Signifiances (Signifying), 3 (Varia), 125-154.
DOI : https://doi.org/10.52497/signifiances.v3i1.246

Sounding the body: the role of the Valsalva mechanism in the emergence of the linguistic sign

Dennis Philps[1]

Abstract

The main aim of this study, conducted within STEELS, a gestural theory of the origins of speech, is to set out a proposal as to the possible role of the Valsalva mechanism in the emergence of the linguistic sign. STEELS posits that in the earliest forms of speech developed by Homo, vocomimetic laryngeal resonances of nonlinguistic origin were integrated into LV (laryngeal + vowel) protosyllables referring back to oro-naso-laryngeal (ONL) actions such as breathing, sneezing and coughing. It further posits that these protosyllables were conceptually mapped to non-ONL bodily actions making use of the Valsalva manoeuvre, such as lifting, birthing, and defecating. This claim, which stems from a submorphemic analysis of certain Proto-Indo-European "body-part" roots projected back, within a gestural framework, to the emergence of speech, suggests that the vocomimetic protosyllables posited would have become (self-)referential through a neurocognitive process of recurrent, somatotopically-driven pattern-extraction.

Keywords: Valsalva ; semiogenetic ; vocomimetic ; gesture ; laryngeal resonances ; self-reference ; Proto-Indo-European

Résumé

Le but principal de cette étude, menée dans le cadre de la TSG, théorie gestuelle des origines du langage articulé, est d'explorer les contours de l'éventuel rôle qu'a pu jouer le mécanisme de Valsalva dans l'émergence du signe linguistique. La TSG postule que dans les premières conformations du langage développées par Homo, des résonances laryngales à caractère vocomimétique d'origine non linguistique ont pu être incorporées dans des protosyllabes de type LV (laryngale + voyelle) renvoyant auto-référentiellement à des actions bucco-naso-laryngales (BNL) telles que respirer, éternuer ou tousser. Elle postule également que ces protosyllabes ont pu être projetées sur des actions corporelles autres que BNL faisant appel à la manœuvre de Valsalva, telles que soulever, enfanter ou déféquer. Cette affirmation, fondée sur une analyse submorphémique de certaines racines du proto-indo-européen renvoyant au corps, rétroprojetée dans une perspective gestuelle jusqu'à l'émergence du langage articulé, laisse penser que les protosyllabes vocomimétiques postulées seraient devenues (auto-)référentielles au moyen d'un processus neurocognitif impliquant l'extraction de schémas récurrents de traits formels somatotopiquement mue.

Mots-clés : Valsalva ; sémiogénétique ; vocomimétique ; geste ; résonances laryngales ; auto-référence ; proto-indo-européen

---

[1] Emeritus Professor, University of Toulouse Jean Jaurès. Cultures Anglo-Saxonnes (EA 801)/Institut de recherche pluridisciplinaire en arts, lettres et langues (IRPALL, FED 4098). E-mail: dennisphilps@orange.fr.

> *Pre-linguistic man, as well as the modern baby,*
> *probably possessed as material for language development*
> *a set of random laryngeal and articulate utterances.*
> Allport (1924: 189)

1. Introduction

1.1 STEELS: a semiogenetic theory of the emergence and evolution of the linguistic sign

This paper builds on one aspect of an article previously published in *Signifiances / Signifying* (Philps 2017) by setting out a proposal as to the possible role of the Valsalva mechanism (Parry 2013: 38) in the emergence of the linguistic sign. It does so within the framework of STEELS, an unformalized, gestural theory of the origins of speech which posits that the developing neurocognitive and sensory-motor capacities of *Homo*[2] allowed it, well before the emergence of the species *sapiens*, to develop self-referential articulatory strategies for referring to the body *in action* by means of mutualized, supralaryngeally-shaped vocomimetic resonances.

Vocomimesis is construed here as encompassing both oro-naso-laryngeal (ONL) self-reference, i.e. that realized by resonances in units which refer back to the actions associated with this region (e.g. breathing, biting, sniffing, swallowing, and coughing) and their effectors, whether internal (teeth, tongue, gums, etc.) or external (lips, chin, cheeks, etc.), and bodily self-reference in general, i.e. that realized by resonances in units which refer to actions performed sympathetically[3] by other parts of the body (e.g. grasping, walking, bending, pulling, etc.).

Embodied conceptual mapping, so called because it makes use of dynamic, pre-existing neural maps of bodily experience (Damasio, 2010: 66-68), primarily involves cognitive processes of metaphor and metonymy (Lakoff & Johnson 2003), simulation (Gallese & Lakoff 2005) and enaction (Bottineau 2008). It is materialized by an essentially "top-down" cognitive naming strategy underpinning both intra-domain transfer within the conceptual domain of the human body and inter-domain transfer from the source domain of the body and its movements to the target domain of inanimate objects and their displacements (Heine 1997: 137-139).

The nature of the actions performed by parts of the body other than those of the ONL region appears to depend predominantly on the concept of homology: what is posited to drive the mapping of these self-referential units from ONL actions to non-ONL actions is the brain's ability to construct and physify somatosensory representations of correspondences, particularly in spatio-temporal movement and configuration, structure, function and (proprio)sensation, between coordinated articulatory gestures performed by the vocal apparatus and coordinated articular gestures performed by other parts of the anatomy.

1.2 STEELS and submorphemic relations

I have previously submitted, on the basis of a submorphemic analysis of those subsets of English '*sn*- words' and '*gr*- words' exhibiting the phono-notional relations {*sn*-/nasality} and {*gr*-/prehension} respectively (Philps 2011), that these dyads, so called because the pair of embraced entities in the subsets concerned is construed to be the result of two interacting vectors, one phonological, the other notional, can be traced back to Proto-Indo-European (henceforth PIE). Examples drawn from the above subsets are, respectively, *sn*- in *sniff*, etc. <

---

[2] The genus *Homo* is generally considered to date back over 2,000,000 years to the emergence of *Homo habilis*, the species *Homo sapiens* around 300,000-200,000 years, and its subspecies *sapiens sapiens* some 125,000 years (see Donald 2001: 261 and Kimbel 2009).

[3] In the Darwinian sense of the term (see Darwin 1998: 40).

PIE *(*s*)*n*- in a *-*p*- extension of *(*s*)*neu̯*- '± relative to the nose' (Southern 1999: 69-71), and *grab* < PIE **ghr*- in **ghrebh*- '± seize, grasp' (LIV 201). The degree of linguistic safety of this back projection can be assessed against the validity of the "Comparative Method" used in historical linguistics, based as it is on the identification of regular correspondences in sound change, syntax, semantics, the lexicon, and other areas of language in order to demonstrate linguistic relatedness and reconstruct protolanguages and their properties (e.g. Durie & Ross 1996, Hale 2014: 146-160). Crucially, my claim also rests on the validity of the extension from the morphemic to the submorphemic level of the principle of linguistic invariance proposed by Guillaume in his psychomechanical theory of language (Guillaume 1984) and that of cognitive invariance proposed by Lakoff in his theory of conceptual metaphor (Lakoff 1990).

However, while retracing submorphemic phono-notional relations such as {*sn*-/nasality} and {*gr*-/prehension} from Modern English to PIE can arguably take us back some 6,000 to 8,000 years BP[4] (EIEC 586), bridging the incomparably long timespan between PIE and the indeterminable period during which speech emerged cannot be accomplished by using the Comparative Method, or indeed by linguistic comparison in general, if only for want of relevant data. However, other methods of reconstruction exist that may provide a guide as to possible directions of exploration, such as that used by de Saussure (1879) in identifying the short vowel + resonant-like segments he called "coefficients sonantiques", later to be known as "laryngeals" in PIE,[5] i.e. internal reconstruction. But whatever linguistic methodology is used to bridge this timespan, it appears doomed to failure, if only because the origins of the linguistic sign were likely nonlinguistic, a tenet held notably by advocates of gestural theories of the emergence of speech such as MacNeilage (1998, 2008).

MacNeilage's approach to the origins of speech is an ethological one set in an embodiment perspective. In particular, it takes into account the relatively recent discovery of mirror neuron systems in the human brain (see 2.1), a discovery which "has had more important consequences for the embodiment perspective than any other event in contemporary cognitive neuroscience" (MacNeilage 2008: 325), and which may well underlie the general-purpose hominid mimetic capability explored by Donald (1990, 2001). Although scope does not allow me to develop the importance of ethological theorizations here, they are clearly far from tangential. For instance, Provine (1996) points out that among ancient modes of prelinguistic and presymbolic communication are those of contagious yawning and laughter. Pursuing a neuroethological approach to these phylogenetically ancient forms of social coupling that coexist with modern, consciously controlled social behavior, he touches in particular on the role of the Valsalva mechanism in the motor act of yawning (*ibid.*, 184).

