risks that Auroux points out and

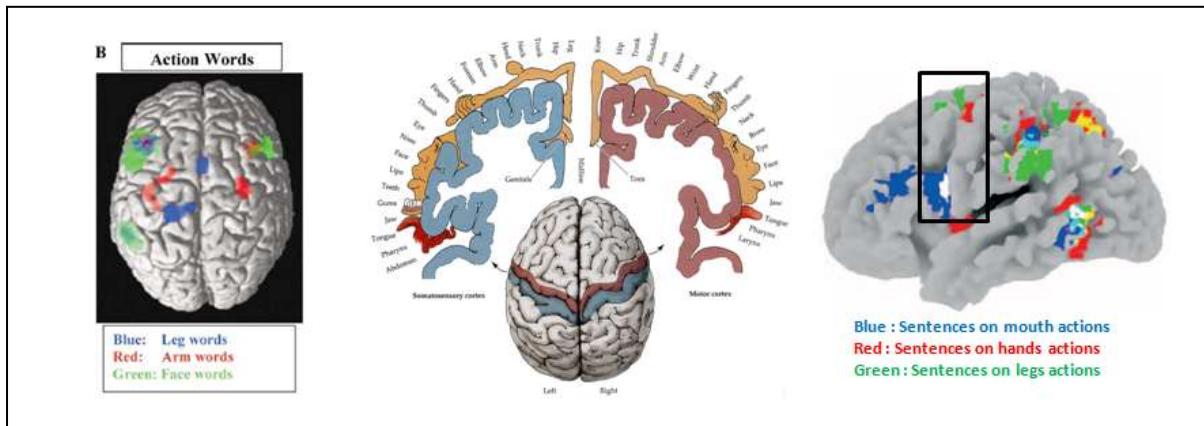
that any questioning of the foundations of a culture involves. In particular, it is undeniable that a certain kind of blurring of the boundary between nature and culture and a certain kind of linguistic naturalism may have been exploited in the past in order to support racist ideologies. However, we believe we can argue that today the situation is quite different, if not almost reversed, and that the risk factors are of a different nature. We therefore do not share Auroux's idea that the defence to the bitter end of the modern separation between nature and culture (and therefore between signifier and signified) must constitute the impassable ethical-political horizon of the human and social science.

If there is one point of agreement between sociologists regarding the resurgence of racism, xenophobia and Nazism over the past thirty years, it is that naturalistic ideologies have become less and less essential within them (Balibar 1991, Jones 1999, Rodat 2017). While it cannot be said that racism in the narrow sense has disappeared, the emerging forms of discrimination are less about the colour of the skin or the shape of the nose than about the colour of the banknotes people have in their pockets, and the shape of the cultural and ethnic-religious worlds they have in their heads. Almost no one no longer believes that one race can be biologically superior or inferior to another, but almost everyone is convinced that a culture can be. The ideologies of intolerance and hatred have essentially become culturalist ideologies, which prioritize and discriminate against people on the basis of their origin culture and cultural level, both outside and within each national community. Now, if this makes the problem all the more insidious because it is less objectifiable and recognizable, what is at least now indisputable is that defending the separation between nature and culture to prevent discriminatory ideologies has become, in this context, completely irrelevant.

On the other hand, a completely different issue calls for an urgent and radical redefinition of our culture's relationship with nature: it is the environmental and climate crisis caused by human activity. In this field, the idea that the human sphere can or should be considered independent of natural constraints is clearly part of the problem, rather than the solution. All in all, it is the same idea that led the economic sciences (a branch of the human and social sciences!) to ignore by postulate the physical constraints that the finiteness of the Earth's surface and resources imposes on infinite economic and demographic growth (Jancovici 2019 et 2017: 47'25" suiv.). The ongoing environmental apocalypse (demonstrated by the natural sciences) proves that this ancient assumption of modernity and economy is false: humanity is not entirely autonomous from nature. Ultimately, like any other living being, it is part of its own environment and must learn to think of itself as such if it wants to hope to preserve part of its living conditions and quality of life in the decades to come.

In this context, a theory of the linguistic sign that in turn thematizes a surpassing, within itself, of the separation between nature and culture (i.e. between signifier and signified), will perhaps facilitate the task of language sciences to rethink their role in order to meet the challenges posed by our times.

This possibility is part of a broader epistemological change that has already been underway for a long time. Thus, over the past 30 years, we have witnessed the emergence of a disciplinary field whose only purpose is the bodily foundations of the mind: cognitive neuroscience. Not only, for this field, the hypothesis of a non-arbitrary correspondence between physiology and psychology constitutes a fundamental postulate and, so to speak, a condition of existence but, within the field, the traditional separation itself between sensory-motor functions and cognitive functions is seriously questioned (cf. Rizzolatti and Sinigaglia 2006). In the sub-field of neurolinguistics (Petersen et al. 1988, Pulvermüller 2002, Pinto and Sato 2016), this is already reflected in the fact that the phono-articulatory sphere can no longer be considered as belonging to a universe radically different from the semantic-pragmatic sphere.



**Figure 4** Neurophysiological correlates of semantic values. Understanding action verbs involving the feet, hands or mouth triggers the activation of motor neurons responsible for the movement of these body parts, according to Hauck et al. 2004 (left) and Tettamanti et al. 2005 (right). In the middle, as a reminder, the expected mapping of tactile and motor functions on the cortex. These studies suggest that sensorimotor mapping which functions as a space for simulating motor gestures represented by the semantic signifieds of words is no different from that which functions as a space for executing articulatory gestures realizing the phonological signifiers of these same words. Signifier and signified therefore physiologically share the same space of cortical representation, constructed essentially in the image of the anatomical and functional structure of the body.

For example, it is now known that an important aspect of understanding the meaning of action verbs, from a neurophysiological point of view, is the embodied simulation of the motor properties of the action they designate within the motor system of the person who is interpreting them (Hauck et al. 2004, Tettamanti et al. 2005; see Figure 4). Understanding the verb *to pick* is unconsciously activating the motor network of your own hands, while understanding *to lick* or *to kick* is activating the motor network of your tongue or feet, respectively. Now, this means that the semantic sphere ceases to be radically irreducible to the phono-articulatory one, because both share a common sensorimotor substrate, structured approximately, overall, like a body map. These discoveries have considerable epistemological implications, which have been partly theoretically represented by the emergence of concepts such as *embodiment* and *enaction* (cf. Varela et al. 1991, Rohrer 2007, Durt et al. 2017, Bottineau 2010 and 2013, Bottineau et Grégoire 2017) which precisely thematize the complexification of the once linear and insurmountable boundary between physiology and psychology of language.

The recent development of research on linguistic iconicity and sound symbolism is therefore part of a major epistemological shift that concerns all scientific knowledge on language. It is no coincidence that among the most influential positions in favour of a motivated link between phonetics and semantics are those of leading personalities in cognitive neuroscience such as Rizzolatti and Craighero (2007), Ramachandran and Hubbard (2001) or Gentilucci and Corballis (2006). Indeed, to affirm that the link between sound and meaning is at least partly motivated is to affirm that, in language (and in particular in the new "language" object that emerged in the 20th century thanks to analog oral technologies, then in the 21st century thanks to digital technology), the relationship between body and mind, nature and culture, physiology and psychology is not a relationship of radical separation that has nothing to teach us, but a relationship, at least in part, of contiguity, similarity, correspondence and interdependence whose specific forms deserve to be explored and investigated.

This innovative position of the natural sciences and their tendency to cross the border with the human sciences does not mean that, in the context of this upheaval, influence should be exercised in one direction only, or that the only legitimate perspective on the motivation of the sign should be that of the natural sciences. Just think of the trajectory of rediscovery of human sciences undertaken by an internationally renowned neurophysiologist such as Vittorio Gallese to see this (Gallese and Lakoff 2005, Gallese and Cuccio 2015, Gallese 2017). Of course, no humanist perspective on the motivation of the sign and on the continuity of nature and culture can emerge without a serious and thorough consideration of the new empirical data available and without a courageous questioning of consolidated but limited habits of thought, such as the prejudice of the arbitrariness of the sign. Nevertheless, the place for such a perspective is already defined as the one that must restore the creative power of the speaking subject, and consequently the ethical and political stakes that this power entails, in relation to the status of an object to which the natural sciences tend constitutively to reduce him.

It will not be pointless to recall in this context that within the ancient Stoic organisation of knowledge the theory of natural values of the speech sounds did not appear in the field of physics, nor in that of rhetoric, but in the field of ethics (Belardi 2002: II, 338-359). This was probably due to the fact that ethical behaviour appeared to the Greeks as behaviour in accordance with natural laws and that the natural values of the sounds of language functioned in their opinion as reminders of these laws. What would such an "ethical" issue of sign motivation look like today, questioning not only what the sign is (or is supposed to be), but also the ways and purposes in which it is (or could be) used?