On a formal level, STEELS attempts to bridge the timespan between PIE and the emergence of speech not by mobilizing the linguistic methods of comparison and reconstruction evoked above, but by viewing the static, manner features of traditional phonetics such as [+occlusive] and [+nasal], and place features such as [+labial] or [+glottal], as combining to create dynamic, vocal *gestures* seen as units of articulatory action (Browman & Goldstein 1992: 23). It is the resonances produced by these gestures, doubtless accompanied by kinemimetic oro-naso-laryngeal processes or acts performed (self-)referentially by the vocal organs such as modulation of breathing (e.g. phonation, aspiration), labialization, protrusion, elevation and retraction,[6] that would have coalesced to form the earliest *Homo* protosyllables (henceforth *H*-protosyllables).

---

[4] 2019 in the case of this paper.

[5] So called because they were believed by Möller and Cuny to have had a pharyngeal, epiglottal, or glottal place of articulation involving a constriction near the larynx.

[6] See Paget 1930: 136-138.

Insofar as these gestures are construed in articulatory phonology as physically real events consisting of the formation and release of constrictions in the vocal tract, STEELS posits that the initial syllabic form of these *H*-protosyllables may be reconstructed as *CV*, in which *C* corresponds to the resonance produced by the constriction phase, and *V* to that produced by the subsequent release phase. This hypothesis is given credence by the fact that recent descriptive and theoretical studies of the syllable recognize that *CV*, usually regarded as consisting of an onset and a nucleus conforming to a hierarchical sonority scale (i.e. the Sonority Sequencing Principle), is an absolute universal in all modern languages, and the first to be acquired by infants (e.g. Carlisle 2001).

On a semantic level, STEELS motivates the attribution of putative "notional" values to submorphemes such as *sn*- (nasality) and *gr*- (prehension) in certain subsets of English '*sn*-words' and '*gr*- words'[7] by adopting one of the major tenets of cognitive semantics, namely that meaning is a culture-dependent conceptual structure within a cognitive system. Conceptual structures are seen in this light as embodied, i.e. mapped within the sensory-motor system (Gallese & Lakoff 2005: 456), which implies that meaning is perceptually and kinaesthetically rooted, rather than being independent of perception or bodily experience, and can as such, be modeled in terms of image-schemas (Lakoff 1990) by means of theories of conceptual spaces such as that proposed by Gärdenfors (2000, 2014).

2. STEELS and the neural basis of vocomimesis

2.1 Mirror neuron systems

As pointed out by Donald (1990: 5), most theories of cognitive structure tend to emphasize the *modern* structure of human mental capacities, to the detriment of their evolutionary path. According to Donald (*ibid*., 2-3), the modern mind constitutes a mosaic structure of cognitive *vestigia* from earlier stages of human emergence including mimetic action, the cognitive basis of which was likely the extended representation of self and the consequent improvement of conscious motor control (*ibid*., 189). Now vocomimesis and imitation in general have a neural basis, as has been confirmed by the discovery of mirror neuron systems, located essentially, though not exclusively, in Broca's area of the human brain. This finding may help to explain the neural basis of vocal interaction, and to sketch a possible account of the origins of human language based on the hypothesis of an evolution from facial and brachio-manual gesturing to oro-laryngeal gesturing (e.g. Rizzolatti & Sinigaglia 2008: 164-168).

Mirror neurons are hypothesized to constitute the neural basis of a mechanism that creates a direct link between speaker and hearer in terms of production and perception processes by transforming a goal-oriented action performed by an individual into a representation of the same action in the motor cortex of the observer, thereby engendering a direct, non-arbitrary semantic link between them that satisfies the 'parity requisite' (*ibid*., 153). In other words, vocal interaction is fundamentally *co-enactive* (Bottineau 2009), a multimodal action such as "grasping" being neurally enacted and *shared* by communicating individuals thanks to the presence in the brain of common neural substrates used for both action and perception (Gallese & Lakoff 2005: 459).

To account for the neurophysiological grounding of the cognitive structure and conceptual spaces hypothesized by contemporary neuroscience, STEELS posits that the original

---

[7] See Grégoire 2012 for a study of this phenomenon as applied, within a theory of "submorphemic saliencing", to the lexicon of Spanish.

vocomimetic naming strategy inferable from the projection of submorphemic data from PIE to its unknown past within a gestural framework results from the articulatory encoding of the dynamical, somatotopically-organized representations of the body in the brain posited by Damasio (2010: 95), Rizzolatti & Sinigaglia (*ibid*., 122), and others. Note that the expression "somatotopically-organized" refers to the topographic organization of function along the cortex, i.e. to a map of the sites at which regions of cortex form functional units corresponding to body parts or to motion across joints (Stippich 2015: 77).

2.2 Conceptual projection

Other than for call systems, the initial use of the human vocal organs, previously dedicated to nonlinguistic purposes such as prehension, ingestion, mastication and protection of the trachea, would, in the light of the semiogenetic perspective outlined above, have been fundamentally self-referential, vocomimetic, metonymic (the sound for the action), and simulative (the sound as if it were the action). Once incorporated into *H*-protosyllables, the resonances thus produced, which would initially have referred back to vocal tract actions and activities, would have been projected by somatotopically grounded conceptual mapping to other bodily actions and effectors that perform close-open movements homologous to those produced by adduction-abduction cycles of the vocal cords and the jaws, one of the most notable of which is flexion-extension, as in bending (the knees, the hands, the elbows, the vertebrae, etc.).

One possible vestige of this inferred naming strategy, as observed through the PIE "body-part" roots **ĝenu-* '± jawbone, chin' (IEW 322) and **ĝenu-* '± knee, angle' (IEW 380-381), is discussed in Philps 2009. Here, the form of the root noun **ĝenu* '± jawbone, chin', in which, given its sense, the occlusive resonance **ĝ-* may continue a resonance that was originally vocomimetic of cycles of mandibular occlusion,[8] would have been projected metaphorically to the cyclical, articular movements of the knees (typically flexion-extension), thus appearing as **ĝ-* in **ĝenu* '± knee, angle', and on, by semantic broadening, to the legs in general.[9]

Once bodily actions and effectors had been named by means of this neurocognitive strategy, the self-referential segments thus created would have been projected metaphorically from the corporeal domain to the pericorporeal and extracorporeal domain, thus allowing early humans to name, infer, and understand their environment in terms of self. In the case under discussion, derivatives of **ĝenu-* '± jawbone, chin' may have been mapped, by mental extraction of the common salient properties of the source domain (see 3.2), to name projecting entities in the extracorporeal domain, and derivatives of **ĝenu-* '± knee, angle' to name angular entities (cf. its Greek reflex γωνία 'corner, angle'). There is however reason to suspect, if only because the root nouns in question are not derived from a verbal form, that PIE **ĝenu-* '± jawbone, chin' and **ĝenu-* '± knee, angle' are secondary formations, perhaps coming to displace, conditionally, derivatives of potentially older (given the presence of a root-initial laryngeal) **h₂eu̯-* '± eat, consume' (LIV 274) and **h₂enk-* '± bend, flex' (LIV 268) respectively (see 7.3).

Although STEELS stems initially from analysis of the Indo-European family of languages, it is legitimate to enquire as to whether examples of the cognitive naming strategy it postulates are to be found in other language families. In this respect, Andersen (1978: 355) provides examples of what appears to be top-down metaphorical mapping (noted >>) from one bodily domain to another in compound words in Poqomchi', spoken by the Poqomchi' Maya of Guatemala:

- *nah* 'head' >> *nah ch'ehk* 'knee' (= 'head of the lower leg'), *nah* 'head' >> *nah oquis* 'toe' (= 'head of the foot')

---

[8] Cf., for the action of 'masticating' broadened to 'eating', **ĝ-* in **ĝebh-* '± 'eat, chew' (LIV 161).

[9] Cf., for the action of 'walking', **ĝh-* in **ĝhengh-* '± stride' (LIV 175-176).

- *ju7* ‘nose’ >> *ju7q’ob’is* ‘finger’ (= ‘nose of the hand’), *ju7* ‘nose’ >> *ju7 oquis* ‘toe’ (= ‘nose of the foot’).

Significantly, comparable instances of top-down metaphorical mapping within the bodily domain may be reconstituted from one subset of polysemous ‘*kn-* words’ recorded in English dialect attesting the phono-notional dyad {*kn-*/protuberance}, e.g.:

- *knob* (n.): ‘head’ >> ‘nose’; >> ‘point/joint of the elbow’; >> (*pl.*) ‘toes’ (EDD^{III} 476-477)
- *knop* (n.): ‘head’ (EDD^{III} 482) >> ‘elbow-joint’; >> ‘front of the knee’ (OED)
- *knot* (n.): ‘the top of the head’ >> ‘knuckle’ (EDD^{III} 482).

In Finnish, Andersen adduces *paa* ‘head’ >> *kynärpää* ‘elbow’ (= ‘head of the ulna’) and, in Hausa, *gwiwa* ‘knee’ >> *gwiwar hannu* ‘elbow’ (= ‘knee of the arm’).

Many other examples of this type of conceptual mapping and its underlying structural patterns (top-down, unidirectionality, metaphor, etc.) are drawn by Heine (1997: 133-139) from African language families in general and, through data provided and analysed by scholars such as Matisoff (1978) and Wilkins (1996), from East and Southeast Asian, Tibeto-Burman and central Australian languages. Even if a possible vocomimetic origin of the above data is impossible to envisage without further investigation, it does seem that in certain modern non Indo-European languages, vocomimesis is still detectable, or at least conceivable. In classical Arabic, for instance, Bohas & Saguer note that:

> Cette corrélation [observée dans les matrices {[+nasal],[+continu]} étudiées] entre les [+nasal] et l’invariant notionnel qui s’organise autour du nez, ne semble pouvoir s’expliquer que par la motivation corporelle, le trait [+nasal] étant le traducteur d’une articulation ou sonorité traductrice d’un signifié. (Bohas & Saguer, 2012: 33-34)

As affirmed in 1.2, the dyads {*sn-*/nasality} and {*gr-*/prehension} can be retraced some 6,000 to 8,000 years from English to PIE with some degree of confidence on both the formal and semantic levels by virtue of laws of regular sound change (e.g. Grimm 1819-1837) and semantic change. Although much less regular and systematic, natural tendencies of semantic change, such as that from more concrete to more abstract meanings (e.g. Sweetser, 1990: 18), may however be used in the initial steps of the Comparative Method according to Wilkins (1996: 298). Furthermore, the discovery of vestigial semantic evidence during this period for top-down conceptual mapping within the bodily domain provided in Modern English by that subset of ‘*kn-* words’ characterized by the phono-notional dyad {*kn-*/bodily protuberance} and, in PIE, by **ĝenu-* ‘± jawbone, chin’[10] >> **ĝenu-* ‘± knee’ (see 2.2 and Guyőri & Hegedűs 2011), does plead for a projection of these phenomena into the more distant past in an attempt to identify their possible conditions of emergence. This is all the more so as comparable semantic evidence of conceptual mapping has been seen to exist in other language families, and as, in the case of the dyad {*kn-*/protuberance}, at least one of the Modern English words concerned, namely *knot* (n.), may be traced back, albeit tentatively, to PIE **ĝenu-* ‘± knee’ via Proto-Germanic.

More specifically, Kroonen (2013: 298-299) suggests that PGerm. **knūÞan-* ~ **knuttan-* (n. m.) ‘knot’ (> OE *cnotta* (n.) ‘knot’, Mod. Eng. *knot* (n.), etc.) is likely to be “a *ton*-formation to the PIE root **ǵnu* ‘knee; node’” [base II of **ĝenu-*]. He also affirms that PGerm. **kinnu-* (n. f.) ‘cheek’ (>OE *cinn* (n.) ‘chin’, Mod. Eng. *chin*, etc.) derives from PIE **ĝenu-* ‘jawbone, cheek’, and provides semantic evidence from daughter languages of conceptual mapping not only within the bodily domain (e.g. (internal → external): jawbone >> chin, jawbone >> cheek),

---

[10] See also the ablauting **o*-grade/zero grade derivatives **ĝ6nh*$_2$*dh-o-s*/**ĝnh̥*$_2$*dh-o-s* ‘jaw' (EIEC 322).

but also from the bodily domain to the extracorporeal domain (e.g. jaw >> edge of an axe[11] (Gk. γένυς, *ibid*., 288)).

2.3 From vocomanual to vocal communication

Long before the emergence of *Homo sapiens* some 300,000-200,000 years ago, members of the genus *Homo* already possessed, in their earliest forms and functions, the oro-naso-laryngeal apparatus and the locomotor-respiratory capacity necessary to effect these vocal gestures (Grine et al. 2009, Bramble & Carrier 1983). However, and this is surely the crux of the matter, whatever the precise morphological configuration and physiological functions of the anatomy that allow humans to produce the full range of speech, they would not have been useful without a brain and its cognitive pattern generators that could reiterate the complex articulatory gestures that underlie speech (Lieberman 2007: 47).

Furthermore, the brain creates dynamic maps not only of the structures that compose the body proper, but also of the functional states they assume, thereby introducing the body *as content* into the mind process (Damasio 2010: 89). So what major cognitive innovations could have allowed early humans to develop speech? For Donald (1990: 135-136, 189), one of these would have been the manner in which the body and its movement in space was represented in the brain through the development of a pre-existing, mimetic capacity for self-representation and representation of entities external to self, thus enabling the use of the entire body as a reenactive device in gesture and pantomime. In short, human self-reference appears largely grounded in personal embodiment and mimesis.

It is these premises that led STEELS to posit, as stated in the Introduction, that speech in *Homo* arose prelinguistically as a result of the gradual development of the brain's (and thence the mind's) capacity for somatotopically-driven, self-referential vocomimesis. This could have led it, well before *Homo* became *sapiens*, to collectively develop a pre-reflective, vocal naming strategy that would have been applied initially to bodily actions and effectors, before being projected to its pericorporeal and extracorporeal environments, which would therefore have been understood and modelled in terms of the ever-evolving human body-image. Such a strategy would have involved encoding the dynamic electro-chemo-neurally formed "brain maps" of the body in action articulatorily by exaptation of the originally nonlinguistic uses of the oro-naso-laryngeal apparatus and functions for prelinguistic and then linguistic purposes. Furthermore, its likelihood is increased by the discovery made by Gentilucci and co-researchers that the same neural command circuitry is involved in controlling grasping movements of both hand and mouth (Gentilucci et al. 2001: 1698), a discovery that has contributed to renew speculation that a brachio-manual system used for intersubjective human communication may have evolved into an oral system.

Although one could hardly expect that linguistic traces of such a transfer pattern between hand and mouth would survive in modern-day languages, particularly in the absence of theories accounting for the way in which the evolution from vocomanual to vocal communication came about, empirical semantic evidence for it may be provided in English by dictionary definitions illustrating the polysemy of '*gr*- words'. One example of this is provided by *grip*: 'to grasp or seize firmly or tightly with the hand; to seize with the mouth' (OED) (if top-down, teeth >> fingers). In summary, despite the immense and empirically unbridgeable time gap involved, reconstructed linguistic traces of this postulated vocomimetic strategy, both formal and semantic, may still be detectable at the morphemic and submorphemic levels some 200,000 to

---

[11] A weapon which may be made from the jawbone of a large animal.

300,000 years later in the reconstructed lexicon of PIE, and empirically, some 6,000 to 8,000 years further on, in the lexicons of many of the world's other major language families.

3. STEELS and the Valsalva manoeuvre

3.1 The Valsalva manoeuvre

The Valsalva manoeuvre, which consists of a voluntary forced expiratory effort against a closed airway, is named after the Italian physician and anatomist Antonio Maria Valsalva (1666-1723), who advised forceful expiration against closed nostrils and mouth to increase intrathoracic pressure transmitted through the open glottis to the oro-naso-pharyngeal cavity, thereby opening Eustachian tubes and inflating the middle ear (Valsalva 1704). This manoeuvre has gradually become confused with abdominal straining, in which forceful expiration occurs against a closed glottis. Whether accomplished with an open glottis or involving abdominal straining with a closed glottis, it can occur spontaneously and unintentionally in everyday life during coughing, vomiting, urinating, defecating, or bearing down during parturition, as well as during other activities involving straining or blowing against resistance, such as blowing up a balloon or playing a wind instrument (Pstras et al. 2016).

Since the various muscles (and other regulatory mechanisms) involved in the Valsalva manoeuvre are neurologically connected, they tend to contract simultaneously. In particular, abdominal straining and contraction of the rectal muscles is typically accompanied by complete, reflexive closure of the larynx, an organ whose functions are maintained by coordinated action of intrinsic and extrinsic muscles, and which depends on an intact neural supply. This fact strengthens Darwin's conjecture that involuntary and purposeless contractions of the muscles of the chest and glottis may have first given rise to the emission of vocal sounds (Darwin 1998: 89). According to Scherer, whom it is worth quoting at some length in the present context,

> it [i.e. the larynx] permits breathing, blowing, and sucking, as well as yawning, voiceless consonant production, and musical instrument playing. As a transient closed valve it produces coughing and throat clearing. As a constant closed valve it participates in swallowing and effortful behaviors such as lifting and defecation. As a voiceless repetitive articulator, it valves airflow to produce staccato whistling. As a voiced repetitive articulator it produces laughter, the singing ornament trillo, and repetitive glottalization of vowels such as the admonition with rising pitch and intensity "a-a-a-ah!". As a partially closed voiceless valve, it produces whisper. As a partially closed voicing valve, the larynx produces vowels and prolonged voiced consonants. And as a speech coarticulator, it participates in the production of consonant-vowel strings." (Scherer 1994: 171)

In addition to its motor activity, the larynx is also a sensory organ, the neural control of which is particularly complex. Breathing activity, for instance, is controlled by central pattern generators (i.e. biological neural circuits) in response to respiratory demand, but can be overridden by voluntary activity, while the larynx functions as a sound generator by opening and closing the airway at a rapid rate, thus interrupting the breath stream (Dickson & Maue-Dickson 1996: 136-137). The larynx is, then, the organ of phonation, of which the basic perceptual features are the presence and change of duration, pitch, register, loudness and quality. Phonation also involves the neuromuscular and biomechanical control of, or changes in, vocal fold motion, vocal fold length, vocal fold contour, arytenoid and vocal fold adduction, subglottal pressure, vocal fold tissue normality, and vocal tract shape.