This is not a question that we can hope to answer exhaustively here. It seems to us, however, that it is similar to the type of questions that Edgard Morin (1997) taught us to ask about the *poetry of life*, as a horizon of ultimate meaning, in his opinion, of human existence. To give an important place to the motivation of the sign, alongside arbitrariness, would be, in this sense, to give a place to the poetic and poietic power of language, alongside its prosaic and representative power. And this at a time when the population of the Earth, largely illiterate, is gaining widespread access to public discourse through digital technologies that have as a distinctive feature the hybridization of the traditional prerogatives of oral and written language. To take seriously into account the poetic and poietic power of language would therefore be to ask the question of the type of world we make when speaking (and the kind we could make when speaking differently).

On the other hand, to question the modern separation between nature and culture as it appears at the heart of the cultural sphere, i.e. in the linguistic domain, is to give an epistemologically adequate response, it seems to us, to the current environmental crisis. To face this crisis, it is urgent to rebuild a representation of the human being that is able to go beyond the antinomic opposition with the natural world. But this begins by recognizing and highlighting what, at the very heart of human culture, that is, in our ability to speak, is partly natural: what brings us closer to other animals and makes us full members of the living world (cf. on this point Descola 2005 and 2017, from a slightly different perspective).

## **6. Writing**

We do not go beyond an outdated conception by opposing it head-on, but by assigning it an honourable place within a new framework that includes and exceeds it. For example, Newtonian physics was not surpassed by condemning it as erroneous, but by making it a special case of general relativity, admissible only for certain scales of magnitude. What would therefore be the role to be attributed to the arbitrariness of the sign, within a linguistic theory that emphasizes the motivation of the relationship between signifier and signified, in order to account for both

its centuries-old success and its current crisis?

We believe that arbitrariness can appear as the central and all-embracing property of language only if the pragmatic and cognitive experience of alphabetic writing is implicitly assumed as the prototypical experience of language in general. This seems to us to have happened for the first time with Aristotle (*On Interpretation* 16a), one of the first collectors of volumes in our tradition and the first philosopher who systematically builds his thoughts in writing, by discussing his 'bibliography'. The perspective he establishes, and the theory of meaning that accompanies it, were then endorsed and placed at the basis of the European cultural and educational system by Thomas Aquinas (*Summa theologica*, P1Q13A1). Later, in the age of printing, the theory of arbitrariness reached its modern formulation, characterized by a progressive radicalization and generalization of its scope, from the relationship between signifier and signified, to the relationship between signified and reality (Descartes 1664: 1-6; Locke 1690: III, §2; Saussure 1916). Saussure is on the threshold of this tradition: on the one hand, its chapter on the nature of the sign (I,1) is presented as a retrospective synthesis, faithful to the Aristotelian-Thomistic tradition of the arbitrariness of the relationship between signifier and signified; on the other hand, its chapter on linguistic value (II, 4) proposes such a radicalisation and generalisation of the lockian concept of arbitrariness between signified and reality (no longer thought of as a specific property of a particular class of ideas, those of mixed modes, but as a property of language in general), that he opens the way to a perspective for surpassing traditional arbitrariness, immediately seized, among others, by Emile Benveniste (1939).

Indeed, if the signified (the linguistic meaning) is arbitrary in relation to the reality it discriminates and categorizes, and if the signifier (the linguistic sound) designates this signified and not reality itself, then the main traditional argument in favour of the arbitrariness of the relationship between signifier and signified evaporates: one can no longer assert, as Aristotle and Locke did, that the arbitrariness of the sign is demonstrated by the fact that different languages use different signifiers to designate the same meanings. On the contrary, it must be recognized that the differences in signifier between languages generally also include differences in signified and that these different meanings may be represented by different sounds in different motivated manners, without this leading to a logical contradiction. For example (to take Saussure's one), if the French word *mouton* does not mean the same thing as English *sheep*, because the former also includes cooked meat and not the latter, then we can no longer say that the different phonological signifiers /mutõ/ and /ʃi:p/ demonstrate by themselves their arbitrary relationship with the identical semantic reality they designate. On the contrary, we are obliged to affirm that these two signifiers designate two different meanings and that these two different meanings can well be designated in a relatively motivated way by two different signifiers like /mutõ/ and /ʃi:p/, each with respect to the system of its language. This type of reflection, which significantly accompanies, in Benveniste (1939), the progressive awareness of the centrality of the oral utterance act, will lead to Jakobson (1965)'s first explicit formulation of a theory of diagrammatic iconicity.

Throughout the time that separates Aristotle from Saussure and Jakobson, that is, during the history of Western thought, alphabetic writing has been the fundamental shared experience on which the learned representation of language has been built. Our hypothesis is that the pragmatic-cognitive experience of writing have functioned throughout history as the matrix of the metaphysical relationship between language and reality that has generally been presupposed by Western culture, a relationship whose theory of the arbitrariness of the sign has only been a reflection in the field of language studies (cf. Nobile 2019).

This hypothesis is part of a long tradition of theories about the influence of writing on thought, which ultimately goes back to the very origin of Western written thought (Plato, *Phaedre*), when

the new perspective began to take shape, and which was then renewed in several forms in the 20th century (Vigotsky 1934, Whorf 1941, McLuhan 1962, Goody and Watt 1963, Havelock 1977, Ong 1983, etc.), when the emergence of speech technologies triggered a new transformation of these 'metaphysical foundations', pushing minds to reconsider the origin of their practices. Most of the language philosophy of 20th century, from Wittgenstein to Heidegger and up to Austin and Searle, would be unthinkable without the progressive objectification of orality, made possible first by the gramophone, telephone and radio, then by cinema, television and audiovisual media, even if this triggering rôle of speech technologies often remained implicit before McLuhan's work (1962).

To understand within its limits and in its core of truth the idea that writing can directly influence the metaphysical foundations of the relationship between language and reality, and thus the organization of thought as a whole, it is necessary to consider writing, not only as an object or a means, but also as a use (Agamben 2015), i.e. as a habitual practice that has an immediate effect on the behaviour and subjectivation of those who adopt it, by placing them (by the very fact of adopting it) in a constellation of gestures, perceptions and beliefs that guide their vision of the world.

The traditional experience of written language (let us leave aside digital writing for the moment) is intrinsically characterized by an objectification of language, that is, by its transformation into a silent and persistent signifying object, separated from its natural sound, and permanently existing before our eyes. This external, persistent and silent object, produced by the hands and perceived by the eyes, is used by a writer to communicate with a reader who is typically elsewhere and in another time, and to refer to a sensitive and pragmatic reality that is also usually absent from the place and time in which the text is written or read. These three separations between sound and the meaning it conveys, the writer and the reader to whom it is addressed, the act of enunciation and the reality represented in the statement are technically necessary for the use of writing and are constituent characteristics of the ontological relationship that alphabetic written cultures presuppose between language and the world: they define metaphysically, in an implicit and binding way, what is usually understood by "language" and "reality" within these cultures. Ultimately, these separations depend on the fact that, unlike oral speech, reading and writing are not natural and spontaneous gestures for us, but they are culturally acquired with some difficulty and require some effort from our sensory-motor and cognitive apparatus, so that we cannot perform them easily while we participate in real life actions with others. For example, we can't write a travel story while we're driving on the highway, or read a tennis story while we're playing a doubles match, while we can easily talk about it. Reading and writing is so cognitively expensive for us, that we generally need to stop all other activities and separate ourselves from the rest of the world so that we can do nothing but read or write.

Written language is therefore a persistent, silent and external object, which necessarily requires an ontological separation between sound and meaning, the writer and the reader, the text and the reality of the actions to which it refers. The first important consequence of this fundamental ontological structure is that written language needs first and foremost to represent the absent reality of which it speaks. The second is that it cannot be adjusted in real time to the changes it produces in the speaker and in reality itself while it is talking about it and, consequently, it cannot produce and guide these changes in a fine and controlled way. In other words, written language is a language where constativity tends to predominate over performativity. This also means that, from the point of view of a culture based on written objectified language, what is called "reality" tends in turn to appear as an objective entity, i.e. as a set of persistent objects whose existence and properties do not depend on the fact that one talks about them. By the way, this is the ontological condition so that linguistic statements about reality can be preserved and

accumulated over time, and so that there can be something like a History, a Philosophy and a Science.