3.2 ONL actions: coughing

As stated above, STEELS posits that laryngeal resonances in particular were recruited by *Homo* to refer back vocomimetically to laryngeal actions mobilizing the neurologically coordinated combination of laryngeal, thoracic, abdominal and rectal muscles known as the Valsalva mechanism, a use I refer to as "laryngeal self-simulation". Neurocognitively speaking, these self-referential vocal gestures would have been accomplished by a process akin to that which Fortescue refers to as "pattern-extraction through abstraction" (2017: 6). More specifically, the pattern of laryngeal (and possibly pharyngeal) resonances produced by recurrent gestures of closure characteristic of the complex, largely neurally controlled actions performed by the larynx during an act of coughing for example, would have been unconsciously extracted, by a process of mental abstraction (i.e. of conceptual generalization across experience), from the holistic act, as would the supralaryngeal shape of these gestures of closure.

And if, in the genus *Homo*, mutual understanding is attributable in particular to the existence of a common neural substrate capable of coding sensory-motor information (Rizzolatti & Sinigaglia 2008: 153), then these voluntary or involuntary resonances may have been understood co-enactively by speaker and hearer alike, whether as individuals or in social groups, as referring back to repeated occurrences of the act performed, both in situ and, perhaps even more importantly, ex situ. With respect to cooperative tasks involving physical effort which gave rise to involuntary vocalizations, Noiré points out that the same sounds would have been uttered during collective, goal-oriented actions, implying that these sounds were recognized and understood as meaningful by all the members of the social group concerned (Noiré 1877: 332).[12]

To amplify on the ONL-related example of "coughing" evoked above, cough, mediated via the vagus nerves, is a mechanism which involves an initial deep breath, a brief, powerful expiratory effort against a closed glottis, and opening of the glottis with closure of the nasopharynx and vigorous expiration through the mouth. Like swallowing, cough can be produced and mimicked voluntarily and accurately, and may also be used as a form of communication (Widdicombe 2003: 17). It is the resonance produced by this iterative, patterned, glottic closure-and-release gesture which, I submit, would have been unconsciously extracted from the holistic act of coughing and incorporated into an *LV* (i.e. laryngeal constriction-release) *H*-protosyllable, understood by speaker and hearer alike as referring reflexively to this act.

3.3 Non-ONL actions: birthing

With respect to non-ONL bodily actions involving the Valsalva mechanism, I will take the example of parturition, particularly in view of the reconstruction of PIE *h_2ens- '± give birth' (> Hit. *ḫāši / ḫašš-* 'give birth', etc.), in which the word-initial laryngeal *h_2 is posited to function as a core invariant (see 6.3) that vectors the phono-notional value of 'birthing' (see [7.3.4]). According to Lemos et al., childbirth is characterized by spontaneous alterations in the mother's breathing coordinated with the generation of marked thoracic and abdominal pressures to assist with expulsion of the fetus (Lemos et al. 2011: 67).

When giving birth to her child, the mother-to-be may adopt several positions: the lithotomy position or, often in a sequence, squatting, standing, kneeling, and crouching on all fours. These positions are known to vary historically, geographically, and culturally (Engelmann 1883: 61ff.). During the second stage of labour, she may perform a Valsalva manoeuvre, which consists of inhaling deeply, and then forcefully exhaling against a closed glottis to create intrathoracic and abdominal pressures, thus releasing an effortful grunt. As for open-glottis pushing, it is accompanied by effortful grunts and groans, so that at any particular moment, the

---

[12] See also Briceño Guerrero 1970: 70 on this subject.

mother-to-be may be pushing with her glottis intermittently open and closed (Barasinski et al. 2016: 12-13).

Now in humans, a grunt has been defined as “the vocalization that results when brief glottal closure (by activation of the laryngeal muscles) is followed by abrupt vowel-like release (i.e., a brief egressive voiced breath), occurring with open or closed lips but no other supraglottal constriction.” (McCune et al. 1996: 27). Since grunts are among the earliest vocalizations observed in infancy, with the same vocal form occurring autonomically in response to metabolic demand and as a communicative vocalization for infants at the transition to speech, the authors suggest that there exists a developmental progression linking effortful grunts with communication (*ibid.*, 28, 29). It is a similar developmental progression, I submit, that occurred during the earliest period of the emergence of the linguistic sign in *Homo*. In the case of parturition, the laryngeal vocalization produced when brief glottal closure is followed by sudden release during labour would have been extracted mentally from the holistic act, as would the physical gesture of the closure itself and the shape of the supralaryngeal cavity, and understood by speaker and hearer alike as referring back to recurrent occurrences of the act of giving birth.

3.4 Phono-notional values attributable to *V* in the *Homo* protosyllable *CV*

If vocomimesis is considered to be one of the fundamental dynamics conditioning the emergence of the linguistic sign, then one cannot rule out the possibility that the *V* component of the *CV* form of the *H*-protosyllable posited by STEELS also partook of this dynamic, particularly if this protosyllable is seen as a gestural unit, i.e. as the constriction and release of one of the vocal organs coupled with phonatory action. It therefore appears legitimate to speculate as to what differential phono-notional values this release component, which combines controlled, strictureless vibration of the vocal folds with supralaryngeal modulation and associated formants, may have possessed.

Although this avenue of research is fraught with theoretical and methodological difficulties, a number of distinguished scholars have attempted to explore it throughout recent and not-so-recent history.[13] Among these, in modern times at least, is Jespersen, who conjectures that in some languages, the vowel *i* is often symbolic of what is small, of a very short time, or, in corresponding pronouns and adverbs, of what is nearer in opposition to other vowels, especially *a* or *u*, often associated with what is farther off (Jespersen, 1922: 402). Furthermore, Swadesh affirms that to the present time, “vocalic timbres are usually associated with shapes corresponding to the form that the mouth must assume to produce each of them; that is, approximately sharp, flat, and round, respectively, for *i*, *a*, and *u*.” (Swadesh, 2006: 200). One Indo-European scholar to have identified the quality of PIE vowels (whose phonetic interpretation is, however, subject to great caution) with time, shape, and size symbolism, is Jóhannesson, who ventures that particularly in roots belonging to “spontaneous sounds of bodily reaction”, *e* often describes what is present in time and space and *o* what is absent in time and space, and that the rounded vowels *u* and *o* probably expressed that which was round, vaulted, hollow, or which had a curved shape (Jóhannesson, 1949: 44, 47).

However, if the three principles governing expressive oral gesturing proposed by Fónagy are correct [voluntary reproduction of symptoms associated with the vocal apparatus, substitution of bodily gestures by the movements of the speech organs, and quantitative isomorphism of expression and content (Fónagy ,1999: 7-9)], then vocomimesis across the postulated *CV* form of the original *H*-protosyllable cannot be envisaged purely in isolation. This is essentially because it is likely that if *Homo imitans* employed vocal mimesis self-referentially as it became

---

[13] In the Upanishads for instance: see Aitareya Aranyaka III.2.6.2, notably in Müller (2001: 263-264).

Homo loquens, it also employed, consciously or not, other forms of mimesis as its self-representational ability developed.

Lastly, Fridlund makes the point that although formal, propositional language may be a relatively recent development in human evolution, nonlinguistic vocalization was probably present among all protohumans, and with it, paravocal facial movements, some of which would have become ritualized as signals (Fridlund, 1994: 302). The author argues, convincingly in view of the fact that speech involves the modification of metabolic breathing behaviour, that facial paralanguage must have arisen from respiration, insofar as respiratory modulation is the basis of vocalization (*ibid.*, 303).

Suffice it to say that there is a strong likelihood that if vocomimesis was at some stage a fundamental dynamic conditioning the emergence of the linguistic sign, it would have operated across the entire postulated *H*-protosyllable *CV*, and not just on *C*, before morphing into a linguistic phenomenon that some term “phonetic iconicity” (e.g. Körtvélyessy, 2011: 28). If so, then it is likely that supralaryngeal phenomena involved in overall vocal tract posturing such as neuromuscularly controlled functions, positions, tensions and movements of the jaw(s), lip(s), and tongue, along with degrees of aperture/closure and intonational/prosodic iconicity, may initially have been vocomimetic, and later symbolic, of nonlinguistic ONL vocalizations. The *CV H*-protosyllables thus configured, henceforth charged with bodily meaning and understood mutually to be so, would subsequently have been projected to different types of non-ONL actions before being mapped to the pericorporeal and extracorporeal conceptual domains. This direction of projection may conceivably have been reversed by expressively-motivated retroprojection to bodily actions and effectors (e.g. Modern Eng. *snout* (n.) ‘the projecting part of the head of an animal, which includes the nose and mouth’ >> ‘the nose in man, esp. when large or badly shaped’ (OED)).

These considerations suggest that the remark made by Diamond (1959: 214) concerning *Homo*’s phonatory ability to produce laryngeal sounds as its glottis closed in the effort of bodily actions does indeed justify non-trivial speculation as to whether effortful closure involving the Valsalva mechanism may have been a factor involved in the development of a capacity for vocomimetic self-reference, and whether traces of this phenomenon may still be detectable, notably in PIE.

4. The Valsalva mechanism and body representations

4.1 Somatotopic representations of the larynx

In neuroimaging experiments on speech production designed to isolate elementary components of phonation and articulation such as lip and tongue movements, Brown et al. (2008) demonstrate the existence of a larynx-specific area in the motor cortex activated comparably by vocal *and nonvocal* tasks (my emphasis). In a subsequent paper (Brown et al. 2009), it is shown that the strongest motor activation for speech corresponds to the somatotopic larynx area of the motor cortex, thereby confirming the important contribution of phonation to speech production. This activation in the orofacial region of the primary motor cortex is interpreted as reflecting “mouth” functioning, and thus articulation. In their 2008 paper, Brown et al. recall that phonation through vocal-fold vibration cannot occur unless the vocal folds are in an adducted position, and that adduction also occurs during an array of nonvocal processes in which glottal closure is necessary, such as childbirth, defecation, coughing, throat clearing, lifting heavy objects, and straining in general. They go on to point out that one clinical use of vocalfold adduction occurs during the Valsalva manoeuvre, in which forced expiratory movement against a closed glottis is used to assess autonomic control of cardiovascular function (*ibid.*, 837).

Now in the light of the discovery of a somatotopic representation of the larynx in the human motor cortex (and also a representation of the expiratory muscles in the same region, possibly reflecting a unique cortical level type of respiratory/phonatory coupling specific to human vocalization),[14] and of a larynx-specific area in the motor cortex which is activated comparably by vocal and nonvocal tasks, it becomes legitimate to explore the hypothesis that resonances produced in the larynx and shaped supralaryngeally may have come to be used vocomimetically by *Homo* as meaningful articulatory bases. These would have referred back not only to the vocal tasks in which they necessarily participate (e.g. calling, speaking, singing, all of which require phonation through vocal-fold vibration), but also to the nonvocal tasks (e.g. parturition, defecation and deglutition, which all involve glottal closure followed by vibratory release) in which they occur naturally.

If, in spite of its indemonstrability, this hypothesis is envisaged, then why are linguistic traces of what amounts to a pre-reflective naming strategy as applied to bodily activities involving glottal closure so few and far between in modern languages? In view of the widespread assumption that notwithstanding the existence of other, exocorporeal models, the body schema serves more or less universally as a structural/conceptual template allowing us to understand, denote and make inferences about our corporeal, pericorporeal and extracorporeal environment (e.g. Heine 1997), why are so many different types of conceptual mapping, bodily partonomy and body-part meaning templates attested crosslinguistically (Majid & van Staden 2015)? Although these interrogations fall outside the scope of this paper, it may be recalled that according to Mueller et al. (2013), the human brain itself is characterized by significant inter-individual variability in neuroanatomy and function, reflected in sizeable individual differences in human cognition and behavior, a variability that the authors attribute notably to genetic and environmental influences that may differentially impact on different brain systems. In their exploration of inter-subject variability in functional connectivity, they also find that variability is highest in phylogenetically late-developing regions of the cortex that are essential to complex human cognitive functions such as reasoning and language.

4.2 Body representations in language

Given the extreme complexity of the factors and parameters involved in the study of body representations, I can only sketch out here the major discernments which must be made to account for them constitutively. At the price of considerable simplification, these factors and parameters can be viewed at three, interconnected levels: the neural, the cognitive and the semantic, the whole overarched, inter alia, by symbolic, cultural, social and environmental factors, as well as by belief systems.[15]

As linguists, our point of departure must be linguistic manifestations of body representations (e.g. lexical polysemy), whether the units analysed belong to the morphemic level (e.g. Eng. *knop* (n., dial.) ‘head, elbow-joint, front of the knee’) or the submorphemic level (e.g. *sn-* in that subset of English ‘*sn-* words’ with meanings, none of which is identical, that refer to the notion of ‘nasality’, such as *sneeze* (n.), *sniff* (n.) and *snot* (n.)). If notions are construed as being conceptual in nature, and meaning as a culture-dependent conceptual structure within a cognitive system, then an appeal may legitimately be made to cognitive semantics (e.g. Allwood & Gärdenfors 1999) and, given the contours of the conceptual domain in question, to embodied meaning (e.g. Johnson 2012).

---

[14] See Loucks et al. 2007.

[15] See Usó-Doménech & Nescolarde-Selva 2015 for a study of belief systems. Among studies of body symbolism are those of Onions 1999 on the knees (174-186), and Alpenfels 1955 on the hands.

In this respect, de Vignemont *et al.* (2005: 147) recall that a basic assumption made in most neuroscientific studies of body representation, bodily sensation and motor action, is that the body is made up of parts, and assert that these parts should not be understood or analyzed in isolation, but, at a more cognitive level, in terms of their relationship with other body parts. The authors further suggest that differentiation of the body into constituent parts may reflect a dynamic, competitive process of mutual inhibition (Lakoff, 2008: 19) which has its origins in body representations in the sensory-motor system. For them, it is the connectivity between neurons in the cerebral cortex that is responsible for imposing an ordered structure on the undifferentiated body by means of an ongoing process of lateral inhibition between cortical neurons. This process limits the spread of excitation among adjacent neurons, thereby functionally isolating cells that are anatomically proximal, and creating somatotopically structured "body maps" as specific neural patterns emerge during sensory experience (*ibid.*, 20).

However, the body image plasticity observable after perceptual and motor learning related to phantom limbs for instance, suggests that there cannot be a precise one-to-one mapping between locations in these somatotopic maps and bodily locations (Longo, 2016: 123). Hence, as stated by de Vignemont et al. (*ibid.*, 147), the representation of the body is not reducible to independent representations of each body part, which in turn implies that the configuration of the body as a whole is *inferred* from the various inputs, rather than being directly perceived. The body schema results, then, from the interaction between the different body parts and the different sensory modalities, and is therefore a product of multisensory (i.e. tactile, proprioceptive and visual) integration.

Although ultimately based on dynamic, somatotopically-structured neural representations of the body as a whole as it evolves in its physical and social environment, the conceptualization of these mappings is a *cognitive* activity: symbolization, metaphorization, metonymization, meronimization, image-schematizing, simulation and imitation are all conceptual processes which necessarily reflect the functioning of our neural circuitry (neural bindings, gestalt circuits, linking circuits, mapping circuits, etc.).[16] Language, as one product of this activity, is therefore a function of the brain's dynamic multisensory, multimodal representations of the body in its environment, as mediated by cognitive representations constructed in the mind (Svorou, 1994: 2), which in turn contribute to reshaping the brain's representations and augmenting their plasticity.

In summary, the empirically observable linguistic manifestations of body representations which constituted our point of departure appear to be the end products of a dynamic, neural representation of the body, an internal body model that is constructed notably from proprioceptive and somesthetic inputs, and is mediated by diverse cognitive representations of the body and its part relations. The crosscultural diversity of such cognitive representations noted by many scholars, but also of somatic awareness (e.g. Ma-Kellams 2014), emerges as one of the principal sources of the structural diversity characterizing the linguistic manifestations under discussion, despite the underlying systematicity in how lexicons are structured cross-linguistically (Majid & van Staden, 2015: 571).

To take the 'knee' as an example once more, this anatomical part and its movements are known to correspond at the neural level to a somatotopic mapping in primary somatosensory cortex (Akselrod *et al.,* 2017: 474), and give rise to linguistic manifestations in the form of verbal and nominal lexemes in most, if not all the world's languages. However, the cognitive representations associated with this part of the body differ crossculturally. In ancient Greek civilizations for instance, a wife would customarily give birth on the knees of her husband and the child would then be placed on the knees of his father or foster-father as a sign that he was acknowledged as his own, or adopted, a custom that may reflect a belief system in which the

---

[16] See Feldman 2006: 13-14, 65-66, and Lakoff 2008: 20-23.

knee was thought to be the seat of paternity, of life and of generative power (Onians 1988: 175). If this is so, then it is the cognitive representation of the knees, enshrined in a specific belief system, that is linguistically encoded, and not the neural representation of this part of the body.