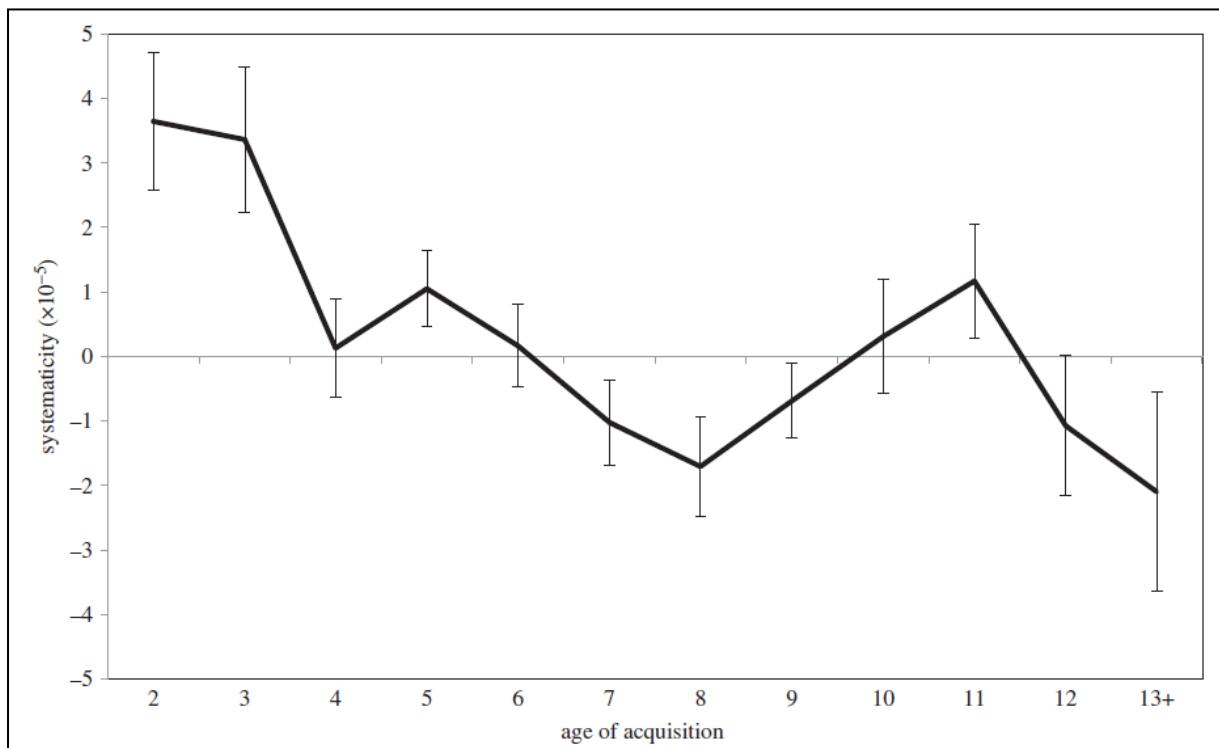
## 7. Orality

The traditional oral experience of language (let's leave aside again, for now, technological oral) is quite different. Oral language is not a silent and persistent object placed by the hands in front of the eyes, but a noisy ephemeral event, generated by the mouth all around the body, and especially around the ears. As a phonetic event, oral language has an ontological structure very different from that of a written object: it is made of energy waves rather than material particles; it has a temporal and cyclic extension (syllabation, breathing, speech turn) rather than a spatial and linear one; it is a cyclic modification of the energetic state and spatial relationships between the material particles of air rather than a new persistent material structure adding to the existing matter. Now, this noisy, ephemeral, transformative event, made of cyclic energy waves that shake the environment, is not addressed to an absent reader, but to a present interlocutor, and does not necessarily refer to an absent reality, but it can also refer (and usually refers) to the present sensitive and pragmatic reality. It is therefore a noisy action, performed in front of a noisy interlocutor, in the middle of noisy actions, to which it refers. Moreover, since the interlocutor and the reality of the concerned events are present, speech does not limit itself to addressing the former to represent the latter, but it can also (and typically does) perform speech acts that immediately change the interlocutor's behaviour and the course of events, changes that can in turn change the speech that is producing them, recursively. Thus, if written language is typically a silent object that objectively describes to an absent reader an absent reality made of silent objects existing independently of the fact that one is speaking of them, oral language, on the contrary, is a noisy event that dynamically influences a speaker interacting with it and changes a reality made of noisy events, that can be changed by the fact that one speaks of them and which in turn can change the speech that is changing them. Unlike written speech, therefore, oral speech is not completely separated from the reality of which it speaks: rather, it is a part of the latter, which can modify the whole and can be modified by it, within a recursive loop of transformation and creation where the performative power of language tends to predominate over its constative power.

These pragmatic-cognitive differences between the experience of writing and that of speaking lead to several lexical and grammatical differences (what is known as the diamesic variation of language). For example, the written word is characterized by a higher rate of nouns, third-person pronouns and declarative sentences (means used to represent absent reality), while the spoken word is characterized by a relatively higher rate of deictics, first and second person pronouns, and interrogative and injunctive sentences (means that allow it to influence the course of events). Among these differences, one of the least studied is the status of sound symbolism: it is relatively marginal in the written word and in written cultures, but becomes more important when oral cultures, less literate social groups or oral varieties of written languages are taken into account.

There are several arguments for such a link between the importance of oral language within a culture and the importance of phonological iconicity within that language. We know, for example, that in English the iconicity rate in the lexicon (defined as the statistical correlation between the phonetic similarity of the words and their semantic similarity) is negatively correlated with the age of word acquisition: iconicity is more frequent among words learned orally before the age of 6 than in words learned in school, when literacy triggers the development of the bookish lexicon, less iconic (see Figure 5); this suggests, among other things, that iconicity could play a certain biological-cognitive role in facilitating language

acquisition (Monaghan et al. 2014; Perry et al. 2015; Massaro and Perlman 2017; and see already Koenig and Fischer 1980).



**Figure 5** Systematicity (or diagrammatic iconicity) rate as a function of the age of acquisition of the English monosyllabic lexicon, according to Monaghan *et al.* (2014)

Second, it can be seen that primary oral cultures such as those of most Nigerian-Congolese, Aboriginal and Amerindian languages tend to assign a greater communicative and performative role to ideophones and other phonosymbolic words than most languages belonging to agricultural and scriptural civilizations; in addition, among the latter, those who have experienced more recent sedentarisation and literacy, such as Korean, Japanese and Turkish cultures, tend to have more important ideophone repertoires than the older Sino-Tibetan, Indo-European and Afro-Asian agricultural and scriptural civilizations. Third, in cultures where ideophones play a notoriously important communicative role, such as in Japanese, Basque or Zulu, these sound symbolic forms typically characterise oral, familiar, informal and rural varieties of the language more than written, careful, formal or urban varieties; for example, Swahili, the main lingua franca of black Africa, is one of the Nigerian-Congolese languages with the fewest ideophones (Childs 1994).

These three orders of fact therefore converge to suggest that sound symbolism mainly characterizes the natural oral form of language and tends to disappear into its written form.

This special relationship between sound symbolism and orality is not difficult to explain in the light of the previous analysis. First of all, from a perceptual point of view, hearing linguistic sounds is obviously essential to be able to appreciate their sound symbolism and this is better guaranteed orally than in writing. Secondly, from a bio-semiotic point of view, we have pointed out that oral language is a noisy event occurring in the midst of the noisy events to which it refers: it is therefore more likely that it 'resonates' with them, and that this resonance makes

sense and assumes a function in the speech. In general, for example, an oral speech, to be appropriate, must harmonize with the rhythm, duration and sound intensity of the events in which it is part; if it harmonizes also with the dominant frequencies and timbres of these events, sound symbolism emerges. In contrast, we have characterized written language as a silent object that refers to an absent and therefore silent reality: it cannot therefore easily resonate with it (with the exception of poetic language which is, after all, a wreck of archaic oral cultures within the written tradition: see below). Third, from a pragmatic point of view, we have suggested that oral language tends to be, overall, more performative and less constative than written language, precisely because of its presence in the face of the events it speaks of, which it does not need to represent so much as to guide, so that expressive effectiveness is more important to it than denotative accuracy; now, sound symbolism is an excellent factor of expressiveness, and a mediocre factor of accuracy. Fourthly, from a socio-anthropological point of view, oral language is used more, on average, by ordinary people, which, historically (in the long history of language formation), means mainly by farmers, shepherds and hunter-gatherers living in contact with nature and animals, whose wide variety of sounds and voices has only encouraged the implementation of the imitative capacities inherent in the human articulated voice (imitative capacities absent in most terrestrial mammals, and comparable only to those of a few bird species). On the contrary, written language was more often used, on average, by socio-cultural elites with the time to learn and use it, thanks to the fact that others worked the land and raised animals in their place, elites who therefore lived more frequently in places farther from animals and their sounds (e. g. in cities or palaces), and in any case in a less constraining existential relationship with other forms of life and their sound productions. Fifth, from a cognitive point of view, unlike written cultures, oral cultures generally have a problem of data memorization: they usually solve it through poetry and song, where sound symbolism and diagrammatic iconicity play a decisive role in establishing and saving the connection between names and referents, as well as between their conceptual constellations. For example, the great ethnozoological lexical repertoires of Amazonian oral cultures (studied by Berlin 1994) are often organized sound-symbolically.