In view of this analysis, one cannot rule out the possibility that PIE *_ĝenu_- '+ knee' was etymologically related upstream from PIE to both *_ĝenh_$_1$- '+ beget a child, be born' (LIV 163-165) and *_ĝneh_$_3$- '+ know, recognize' (LIV 168-170), particularly as the hypothesized canonical form of these roots appears to be identical, i.e. *_ĝen_-.[17] Such an etymological relation could have resulted from a cognitive process of 'body bleaching', i.e. desemanticization of the body image conveyed by a word over time as its original meaning generalizes or specializes. This process could have centred on the verb event itself (arguably, in the case of *_ĝenh_$_1$-, '± to bend the knees so as to give birth to a child' > '± to give birth to a child' > '± to give birth'), or on the goal or result of the verb event (arguably, in the case of *_ĝneh_$_3$-, '± to sit a child on one's knees so as to recognize paternity' > '± to recognize paternity' > '± to recognize').[18]

5. Valsalva actions and paralinguistics

5.1 Paralinguistic vestiges?

Although linguistic traces of the pre-reflective, body-naming strategy posited by STEELS appear thin on the ground in modern languages, one paralinguistic vestige may remain in the use by an adult of the resonance symbolized phonetically by [ʔ] to encourage an infant to defecate (Diamond 1959: 214). As will be enlarged upon, another such vestige may be located in word-initial position in the PIE root for "coughing", which is normally reconstructed as *_k_^{u}_eh_$_2$_s_- '± cough' (LIV 377) or *_kweh_$_2$_s_- (Hamp 1980). Recall that coughing, like defecating, involves mobilizing the Valsalva mechanism, a "powerful alliance of laryngeal, respiratory, abdominal, and rectal muscles" (Parry 1985: 318). Now among the reflexes of this root are OInd. _kāsate_ 'coughs' and OE _hwōsan_ 'cough', although according to EIEC (518), the latter may alternatively derive from *_k̂u̯es_- '± breathe; sigh, groan' (LIV 341). Although these two roots do not appear to be etymologically related (Hamp 1980: 131), it is significant that their reconstructed meanings all refer to paralinguistic behaviours (Poyatos 2002: 57-58).

In reference dictionaries, cough is defined as a rapid expulsion of air from the lungs, typically in order to clear the lung airways of fluids, mucus, or other material. On an emotive plane, it may be used to express satisfaction, uncertainty, surprise, embarrassment, shyness, etc. (_ibid._, 121). Sighing is typically defined as a variably prolonged ingression of respiratory air followed by an audible egression, and may be expressive of emotions such as sorrow, weariness and relief (_ibid._, 107-108). Groaning is more loosely defined as the production of a deep, inarticulate sound, one which may express attitudes of derision, disapproval, grief or desire, for example (_ibid._, 47). As for breathing, it may be defined as the process of respiration during which air is inhaled into the lungs through the mouth or nose due to muscle contraction, and then exhaled due to muscle relaxation. Whether voluntarily or involuntarily regulated, different types of breathing characterize emotions such as joy-laughter, sadness-crying, fear-anxiety, anger and tenderness (Bloch et al. 1991).

To turn to speech in general, it may be construed as a modified breathing behaviour that uses the respiratory system to provide an energy source, and mobilizes structures within the respiratory tract that allow this energy to be modulated into meaningful sounds (Warren _et al._,

---

[17] See Philps 2009: §47-48.

[18] See Philps 2012: §39.

1992: 516). Significantly, the above-mentioned paralinguistic behaviours are all modifications of metabolic breathing behaviour (Fridlund, 1994: 303), which is the main reason why STEELS posits that it is breathing, along with its physiological apparatus (lungs, tubes, nose, mouth, etc.), its life-sustaining functions and its life-symbolizing potentialities,[19] that was encoded vocomimetically at the very earliest stages by laryngeal (and doubtless pharyngeal) resonances. Added to this is the fact that the larynx houses the lowest anatomical site in the vocal tract (i.e. the glottis) where the egressive flow of air from the lungs can be modulated and filtered for purposes of phonation, articulation and, according to STEELS, self-referential vocomimesis.

According to Poyatos (*ibid.*, 57-58), there are, between those paralinguistic phenomena that occur only as modifications of verbal utterances (primary qualities and qualifiers) and those functioning as quasi-lexical items within each linguistic and cultural community (alternants), others, termed "differentiators", that possess both qualities, and which characterize and differentiate physiological reactions (often of a reflex nature), psychological states, and emotional reactions. These differentiators all alter normal breathing and the audible and visual characteristics of speech, thereby influencing kinesics and affecting the entire language-paralanguage-kinesics relation. Poyatos maintains that the phonetic transcription of these differentiators should be established, e.g., in the case of coughing, [Kx] for a strongly pharyngeal cough and [KZZ] for a prolonged whizzing one, as well as their written forms, such as 'Koff-koff!' in English (*ibid.*, 120). These are naturally subject to variation both crosslinguistically and crossculturally.

In parallel to the synchronic relation between the paralinguistic use of the glottal occlusive [ʔ] to encourage an infant to defecate, and the velar occlusive [k] in word-initial position in, e.g., the linguistic realization *crap* 'defecate' in vulgar English slang, there may well exist a comparable relation between the paralinguistic use of [k] to express emotions such as embarrassment, and word-initial [k] in, e.g., Eng. *cough*. If this relation were conceivable, it would go some way to confirming the submorphemic, phono-notional status of [k] in such linguistic realizations (in Modern English at least), and its potential emotive value in a given intersubjective, sociocultural context.

5.2 Paralinguistic uses of [ʔ] and [k]

Turning to a diachronic perspective, whether or not the paralinguistic uses of [ʔ] and [k] adduced above are held to be examples of cognitive *vestigia* from earlier stages of human emergence, including mimetic action (Donald 1990: 2-3), the relations between paralinguistic [ʔ] and [k] and linguistic realizations of word-initial [k] can be traced back not only to PIE **kak(k)eh*$_2$*ie/o-* '± defecate' (EIEC 187) but also, as suggested above, to **k*^{u}*eh*$_2$*s-* '± cough' and **k̂u̯es-* '± breathe; sigh, groan'. In all these roots, the consonant occupying the *C*$_1$ slot is hypothesized to function as a core invariant (<*k>) that vectors a phono-notional value (see 6.3), while in the latter two roots, <*k> is construed as having two phonemic variants, one labialized (**k*^{u}), and one palatalized (*k̂*-).[20]

The fact that the occlusion accompanying an acute rise in intrathoracic and intra abdominal pressure brought about by contraction of the trunk muscles during a Valsalva manoeuvre can take place not only in the larynx (corresponding phonetically to a glottal stop) but also, more peripherally, in the nasopharynx (Jellinek, 2006: 448), which extends from the base of the skull to the upper surface of the soft palate (corresponding phonetically to a velar stop). This fact may give further credence to the hypothesis formulated by Martinet (1975: 129, 133), Rousseau (1990), Daude (1994) and others that in PIE, word-initial laryngeals "hardened" under certain

---

[19] For the symbolism of breath and speech in the Upanishads for instance, see Müller 2001 Part One (2, etc.).

[20] See Beekes 2011: 124-127 for a discussion of the "three velar series" in PIE.

conditions into **k*, as in $*h_2ost$ '± bone' > **kost*- '± rib, bone'.[21] It must however be noted that no PIE root with a word-initial laryngeal referring specifically to the act of coughing has been reconstructed (see [7.2.3]).

6. PIE "body-part" roots referring to bodily actions and effectors

6.1 From *L* in protosyllabic *LV* to **H* in PIE **HVC*-

With respect to the transformations necessarily undergone over time by what is posited to be the earliest *H*-protosyllable shape (i.e. *CV*, see 1.2), it is naturally unthinkable that between the indeterminable period of the emergence of the linguistic sign (noted p_o) and that of early PIE (noted p_1), the shape in question would have remained unaffected by linguistic factors such as root structure evolution, analogy and regular sound change. Even within the relatively short recorded history of Indo-European languages, these factors have combined to provoke major upheavals in syllable shape, root shape and phonotactic distribution. This alone, without any consideration of the effects of semantic change, would appear to be sufficient to obscure any vestigial traces in PIE of the unconscious body-naming strategy posited by STEELS. However, independently of the effects of linguistic change, positing the two reference points p_o and p_1 does allow us to reconstruct some of the *structural* developments that must have affected the *H*-protosyllable during the intervening period (i.e. between p_o, corresponding to *CV*, and p_1, corresponding to *CVC*, the hypothesized canonical structure of the root in PIE).[22] The most important of these developments would appear to be:

- consonant incrementation (e.g. *CV*- > *CVC*- (Southern 1999: 152))
- vowel decrementation, i.e. reduplication followed by vowel syncope (e.g. *CV*- > *CVCV*- > *CVC*- where *C* is identical, or C_1VC_2V- > C_1VC_2- where *C* is differential)
- ablaut (e.g., paradigmatically, *V*- in *CV*- > CV_1- ~ CV_2- (Meier-Brügger 2003: 144-152))
- phonetic differentiation subsequent to consonant incrementation (e.g. *CV*- > *CVR*- (where *R* = resonant) > *CVl-/CVr*- (Benveniste 1964: 25))
- reduplication (e.g. *CV*-> *CVCV*-, possibly illustrated by $*kak(k)eh_2ie/o$- '± defecate' (EIEC 187), as well as combinatory variations such as *VCVC*- (Beekes 2011: 253-254)).