Finally, from the point of view of the history of ideas, this special relationship of sound symbolism with orality explains well why its treatment represented such a crucial question at the beginning of different written traditions, and in particular of the alphabetical tradition, to the point that the first work on philosophy of language that has reached us, Plato's *Cratylus*, is largely devoted to it (cf. Dalimier 1998). In our opinion, this centrality of sound symbolism in Plato is due to the fact that it represents the main gap between the traditional poetic-oracular sapience on language, which Plato deeply respects, and the new empiric rational perspective of written philosophy, which he is founding. For him, therefore, sound symbolism is the main problem to be addressed if he wants to integrate the old linguistic knowledge of the oral tradition into the new alphabetical format of his philosophy (see Nobile and Lombardi Vallauri 2016: 23-33 on this point).

## 8. Scholars

The original link of sound symbolism with orality, childhood, oral cultures and illiteracy, which we have tried to illustrate in the previous chapters, explains well why, in the history of thought, this phenomenon may have been the subject of a haughty and contemptuous refusal on the part of scholars, who have sometimes treated it as the very prototype of a popular, anti-scientific and irrational belief, unworthy of appearing in the writings of well-educated people, that is, educated in the framework of the written culture. In this respect, it will suffice to recall the welcome that some members of the *Académie française* gave in 1913 to one of the last authors of a mystical theory of sound symbolism, Jean-Pierre Brisset, by flouting him in front of the

crowd with the sarcastic title of "Prince of Thinkers" (Decimo 2001).

This aversion of scholars reflects a very justified fear, because sound symbolism is a clear indicator of the bias of their written culture and its inadequacy as a modeling device for language in general. This fear is particularly obsessive for linguists because, on the one hand, they cannot ignore the indisputable ontogenetic and phylogenetic primacy of oral speech and, on the other hand, they can only build themselves as language professionals on the basis of the objectifying separation, ensured by writing, between (written) language and reality, with the particularity that in their case the reality which is the subject of their (written) speech is in turn represented by (written) language. In other words, any influential linguist, to become one, must devote much more time to reading and writing than the general population. As much as possible, he must tear himself away from the cognitive universe of orality to immerse himself in the world of writing until he makes it his own natural environment. He must write and publish as many texts as possible demonstrating that he knows how to use his linguistic tool in a descriptive and non-expressive way to move his target language away from himself until it becomes a real object of thought. In addition, he must be able to support his statements with written attestations, whether primary (examples, *corpora*) or secondary (bibliographic sources). In this process, which is both scientific and existential, the pragmatic-cognitive characteristics of orality often end up falling into the background when they are not simply suppressed from the linguist's introspective consciousness.

The linguist thus builds his socio-professional status as a language expert at the cost of a necessary and fundamental distancing from the common experience of spoken language. Now, the latter is often characterised by the perception of a certain motivation of the relationship between signifier and signified, especially among the less educated. The rejection of sound symbolism thus becomes the point of honour on which the linguist hopes to assert the superiority of his "objective" view in the face of the "subjective" beliefs of the majority of the population (see already Benveniste 1939 on this point). But the same cognitive process that ensures the objectivity of his gaze always risks depriving him of something so precious: the awareness of the partial and atypical nature of his own experience of language, precisely as a linguist. Now, to the extent that his judgments are often influenced by introspective approaches (or at best by the analysis of written corpora), it is legitimate to hypothesize that his tendency to overgeneralize the scope of the arbitrariness of the sign reflects a biased language experience in which writing prevails over orality and conceals its prerogatives.

It is sufficient, by the way, to take up the *Course in General Linguistics* again to see that the concept of "*langue*" which is its object, and of which arbitrariness constitutes the fundamental property, is exhaustively defined by its written traces. The proof that *langue* exists independently of speech, Saussure tells us, is its existence in the form of dead languages, grammars and dictionaries, that is writings (Saussure 1916: 31-32). It is interesting to note, moreover, that at the other end of the history, when Aristotle first formulated the concept of arbitrariness, the comparison with writing also enters into his definition:

Spoken words are the symbols of mental experience and written words are the symbols of spoken words. Just as all men have not the same writing, so all men have not the same speech sounds, but the mental experiences, which these directly symbolize, are the same for all, as also are those things of which our experiences are the images (*De interpretatione*, 16a; Edghill's translation).

This implicit adoption of written language as a tool for modelling language in general has its predictable counterparts, both in Saussure and Aristotle, in the separation between sound and meaning and in the centrality of the constative speech act, which Aristotle himself is the first to conceptualize and distinguish from the performative by calling it "apophantic speech".

Overall, the history of thought, as a history, and therefore as a fact of writing, is the history of the predominance of the arbitrariness of the sign. Yet it is far from representing the entire human experience of language because writing and history, however prestigious they may be, have never represented anything more than the experience of a learned minority. At least, until today.

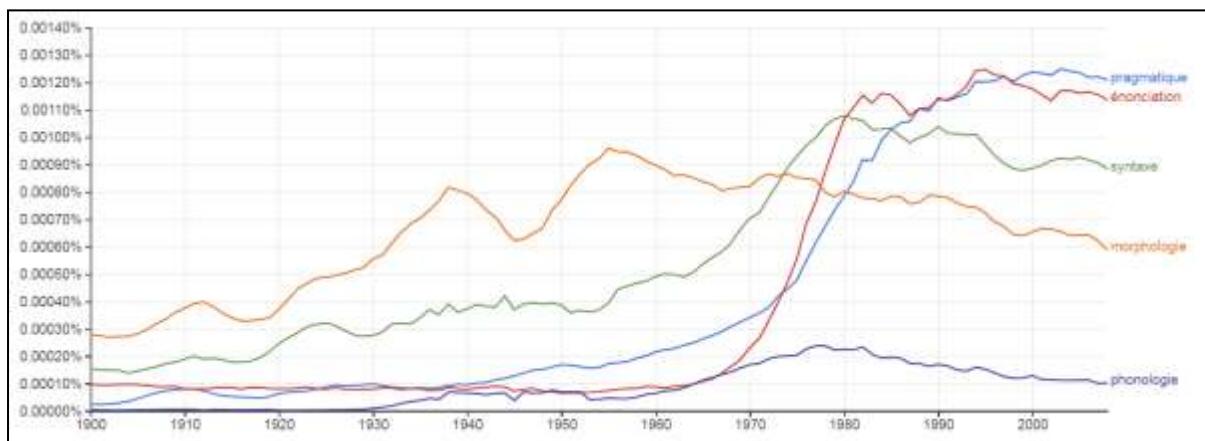
## **9. Digital**

If we have been able to trace the above synthesis proposing an external view of the whole of Western written tradition and the particular relationship it establishes between language and reality, it is because we are now, if not outside this tradition, at least on its final threshold. The ongoing technological revolution, by completing a transformation that began at the end of the 19th century, has not only shaken the millenary divide that separated and hierarchized orality and writing, but has created for the first time a common, flexible and configurable medium for these two forms of expression. On the one hand, the digital medium promotes interoperability and hybridization between orality and writing and, on the other hand, it allows a fine configuration of their uses, i.e. of what we thought we could describe as the material foundations of the 'metaphysical' relationship between language and reality in our culture. These foundations, which until now appeared to us as a reflection of certain physical constraints imposed on different language practices, are now increasingly becoming the product of a deliberate human project, that is, of a computer-based programming of the forms of oral and written language interaction in the society.

If our hypothesis is correct and if the centrality of the separation between signifier and signified, body and mind, physiology and psychology of language, within our culture, is a reflection of the pragmatic-cognitive experience of paper-based alphabetic writing, then this separation can only be challenged and profoundly redefined by the transformations that language technologies have introduced into the social treatment of language. These transformations have led to both a colossal democratization of the reading and writing experience, and the progressive marginalization of its traditional form compared to analog audiovisual, and then to its technical and functional hybridization with the new forms of digital orality, within the multimedia and interactive online space.

While writing on paper has now lost the centrality it had at the beginning of the 20th century (and for the previous 5000 years), online mass interactive digital writing is now acquiring new properties, previously typical of oral communication, such as instantaneity, dialogicity, multimedia, modifiability, proxemic contextuality (thanks to smartphones) and even evanescence (in the case of self-destructive SnapChat messages, for example). Conversely, online mass digital audiovisual oral communication can today enjoy features that were once typical of writing, such as persistence, archivability, reproducibility, asynchrony, unidirectionality, spatial transferability and traceability. Even if some of these characteristics had already surfaced in the analog audiovisual sector, it is only with digital technology that they have a daily impact on the active and passive uses of language by most of the population. As a result, the two modes of expression now converge, in the common experience, towards increasingly complete interoperability: we can publish a blog post or a live video streaming, perform a keyboard or voice command search, dictate a text on our phone or have one read by a synthetic voice. Thus, the gap between oral and written language is tempered both in its pragmatic forms and pragmatic functions (as well as obviously in its grammatical forms and functions). Given that on a global scale, truly literate users remain a minority, it is likely that this hybridizing interoperability between orality and writing will benefit mainly to orality, and that it will soon become the most important modality for digitally mediated language interaction.

From the point of view of the epistemology of language sciences, this relative return to power of technologically equipped orality cannot, of course, lead to a pure and simple return to the archaic poetic-oracular perspectives on sound symbolism, represented for example in Plato's *Cratylus* as the legacy of a prephilosophical oral culture (that of Heraclitus, Homer and Orpheus). Between these ancestral visions and the one emerging today there is about the same ontological distance as between a face-to-face oral conversation and a live streaming videoconference with an integrated interactive chat. Nevertheless, the technological transformations underway will undoubtedly undermine the purely scriptural perspective sketched by Saussure at the beginning of the 20th century and will necessarily involve the return of a number of properties of the archaic sound symbolic visions of language, just as a live streaming with integrated chat undeniably shares a number of formal characteristics with oral face-to-face conversation. This is, after all, only an epistemological corollary of Jean-François Lyotard's famous thesis (1979) on the postmodern condition.



**Figure 6** Relative frequency of the terms *pragmatique* (blue line), *énonciation* (red), *syntaxe* (green), *morphologie* (orange) and *phonologie* (violet) in French books between 1900 and 2008 according to Google N-Gram Viewer. *Pragmatique* and *énonciation* became the most frequent from the 1975-1985 decade onwards, simultaneously with the spread of the analog audiovisual media.

This return of archaic features in the epistemology of language sciences is already evident in the hegemony that pragmatics and theories of the utterance act have exercised over the rest of the field for half a century (see Figure 6), and in the undeniable proximity between some of their founding themes (*How to do things with words*, Austin 1962) and some traditional problems of magic (magical formulas like *abracadabra* were precisely supposed to "do things with words"). This is also the profound meaning of Giorgio Agamben's famous thesis, in our opinion, according to which the field of modern pragmatics correspond exactly to that of ancient metaphysics (1982: 36). This correspondence is also well perceived by French editors of children's books, who often present the learning of the first illocutionary acts (*sorry, thank you, please*) as that of the new 'magic words'.

It must be stressed, however, that in absolute terms, the most salient feature of digital media is neither a return to orality nor a generalization of writing, but the confluence of these two forms of expression in a single digital medium which, by adapting them to its own constraints and potential, determines their hybridization. If, on the one hand, this tends to temper the traditional sociolinguistic hierarchy between writing and orality (because today's blog-writer no longer enjoys a more prestigious position than that of the video-speaker), on the other hand, it brings

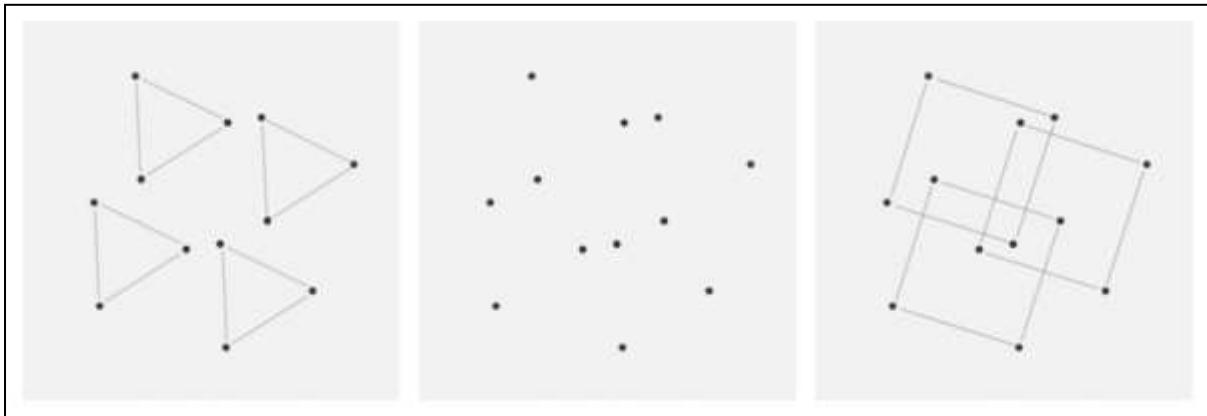
about a whole new level of sociolinguistic hierarchy, represented by the technical mastering of the computer code that shapes the structure of the underlying support, shared by digital orality and writing.

From a semiotic point of view, computer programming is a form of writing that is perfectly separated from oral language, since it can be reduced to logico-mathematical meanings only and purified of any connection with the phonological signifier. However, from a pragmatic point of view, it is also a writing that is perfectly hybridised with the modalities of orality, insofar as, unlike traditional writing, it never serves to describe realities that exist independently of the fact that it talks about them, but it always serves to create them by the very fact of 'speaking' of them. In other words, like the Creator Word of origins, coding says nothing but what it does.

Now, what it does, in terms of language, is to organize the general way of functioning and the particular functionalities of the space within which oral and written language interactions between individuals occur. In other words, computer coding is the metadiscourse that defines the conditions of existence and operational details of any digitally mediated language use. But if, as we have tried to demonstrate, these uses constitute the material foundations of the metaphysical presuppositions of any cultural universe, then the specificity of the present cultural universe is that its metaphysical presuppositions are no longer really presupposed, but they are now deliberately posed by human work (although still partly unconsciously). Human culture ceases to consist primarily of talking about reality and increasingly becomes a permanent process of redefining what "talking" and "reality" mean. The forms in which the GAFAs (and possibly States) will inscribe human language interactions will immediately determine (whether they want it or not) the types of relationship between language and reality that these interactions will presuppose and therefore the types of cultural universes to which they will give rise. The recent re-emergence of mythical universes based on the equivalence between news and fake news, social theory and conspiracy theories, empirical evidence and deepfake is only a foretaste of what we will face in the coming years.

The possibility of reprogramming by ICTs the pragmatic conditions of our linguistic uses is the exact equivalent, from a cognitive and collective point of view, of what the reprogramming of DNA with CRISPR technology represents from an anatomical and individual point of view. With only one difference, that in the second case we have a much better mastery of the technique and are all in all more aware of the risks it entails.

A theory of the linguistic sign adequate for our time can only take into account the emerging hybridization between arbitrariness and motivation, and between constative and performative uses of language. Just as quantum computing is preparing to surpass the binary logic of the bit to go toward the hybrid and probabilistic logic of the qubit, in the same way, a theory of the linguistic sign at the level of the present challenges will have to consider, alongside the traditional cases of arbitrary and naturally motivated signs, a new family of potentially predominant phenomena. These are cases where, as a result of the radical arbitrariness of the sign, it is possible to identify differential networks of sound symbolically motivated signs characteristic of each language. Indeed, each language carries a different semantic interpretation of reality, which can be seen both as a representation and as a creation of the latter (see Figure 7). Now, sound symbolic signifiers can also both imitate certain properties of reality and contribute to semantically highlighting them, and this in different ways in the different languages. This class of phenomena represents in the end only a generalization of criteria already used today in the identification of phonesthemes and submorphemes. In it, we observe neither a naturalistic and universal association between an individual sound and a concept, nor an arbitrary convention uniting a signifier and a signified, but a system of motivated differences between signifiers, which represents or generates phonosymbolically a system of differences between the signified cognitively codified by a language (see Nobile 2011, 2014a, 2014b).



**Figure 7** The image suggests how a single referential reality (the 12 dots shown in the central figure) can receive different relevant semantic interpretations (the four "triangles" on the left or the three "squares" on the right), and how these different interpretations can be considered both as representations of primary reality and as creations of secondary realities. A sound symbolic signifier can imitate the sensory properties of primary reality as well as help to shape those of secondary reality, in differently motivated ways within different languages.

This type of perspective, which resolutely goes beyond the traditional metaphysical divide between nature and culture, may make it possible to redefine criteria to guide oneself in the proliferation of uses and universes that digital technology will continue to nourish. In particular, it will be a question of understanding which of these innumerable devices of representation and creation of reality will make it easier for individuals to rebuild around them, by speaking, poetically habitable worlds.