With specific reference to *LV*-shaped *H*-protosyllables ((laryngeal + vowel, see 3.2), if *L* in *LV* was indeed a laryngeal at p_o, and if it evolved into the reconstructed PIE laryngeal **H* (assumed $*h_1$, $*h_2$, $*h_3$) at p_1, then for the whole duration of this timespan, the *H*-protosyllables in which *L* was embedded would have undergone, prior to the beginning of the phased disappearance of laryngeals in PIE, various processes of linguistic differentiation. These processes may be reflected notably in the extent to which the phonological differentiation of **H* into $*h_1$, $*h_2$, $*h_3$ in PIE correlates with semantic differentiation, and also in *aktionsart*, e.g. action → effector, as in $*h_1ed$- '± bite, eat' → $*h_1dont$- '± tooth', or action → result of action, as observed in Modern Eng. *cut* (v.) → *cut* (n.). Assuming, then, on the basis of the above analysis, that word-initial **H* in the **HVC*- form of the PIE root may be a submorphemic vestige of *L* in the *LV* form of the earliest *CV* protosyllables referring vocomimetically to ONL and non-ONL body actions and effectors posited by STEELS, I adduce, in 6.2 and 6.3, a number of possible examples of the roots concerned.

---

[21] Other explanations of this initial **k*- do however exist (prefixal, sandhi…).

[22] More precisely, *Cḙ́C*-; see Benveniste 1935: 170.

6.2 Roots referring to ONL actions and effectors

It should be noted that the order of presentation of the roots given below (i.e. with the category "body action" preceding that of "body part"), is intended to reflect the fact that the reconstructed lexical roots of PIE are mostly verbal, typically referring to actions or states, while nominal forms are usually shaped by various morphological processes. It should also be noted that the body parts concerned are symmetrically paired to each side of the vertical median plane, or located along its "midline" (Philps, 2017: 121).

[6.2.1] Nose/nostrils

[6.2.1.1] Body action: *$\boldsymbol{h_2}$*enh*$_1$- '± breathe' (LIV 267-268, NIL 307 ff.); [> Gk. ἄνεμος 'wind', Arm. *holm* (< **honm*) 'wind', OInd. *ániti* 'breathes', Toch. B *anāsk*- 'breathe, inhale', Lat. *animus* 'spirit, wind', etc.]

[6.2.1.2] Related body part: *$\boldsymbol{h_x}$*náss* ~ *h_x*nā́s*[23] '± nose, nostril(s)' (EIEC 395); [> OInd. *nā́sā* (dual) 'nostrils' (cf. *urūṇasá*- 'wide-nosed'), Lat. *nāris* 'nostril' (pl. 'nose'), *nāsus* ~ *nāssus* 'nose', OEng. *nosu* 'nose', etc.]. Fritz (1996) hypothesizes that what he debatably reconstructs as *h_2*n̥h*$_1$*os*- '± nose', is a zero-grade nominal derivative of *$\boldsymbol{h_2}$*enh*$_1$- '± breathe'.

[6.2.2] Mouth/lips

[6.2.2.1] Body action: *$\boldsymbol{h_1}$*eĝ*- (or *$\boldsymbol{h_1}$*eh*$_1$*ĝ*- see EIEC 535) '± speak, say' (IEW 290, **ēĝ*-), *$\boldsymbol{h_2}$*er*- '± speak loudly, solemnly' (LIV 271); [> Gk. *ἀράομαι* 'pray', Hit. *ariya*- 'consult an omen, determine by oracle' (HIL 201-203), OInd. *áryati* 'acknowledges, praises', Lat. *ōrō* 'address, solicit (the gods)', etc.]

[6.2.2.2] Related body part: *$\boldsymbol{h_3}$*óu̯st-o*- '± mouth, lip(s)' (NIL 390-391); [> Av. *aošt*(*r*)*a*- 'lip', OInd. *ós̥t̥ha*- 'lip', OPrus. *austo* 'mouth', etc.].

[6.2.3] Tooth, teeth

[6.2.3.1] Body action: *$\boldsymbol{h_1}$*ed*- '± bite, eat' (LIV 230-231); [> Gk. ἔδω 'eat (up), devour', Arm. *utem* (< *h_1*ōde/o*-) 'eat', Hit. *etmi* 'eat' (HIL 120), OInd. *ádmi* 'eat', OEng. *etan* 'eat', etc.]

[6.2.3.2] Related body part: *$\boldsymbol{h_1}$*dont*- '± tooth' (NIL 210); [> Gk. ὀδών 'tooth' (Aeolic ἔδοντες 'teeth'), Arm. *atamn* 'tooth', OInd. *dánt*- 'tooth', OEng. *tōþ* 'tooth', etc.].

6.3 Roots referring to non-ONL actions and effectors

[6.3.1] Nape, neck

[6.3.1.1] Body action: *$\boldsymbol{h_2}$*eng-/k*- '± bend' (LIV 268); [> Gk. ὄγκος 'barb', OInd. *áñcati* 'bends', Lat. *uncus* 'bent', etc.]

[6.3.1.2] Related body part: *$\boldsymbol{h_2}$*enĝh*(*u̯*)*én*- '± neck, nape' (< *h_2*enĝh*- 'narrow', IEW 42-43, **anĝh*- '± narrow'); [> Gk. (Aeolic) ἄμφην 'nape', Arm. *awjik'* (pl.) 'neck', Goth. *hals-agga* 'nape of neck', etc.].

[6.3.2] Bones (many of which are paired)

---

[23] *h_x = indeterminate laryngeal.

[6.3.2.1] Body action: bend (see [6.2.1.1]); also, join: *$\boldsymbol{h_2}$*ep-* '± fasten, join' (LIV 269); [> Hit. *ḫappeššar* 'joint, limb, part of the body' (HIL 293-294), Toch. A *āpsā* (pl.) 'limbs', Lat. *apere* 'attach, join', etc.]

[6.3.2.2] Related body part: *$\boldsymbol{h_2}$*ost* '± bone' (IEW 783, **ost*(*h*)-); [> Hit. *ḫaštāi-* 'bone' (HIL 325-326), Gk. ὀστέον 'bone', Arm. *oskr* (< *h_2*ost-u̯r̥*) 'bone', OInd. *ásthi* 'bone', Lat. *os* 'bone', etc.].

[6.3.3] Ear

[6.3.3.1] Body action: *$\boldsymbol{h_2}$*eu̯is-* '± perceive' (*h_2*eu-*, IEW 78, **au̯-*); [> Gk. *αἰσθάνομαι* 'perceive', Lat. *audiō* (< *h_2*eu̯is-dh-i̯e/o-*) 'hear', etc.]. This root may be related to the PIE word for 'see', e.g. Hit. *uḫḫi* (< *h_2*eu-*h_2*e-i* 'see' (HIL 229), OInd. *uvé* 'I see' (cf. GI 688 and EIEC 418))

[6.3.3.2] Related body part: *$\boldsymbol{h_2}$*ou̯s-os-*, '± ear' (NIL 339ff.); [> Gk. οὖς 'ear', Av. *uši* (dual) 'ears', Lat. *auris* 'ear', OEng. *ēare* 'ear', etc.].

It is important to note that in the above roots and their derivatives, it is the (highlighted) laryngeal occupying the C_1 slot, whether in full grade (e.g. *$\boldsymbol{h_2}$- in *$\boldsymbol{h_2}$*ost*) or zero grade (e.g. *$\boldsymbol{h_1}$- in *$\boldsymbol{h_1}$*dont-*), which is posited to constitute a vestige of the purportedly vocomimetic quality of the *LV* protosyllables that may have referred self-referentially to the bodily actions and effectors in question. This implies that the phono-notional value attributed to C_1 in the words concerned was present *before* the latter developed their full phonetic form (i.e. in postulated *LV H*-protosyllables before they developed, by whatever processes, into *LVC*, etc.).

Examples of the metaphorically-grounded conceptual transfer of words in PIE that denote ONL body actions and parts to non-ONL bodily actions and parts (noted >>, see Heine 1997: 133-137) are few and far between, the most likely candidate being the root noun **ĝenu* (chin >> knee (IEW 380-382, EIEC 336)),[24] in which the consonant occupying the C_1 slot (<*ĝ>) is posited to function as a core invariant. A core invariant (noted between chevrons) may be defined as the smallest word-initial phonological (or, in cases such as Modern Eng. *kn-*, semiological) segment in a given class of words within a given language to which a notion common to all the members of a heuristically established subset of this class can be attributed at a submorphemic level, e.g. <n> in that subset of English '*sn-* words' with meanings referring to the notion of 'nasality' (*sneeze*, *sniff*, *snore*, etc., see Philps 2011: 1127), hence the descriptive term 'phono-notional'. Arguably, the closest that nominal derivatives reconstructed in PIE with a word-initial laryngeal come to illustrating this type of transfer at word level is:

- (top-up transfer):[25] mouth >> ear: *$\boldsymbol{h_3}$*óh*$_1$*-s-* '± mouth, lips' >> *$\boldsymbol{h_2}$*ou̯s-os-* '± ear'
- (top-down transfer)':[26] (if *$\boldsymbol{h_3}$*óh*$_1$*-s-* is construed as referring to the jawbones), mouth >> bone: *$\boldsymbol{h_3}$*óh*$_1$*-s-* '± mouth, lips' >> *$\boldsymbol{h_2}$*ost* '± bone'.