## Bibliography

- ABELIN, Åsa (1999). *Studies in sound symbolism* [thesis], Göteborg, Göteborg University.
- ABRAMOVA, Ekaterina and FERNÁNDEZ, Raquel (2016). “Questioning Arbitrariness in Language: a Data-Driven Study of Conventional Iconicity”, *Proceedings of NAACL-HLT*, 343–352.
- AGAMBEN, Giorgio (1982). *Il linguaggio e la morte*, Torino, Einaudi.
- AGAMBEN, Giorgio (2015). *L'uso dei corpi*, Vicenza, Neri Pozza.
- AKITA, Kimi (2009). *A grammar of sound-symbolic words in Japanese* [thesis], Tokyo, Kobe University.
- AKITA, Kimi (2011). "Toward a phonosemantic definition of iconic words", Michelucci *et al.* 2011: 3-18.
- AKITA, Kimi (2012). "Toward a frame-semantic definition of sound-symbolic words: A collocational analysis of Japanese mimetics", *Cognitive Linguistics* 23(1). 67-90.
- AKITA, Kimi and PARDESHI, Prashant (2019). *Ideophones, Mimetics and Expressives*, Amsterdam and Philadelphia: John Benjamins.

- ANDLER, Daniel (2016). *La silhouette de l'humain : quelle place pour le naturalisme dans le monde d'aujourd'hui ?*, Paris : Gallimard.
- ASTON, William (1894). "Japanese onomatopes and the origin of language", *Journal of the Anthropological Institute of Great Britain and Ireland* 23, 332-362.
- AUROUX, Sylvain (2007). "Introduction: le paradigme naturaliste", *Histoire Epistémologie Langage*, 29(2). 5-15.
- BALIBAR, Étienne (1991). "Is there a Neo-Racism?", Étienne BALIBAR and I. Wallerstein (eds.). *Race, Nation, Class: Ambiguous Identities*. London: Verso, 17-28.
- BERGEN, Benjamin (2004). "The psychological reality of phonaesthemes", *Language* 80(2). 290-311.
- BENVENISTE, Émile (1939). "Nature du signe linguistique", *Acta linguistica* 1, 23-29.
- BELARDI, Walter (2002). *L'etimologia nella storia della cultura occidentale*, Rome: Calamo.
- BERLIN, Brent (1994). "Evidence for pervasive synesthetic sound symbolism in ethnozoological nomenclature", in Hinton *et al.* 1994: 76-93.
- BLASI, Damián, WICHMANN, Søren, HAMMARSTRÖM, Harald, STADLER, Peter and CHRISTIANSEN, Morten (2016). "Sound-meaning association biases evidenced across thousands of languages", *PNAS*, 113(39). 10818-10823.
- BLOOMFIELD, Leonard (1933). *Language*, New York: Holt Rinehart and Winston.
- BLUST, Robert (2003). "The Phonestheme *ŋ*- in Austronesian Languages", *Oceanic Linguistics*, 42(1). 187-212.
- BOHAS, George et DAT, Florin-Mihai (2007). *Une théorie de l'organisation du lexique des langues sémitiques: matrice et étymon*, Lyon : ENS Editions.
- BÖHME, Jakob (1635). *De signatura rerum*, Amsterdam: Janssonius.
- BOTTINEAU, Didier (2008). "The submorphemic conjecture in English: towards a distributed model of the cognitive dynamics of submorphemes", *Lexis* 2, 17-38.
- BOTTINEAU, Didier (2010). "Language and enaction", J. STEWART, O. GAPENNE et E. DI PAOLO (éds). *Enaction : toward a new paradigm for cognitive science*, Cambridge and London: MIT Press, 267-306.
- BOTTINEAU, Didier (2013). "Pour une approche enactive de la parole dans les langues", *Langages* 192(4). 11-27.
- BOTTINEAU, Didier and GREGOIRE, Michaël (2017). "Le langage humain, les langues et la parole du point de vue du *languaging* et de l'*énaction*", *Intellectica* 68, 7-18.
- BOWLES, Hugo (1995). "The semantic properties of the phonaestheme", *Studi Italiani di Linguistica Teorica e Applicata* 24(1). 91-106.
- BOWLES, Hugo (1998). "The phonetic structure of the phonaestheme", *Studi Italiani di Linguistica Teorica e Applicata* 27(2). 351-368.
- BROSSES, Charles de (1765). *Traité de la formation méchanique des langues et des principes physiques de l'étymologie*, Paris, Saillant
- CESAROTTI Melchiorre (1785). *Saggio sopra la lingua italiana*, Padoue, Penada
- CHASTAING, Maxime (1958). "Le symbolisme des voyelles: significations des *i*", *Journal de psychologie normale et pathologique* 51(3). 403-423 and 461-481.

- CHASTAING, Maxime (1962). "La brillance des voyelles", *Archivum Linguisticum* 14(1). 1-13.
- CHASTAING, Maxime (1964). "L'opposition des consonnes 'sourdes' aux consonnes 'sonores' a-t-elle une valeur symbolique?", *Vie et langage* 147, 367-370.
- CHASTAING, Maxime (1966). "Si les R étaient des L...", *Vie et langage* 159, 311-317.
- CHAVEE, Honoré (1849). *Lexiologie indo-européenne ou Essai sur la science des mots*, Paris-Leipzig, Franck.
- CHILD, G. Tucker (1994). "African ideophones", in HINTON *et al.* 1994: 178-204.
- CRISINEL, Anne-Sylvie, JONES, Sophie and SPENCE, Charles (2012) « "The Sweet Taste of Maluma": Crossmodal Associations Between Tastes and Words ». *Chemosensory Perception* 5, 266-273.
- DALIMIER, Catherine (1998). "Introduction", Platon, *Cratyle*, Paris: Flammarion, 11-60.
- DAVIS, R. (1961) "The fitness of names to drawings: a cross-cultural study in Tanganyika", *British Journal of Psychology* 52, 259-268.
- DECIMO, Marc (2001). *Jean-Pierre Brisset - Prince des penseurs, inventeur, grammairien et prophète*, Dijon, Les presses du réel.
- DESCARTES, René (1664). *Le monde ou le Traité de la lumière*, Paris, Bobin et Le Gras.
- DESCOLA, Philippe (2005). *Par-delà nature et culture*, Paris, Gallimard.
- DESCOLA, Philippe (2017). *Penser la nature à l'heure de l'anthropocène* [videoconference], Marseille, MuCem <youtu.be/6l9Bfm6rEOc>, visited on 30.4.2019.
- DIFFLOTH, Gérard (1972). "Notes on expressive meaning", *Papers of the Chicago Linguistic Society* 8, 440-447.
- DINGEMANSE, Mark (2011). *The Meaning and Use of Ideophones in Siwu* [thesis], Nijmegen, Universiteit Nijmegen.
- DINGEMANSE, Mark (2012). "Advances in the Cross-Linguistic Study of Ideophones", *Language and Linguistics Compass* 6(10), 654-672.
- DINGEMANSE, Mark (2018). "Redrawing the margins of language: Lessons from research on ideophones", *Glossa: a journal of general linguistics* 3/4, 1-30.
- DOKE, Clement Martyn (1935). *Bantu linguistic terminology*, Londres : Longmans and Green.
- DURT, Christoph, FUCHS, Thomas and TEWES, Christian, éds (2017). *Embodiment, Enaction, and Culture. Investigating the Constitution of the Shared World*, Cambridge (MA). MIT Press.
- FIRTH, John Rupert (1930). *Speech*, London, Ernest Benn.
- FITCH, William Tecumseh (2016). "Sound and meaning in the world's languages", *Nature* 539, 39-40.
- FOX, Charles Warren (1935). « An experimental study of naming », *The american journal of psychology*, 47(4), 545-579.
- GABELENZ, Georg von der (1891). *Die Sprachwissenschaft*, Leipzig: Tauchnitz, 1901.
- GALLESE, Vittorio (2017). "Neoteny and social cognition: a neuroscientific perspective on embodiment", Durt *et al.* 309-332.
- GALLESE, Vittorio and CUCCIO, Valentina (2015). "The Paradigmatic Body. Embodied Simulation, Intersubjectivity, the Bodily Self, and Language", T. METZINGER and J. WINDT

- (éds). *Open MIND*, Frankfurt am Main, MIND Group.
- GALLESE, Vittorio, and LAKOFF, George (2005). "The brain's concepts: the role of the sensory-motor system in reason and language", *Cognitive Neuropsychology* 22, 455-479.
- GENTILUCCI, Maurizio and CORBALLIS Michael (2006). "From manual gesture to speech: a gradual transition", *Neuroscience and Biobehavioral Reviews* 30, 949-960.
- GOODY, Jack and WATT, Ian (1963). "The consequences of literacy", *Comparative studies in society and history* 5(3), 304-345.
- GRAMMONT, Maurice (1901). "Onomatopées et mots expressifs", *Revue de langues romanes* 44/4, 97-158.
- GRAMMONT, Maurice (1933). *Traité de phonétique*, Paris : Delagrave.
- HAUK, Olaf, JOHNSRUDE, Ingrid and PULVERMÜLLER, Friedemann (2004). "Somatotopic Representation of Action Words in Human Motor and Premotor Cortex", *Neuron* 41(2), 301-307.
- HAVELOCK, Eric Alfred (1977). "The preliteracy of the Greeks", *New literary history* 8(3), 369-391.
- HINTON, Leanne, NICHOLS, Johanna and OHALA, John (1994) (éds.). *Sound Symbolism*, Cambridge: Cambridge University Press.
- HAMANO, Shoko (1998). *The sound-symbolic system of Japanese*, Stanford : CSLI.
- HAYNIE, Hannah, BOWERN, Claire and LA PALOMBARA, Hannah (2014). "Sound symbolism in the languages of Australia", *PlosOne* 9(4), 1-16.
- HJELMSLEV, Louis (1928). *Principes de grammaire générale*, Copenhagen : Munksgaard.
- HUMBOLDT, Wilhelm von (1822). "Über das Entstehen der grammatischen Formen und ihren Einfluss auf die Ideenentwicklung", *Abhandlungen der Königlichen Akademie der Wissenschaften* 8, 401-430.
- HUMBOLDT, Wilhelm von (1836). *Über die Vielfaltheit des menschlichen Sprachbaues und ihren Einfluss auf die geistige Entwicklung des Menschengeschlechts*, Berlin : Königlichen Akademie der Wissenschaften.
- HUTCHINS, Sharon Suzanne (1998). *The psychological reality, variability, and compositionality of English phonesthemes* [thesis], Atlanta: Emory University.
- IMAI, Mutsumi, KITA, Sotaro, NAGUMO, Miho and OKADA, Hiroyuki (2008). "Sound symbolism facilitates early verb learning", *Cognition* 109, 54-65.
- JAKOBSON, Roman (1960). "Why 'mama' and 'papa'??", B. Kaplan & S. Wapner (eds.). *Perspectives in psychological theory*, New York : International Universities Press, 124-134.
- JAKOBSON, Roman (1965). "À la recherche de l'essence du langage", *Diogènes* 51, 22-38.
- JANCOVICI, Jean-Marc (2017). "La physique et l'économie : amies ou ennemis ?" [Conference for the seminar "Questions de Physique" organized by the Alpes section of the French Physical Society, Grenoble, 20 November 2017], *You Tube*, <<https://youtu.be/nfRbpqQu6kU>> seen on 8 October 2019.
- JANCOVICI, Jean-Marc (2019). "Jancovici: CO2 ou PIB, il faut choisir" [Conference at SciencesPo, Paris, 29.08.2019], *You Tube*, <<https://youtu.be/Vjkq8V5rVy0>> seen on 10 December 2019.
- JESPERSEN, Otto (1922a). *Language : its nature, development and origin*, London : Allen.

- JONES, James (1999) "Cultural racism: The intersection of race and culture in intergroup conflict", D. A. PRENTICE and D. T. MILLER (éds.). *Cultural divides: Understanding and overcoming group conflict*, New York: Russell Sage Foundation, 465-490.
- KANTARTZIS, Katerina, IMAI, Mutsumi and KITA, Sotaro (2011). "Japanese sound-symbolism facilitates word learning in English-speaking children", *Cognitive science* 35, 575-586.
- KLINK, Richard (2000) "Creating brand names with meaning: the use of sound symbolism" *Marketing Letters* 11(1), 5-20.
- KØNIG, Fredrick et FISCHER, John L. (1980). "Phonetic symbolism and literacy", *Language sciences* 2(2), 309-317.
- KÖHLER, Wolfgang (1929). *Gestalt Psychology* [1947<sup>2</sup>], New York : Liveright.
- KOVIĆ, Vanja, PLUNKETT, Kim and WESTERMANN, Gert (2010). "The Shape of Words in the Brain", *Cognition* 114(1), 19-28.
- KNOEFERLE, Klemens, LI, Jixing, MAGGIONI, Emanuela and SPENCE, Charles (2017). "What drives sound symbolism? Different acoustic cues underlie sound-size and sound-shape mappings", *Nature Scientific Reports* 5562(7), 1-11.
- KWON, Nahyun (2017). "Empirically Observed Iconicity Levels of English Phonaesthemes", *Public Journal of Semiotics* 7(2), 73-93.
- LEIBNIZ, Gottfried Wilhelm (1710). "Brevis designatio meditationum de Originibus Gentium ductis potissimum ex indicio linguarum", *Miscellanea berolinensis ad incrementum scientiarum*, Berlin: Papen.
- LEIBNIZ, Gottfried Wilhelm (1712 / 1991). "Epistolica de historia etymologica dissertatio", S. GENSINI (ed.). *Il naturale e il simbolico: saggio su Leibniz*, Roma, Bulzoni, 191-271.
- LEIBNIZ, Gottfried Wilhelm (1765). *New Essays on Human Understanding*. Id. *Latin and French philosophical works*, Amsterdam-Leipzig: Schreiber.
- LOCKE, John (1690). *An essay concerning human understanding*, London : Basset-Mory.
- LOMONOSOV, Mikhaïl Vassilievitch (1748). *Kratkoe rukovodstvo k Imperatorskoï* [Small handbook on eloquence], St Petersburg : Akademī krasnorečiju Nauk.
- LYMAN, Bernard (1979). "Representation of complex emotional and abstract meanings by simple forms", *Perceptual and motor skills* 49, 839-842.
- LYOTARD, Jean-François (1979). *La condition postmoderne*, Paris, Minuit.
- MASSARO, Dominic W. and PERLMAN, Marcus (2017). "Quantifying Iconicity's Contribution during Language Acquisition: Implications for Vocabulary Learning", *Frontiers in Communication* 2(4), 1-14.
- MCLUHAN, Marshall (1962). *The Gutenberg Galaxy*, Toronto : University of Toronto Press.
- MICHELUCCI, Pascal, FISCHER, Olga and LJUNGBERG, Christina éds (2011). *Semblance and signification*, Amsterdam and Philadelphia : Benjamins.
- MONAGHAN, Padraig, SHILLCOCK, Richard, CHRISTIANSEN, Morten and KIRBY, Simon (2014). "How arbitrary is language?", *Philosophical Transactions of the Royal Society B: Biological Sciences*, 369(1651), n.p. [article n° 20130299].
- MORIN, Edgar (1997). *Amour Poésie Sagesse*, Paris : Seuil.
- NEWMAN, Stanley (1933). "Further experiments on phonetic symbolism", *American Journal of Psychology* 45, 53-75.

- NOBILE, Luca (2010). "Sémantique et phonologie des suffixes altératifs de l'italien". *Studia Universitatis Babes-Bolyai Philologia LV*(4), 83-98.
- NOBILE, Luca (2011). "Words in the mirror : analysing the sensorimotor interface between phonetics and semantics in Italian", in MICHELUCCI *et al.* 2011: 101-131.
- NOBILE, Luca (2012). "Sémantique et phonologie du système des personnes en italien. Un cas d'iconicité diagrammatique?", L. BEGINI et C. BRACQUENIER (ed.). *Sémantique et lexicologie des langues d'Europe*, Rennes : PUR, 213-232.
- NOBILE, Luca (2014a). "Introduction. Formes de l'iconicité", *Le Français Moderne*, 82(1), 1-45.
- NOBILE, Luca (2014b). "L'iconicité phonologique dans les neurosciences cognitives et dans la tradition linguistique française", *Le Français Moderne* 82(1), 131-169.
- NOBILE, Luca (2015). « Phonemes as images. An experimental inquiry into shape sound symbolism applied to the distinctive features of French », M. HIRAGA, W. HERLOFSKY, K. SHINOHARA et K. AKITA (éds). *Iconicity : East meets West*, Amsterdam and Philadelphia: John Benjamins, 71-92.
- NOBILE, Luca (2019). "Voce natura storia: architetture del rapporto tra linguaggio e realtà dalle origini alla fine del mondo", A. CESTELLI GUIDI and F. R. OPPEDISANO (éds). *Il corpo della voce: Carmelo Bene, Cathy Berberian, Demetrio Stratos*, Rome: Palazzo delle Esposizioni, 52-69.
- NOBILE, Luca and BALLESTER, Jordi (2017). "Du goût des mets au son des mots. Recherches expérimentales sur le symbolisme phonétique des goûts et des arômes", F. ARGOD-DUTARD (ed.). *Le français à table*, Rennes : PUR, 125-144.
- NOBILE, Luca et LOMBARDI VALLAURI, Edoardo (2016). *Onomatopea e fonosimbolismo*, Roma: Carocci.
- NODIER, Charles (1808). *Dictionnaire raisonné des onomatopées françaises*, Paris : Demonville.
- NODIER, Charles (1834). *Oeuvres complètes*, vol. IX : Philologie, *Notions élémentaires de linguistique ou histoire abrégée de la parole et de l'écriture*, Brussels : Meline.
- ONG, Walter (1983). *Oralità e scrittura: le tecnologie della parola*, Bologna, il Mulino.
- OTIS, Katya and SAGI, Eyal (2008). Phonaesthemes: A Corpus-Based Analysis, *Proceedings of the Annual Meeting of the Cognitive Science Society* 30, 65-70.
- PARAULT, Susan and SCHWANENFUEGEL Paula (2006). "Sound-symbolism : a piece in the puzzle of word learning", *Journal of Psycholinguistic Research* 35, 329-351.
- PECK, Harry Thurston (1886). "Onomatopoeia in Some West African Languages", *American Journal of Philology* 7, 489-495.
- PEIRCE, Charles Sanders (1885 / 1993). « One, Two, Three : Fundamental Categories of Thought and of Nature » [manuscrit], The Peirce Edition Project (éds). *Writings of Charles S. Peirce: A Chronological Edition*, vol. 5: 1884-1886, Bloomington, Indiana University Press, 242-247.
- PEIRCE, Charles Sanders (1903). « Syllabus of a Course of Lectures at the Lowell Institute beginning 1903, Nov. 23. On Some Topics of Logic » [manuscrit], in The Peirce Edition Project (éds). *The Essential Peirce: Selected Philosophical Writings*, vol. 2: 1893-1913, Bloomington, Indiana University Press, 1998, 258-288.

- PERRY, Lynn, PERLMAN, Marcus and LUPYAN, Gary (2015). "Iconicity in English and Spanish and Its Relation to Lexical Category and Age of Acquisition", *PlosOne*, 10(9), e0137147.
- PETERFALVI, Jean-Michel (1964). "Etude du symbolisme phonétique par l'appariement de mots sans signification à des figures", *L'année psychologique* 64(2), 411-432.
- PETERFALVI, Jean-Michel (1965). "Les recherches expérimentales sur le symbolisme phonétique", *L'année psychologique* 65(2), 439-474.
- PETERFALVI, Jean-Michel (1966). "Symbolisme phonétique et arbitraire du signe linguistique", *Bulletin de psychologie*, 274/XIX/8-12, 632-635.
- PETERFALVI, Jean-Michel (1970). *Recherches expérimentales sur le symbolisme phonétique*, Paris : CNRS.
- PETERSEN, Steven, FOX, Peter, POSNER, Michael, MINTUN, Mark and RAICHLE, Marcus (1988). "Positron emission tomographic studies of the cortical anatomy of single-word processing", *Nature* 331, 585-589.
- PHILPS, Dennis (2008). "Submorphemic iconicity in the lexicon: a diachronic approach to English *gn-* words", *Lexis* 2, 125-139.
- PHILPS, Dennis (2011). "Reconsidering phonæstheses: Submorphemic invariance in English *sn-* words", *Lingua* 121, 1121-1137.
- PINTO, Serge and SATO, Marc (2016). *Traité de neurolinguistique*, Louvain-la-Neuve : De Boeck.
- PULVERMÜLLER, Friedemann (2002). *The neuroscience of language. On brain circuits of words and serial order*, Cambridge: Cambridge University Press.
- PYCHA, Anne (2016). "R Is for Red: Common Words Share Similar Sounds in Many Languages. The link between word sounds and meanings may not be arbitrary after all", *Scientific American*, 15.09.2016 <<https://www.scientificamerican.com/article/r-is-for-red-common-words-share-similar-sounds-in-many-languages/>>.
- RAMACHANDRAN, Vilayanur and HUBBARD, Edward (2001). "Synesthesia - A Window into Perception, Thought and Language". *Journal of Consciousness Studies* 8(12), 3-34.
- REVILL, Kate Pirog, NAMY, Laura, DE FIFE, Lauren Clepper and NYGAARD, Lynne (2014). « Cross-Linguistic Sound Symbolism and Crossmodal Correspondence: Evidence from fMRI and DTI », *Brain & Language* 128(1), 18-24.
- RIZZOLATTI, Giacomo and SINIGAGLIA, Corrado (2006). *So quel che fai: il cervello che agisce e i neuroni specchio*, Milan: Raffaello Cortina.
- RIZZOLATTI, Giacomo and CRAIGHERO, Laila (2007). "Language and mirror neurons", Gaskell, M. G. (éd). *The Oxford handbook of psycholinguistics*, Oxford: Oxford University Press.
- RODAT, Simona (2017). "Cultural Racism: A Conceptual Framework", *RSP* 54, 129-140.
- ROSIER, Irène (1995). "Henry de Gand, le *De Dialectica d'Augustin*, et l'institution des noms divins", *Documenti e Studi sulla Tradizione Filosofica Medievale* 6, 145-253.
- SAJI, Noburo, AKITA, Kimi, IMAI, Mutsumi and KANTARTZIS, Katerina (2013). « Cross-Linguistically Shared and Language-Specific Sound Symbolism for Motion: An Exploratory Data Mining Approach », M. KNAUFF, M. PAUEN, N. SEBANZ and I. WACHSMUTH (eds.). *Proceedings of the 35th Annual Meeting of Cognitive Science Society*, Austin, Cognitive Science Society, 1253-1258.

- SAMARIN, William (1965). "Perspective on African ideophones", *African Studies* 24, 117-121.
- SAMARIN, William (1971). "Survey of Bantu ideophones", *African Language Studies* 12, 130-168.
- SAPIR, Edward (1929). "A study in phonetic symbolism", *Journal of experimental psychology* 12, 225-239.
- SAUSSURE, Ferdinand de (1916). *Cours de linguistique générale*, Paris : Payot.
- SCHLEGEL, Bernhard (1857). *Schlüssel der Ewe-Sprache, dargeboten in den Grammatischen Grundzügen des Anlodialekts*, Breman: Valett.
- SCHOLEM, Gershom (1946/1995). « Abraham Abulafia and the doctrine of prophetic kabbalism », Id., *Major trends in Jewish Mysticism*, New York, Schocken, 119-155.
- SIMNER, Julia, CUSKLEY, Christine and KIRBY, Simon (2010) « What sound does that taste ? Cross-modal mappings across gustation and audition », *Perception* 39, 553-569.
- STAROBINSKI, Jean (1971). *Les Mots sous les mots*, Paris : Gallimard.
- SUZUKI, Akira (1816). *Ga-Go Onjo-Ko* [Reflections on the sound of our language].
- TAYLOR, Insup Kim and TAYLOR Maurice (1962). "Phonetic symbolism in four unrelated languages", *Canadian Journal of Psychology* 16, 344-356.
- TETTAMANTI, Marco, BUCCINO, Giovanni, SACCUMAN, Maria Cristina, GALLESE, Vittorio, DANNA, Massimo, SCIFO, Paola, FAZIO, Ferruccio, RIZZOLATTI, Giacomo, CAPPA, Stefano and PERANI, Daniela (2005). "Listening to Action-related Sentences Activates Fronto-parietal Motor Circuits", *Journal of Cognitive Neuroscience* 17(2), 273–281.
- ULTAN, Russell (1978). "Size-sound symbolism", J. H. GREENBERG (ed.). *Universals in human language*, vol. 2: Phonology, Stanford : Stanford University Press.
- VARELA, Francisco, THOMPSON, Evan and ROSCH, Eleanor (1991). *The embodied mind. Cognitive science and human experience*, Cambridge (MA) : MIT Press.
- IVO, Giambattista (1744). *Principi di scienza nuova*, Naples : Muziana.
- VILLEMAIN, Abel-François (1835). "Préface", *Dictionnaire de l'Académie française*, 6<sup>th</sup> ed., Paris : Institut de France.
- VIGOTSKY, Lev (1934/2014). *Pensiero e linguaggio: ricerche psicologiche*, Milan : Fabbri.
- VOELTZ, Erhard et KILIAN-HATZ, Christa, eds. (2001). *Ideophones*, Amsterdam and Philadelphia: John Benjamins.
- WALLIS, John (1653). *Grammatica Linguae Anglicanae*, Oxoniae: Lichfield.
- WEDGWOOD, Hensleigh (1845). "On onomatopoeia", *Proceedings of the Philological Society* 2(34), 109-118.
- WEDGWOOD, Hensleigh (1866) *On the Origin of Language*, Londres : Trübner.
- WESTERMANN, Diedrich (1907). *Grammatik der Ewe-Sprache*, Berlin: Reimer.
- WHORF, Benjamin Lee (1941). "The relation of habitual thought and behavior to language", L. SPIER (éd.). *Language culture and personality: essays in memory of Edward Sapir*, Menasha, Sapir Memorial Publication Fund, 75-93.
- WICHMANN, Søren, HOLMAN, Eric and BROWN, Cecil (2010). "Sound symbolism in basic vocabulary", *Entropy* 12(4), 844-858.

FASTL, Hugo and ZWICKER, Eberhard (1999), *Psychoacoustics: facts and models*, Berlin and New York: Springer.