---

[24] "**ĝónu* 'knee'. […] Most probably related to **ĝénu* 'chin, jaw', both being sharply angled parts of the body." See also Philps 2009.

[25] That is, to bodily domains located *above* the ONL region.

[26] That is, to bodily domains located *below* the ONL region.

7. PIE “body-part” roots with a word-initial laryngeal referring to Valsalva-related actions and effectors

7.1 ONL and non-ONL roots

After having focused in 6.2 and 6.3 on a number of PIE roots reconstructed with a word-initial laryngeal that refer not only to ONL bodily actions and effectors, but also to non-ONL bodily actions and effectors in general, I will now adduce, in 7.2 and 7.3, a number of those that refer not only to ONL bodily actions and effectors, but also, more specifically, to Valsalva-related bodily actions and effectors. My point of departure will be the list of Valsalva-related actions taken from Pstras et al. (2016) that appears in 3.1, i.e. different forms of straining, etc., to which I have added one or two others. Examples of Valsalva-related actions other than coughing and defecating (see 5.1 and 5.2) which may have originally been encoded vocomimetically by means of supralaryngeally-shaped laryngeal resonances are swallowing, lifting, parturition, micturition, and the blowing of wind instruments, all being accompanied by constriction-release cycles of the larynx related to acts of effort closure (Parry 1985: 317, 318). As in 6.2 and 6.3, I have only provided succinct root etymologies, which inevitably means that a considerable amount of pertinent morpho-syntactic information is not exploited here. Furthermore, the roots, stems and reflexes adduced in these sections all pose formal and semantic problems of reconstruction and analysis, discussion of which is not within the scope of this paper.

7.2 ONL examples

[7.2.1] Blowing: PIE *_**h**_$_2$_u̯eh_$_1$_-_ ‘± blow’ (LIV 287); [> Gk. _ἄησι_ ‘blows’, Av. _vāiti_ ‘blows’, OInd. _vā́ti_ ‘blows’, OEng. _wāwan_ ‘blow’]. Without a word-initial laryngeal, e.g.: *_dhmeH-_ ‘± blow’ (LIV 153)

[7.2.2] Breathing: PIE *_**h**_$_2$_enh_$_1$- ‘± breathe’ (LIV 267-268); [> Gk. ἄνεμος ‘wind’, OInd. _ániti_ ‘breathes’, Toch. B _anāsk_ ‘breathe, inhale’, Lat. _animus_ ‘spirit, wind’; also *_**h**_$_1$_eh_$_1$- ‘± breathe’ < unattested *_**h**_$_1$_eh_$_1$_t-_ in *_**h**_$_1$_eh_$_1$_tmén-_ ‘± breath’ (IEW 345 _(*ēt-men-)_); [> OInd. _ātmán_ ‘breath, soul’, Toch. A _āñcäm_ ‘self, soul’, OEng. _ǣðm_ ‘breath’, etc.]. With regard to the latter root and its non-Benvenistian structure (i.e. _C_$_1$_ĕC_$_1$-), *_h_$_1$_eh_$_1$_t-_ may conceivably result from earlier reduplication (< *_h_$_1$_e-h_$_1$_t-_ < *_h_$_1$_e-h_$_1$_et-_). Without a word-initial laryngeal, e.g.: *_k̂u̯es-_ ‘± breathe deeply, sigh’ (LIV 341)

[7.2.3] Coughing: Ø. Without a word-initial laryngeal, e.g.: *_**k**_$^{u̯}$_eh_$_2$_s-_ ‘± cough’ (LIV 377, see also section 5)

[7.2.4] Singing: Ø. Without a word-initial laryngeal, e.g.: *_sh_$_2$_ómen-_ ‘± song’ (plausibly derived from an *-_m_- extension of *_sh_$_2$_ei̯-_ ‘± bind’ (LIV 544) (see HIL 394)

[7.2.5] Speaking: *_**h**_$_1$_e_(_h_$_1$)_g-_ ‘± speak, say’ (see [6.2.2.1]); [> Gk. ἦ ‘said’, _ἄνωγα_ ‘I ordered’, Lat. _āiō_ ‘say’, etc.); *_**h**_$_2$_er-_ ‘± speak solemnly’ (LIV 271); [> Gk. _ἀρᾱ́_ ‘prayer’, OInd. _ā́ryati_ ‘acknowledges, praises’, Hit. _ari̯i̯e/a-_ ‘consult an omen, determine by oracle’ (HIL 202), Lat. _ōrō_ ‘address, solicit (the gods)’, etc.]. Without a word-initial laryngeal, e.g.: *_bheh_$_2$- ‘± speak, say’ (LIV 69-70)

[7.2.6] Swallowing: Ø. Without a word-initial laryngeal, e.g.: *_g_^{w}_erh_$_3$- ‘± swallow’ (LIV 211-212).

7.3 Non-ONL examples

[7.3.1] Bending: *_h$_2$eng-/k-_ '± bend' (LIV 268). Without a word-initial laryngeal, e.g.: *_bhedh-_ '± bend (one's body)' (IEW 114)

[7.3.2] Defecation: Ø. Without a word-initial laryngeal, e.g.: *_kak(k)eh$_2$ie/o-_ '± defecate' (IEW 521 (*_kakka-_))

[7.3.3] Micturition: PIE *_h$_3$méiĝhe/o-_ '± urinate' (LIV 301-302); [> Gk. *ὀμείχω* 'urinate', Arm. *mizem* 'urinate', Lat. *mēiō ~ mingō* 'urinate', OEng. *mīgan* 'urinate', etc.]. Without a word-initial laryngeal: Ø

[7.3.4] Parturition: *_h$_2$ens-_ '± give birth' (LIV 269); [> Hit. *ḫāši/ḫašš-* 'give birth' < *_h$_2$oms-/_*_h$_2$ms-_ (HIL 319-321), etc. According to Kloekhorst, CLuw. *ḫamša/i-* and HLuw. *hamsa/i-* 'grandchild', together with ON *áss,* point to a stem *_h$_2$ems-_ (HIL 319)]. Without a word-initial laryngeal, e.g.: *_ĝenh$_1$-_ '± give birth, beget' (LIV 163)

[7.3.5] Rowing: *_h$_1$erh$_1$-_ '± row' (LIV 251-252); [> Gk. ἐρέτης*;* 'rower', OInd. *aritár-* 'rower' (<*_h$_1$erh$_1$tér-_), OEng. *rōwan* 'row', etc.]. Without a word-initial laryngeal: Ø

[7.3.6] Sexual intercourse: *_h$_1$erH-_ 'to mount' (LIV 238-239); [> Hit. *ārk-i / ark-* 'mount, cover, copulate' (< *_h$_3$órĝ^h-ei_, HIL 203-204), OInd. *ṛghāyáte* 'is impetuous, rages', etc.]. Without a word-initial laryngeal, e.g.: *_i̯ebh-_ '± enter, penetrate, copulate' (LIV 309)

[7.3.7] Sitting down: *_h$_1$e(h$_1$)s-_[27] '± sit' (LIV 232); [> Gk. ἧσθαι 'sit', Hit. *eš- / aš-* 'sit' (HIL 252ff.), Av. *āste* 'sits', OInd. *ā́ste* 'sits' etc.]. Without a word-initial laryngeal, e.g.: *_sed-_ '± sit (down)' (LIV 513-515)

[7.3.8] Straining: *_h$_2$u̯elk-_ '± pull' (GI 595/EIEC 471); [> Lith. *velkù* 'pull', Alb. *heq* 'pull (out), remove', etc.]. Without a word-initial laryngeal, e.g.: *_kel(h$_1$)-_ '± lift, raise up' (LIV 349).

7.4 Chronological layering in PIE

If it is held that a correlation is still detectable between the reconstructed presence of an initial laryngeal in PIE "body-part" roots and Valsalva-related bodily actions, then one major task is clearly to explain why certain PIE roots and their derivatives referring to these actions do not begin with a laryngeal. This of course directs us to the Saussurean principle of the arbitrary nature of the linguistic sign and, on a different level, to stochastic processes and the "chance factor", which I will not go into here. However, viewed against the backdrop of STEELS and assuming, not uncontroversially, that these laryngeals were obstruents, another possible explanation would be that PIE (whether seen as a single 'block' or as a conglomerate of roughly contemporary dialects), is characterized, at obstruent level, by two chronologically layered phonological systems.

The older chronological layer would have attested, notably in canonical *_HeH-_ structures formed by processes such as consonant incrementation and vowel decrementation (see 6.), various phonologically differentiated laryngeal or pharyngeal obstruents (subsumed by the symbol *_H_) construed as continuing the original vocomimetic *LV H*-protosyllables posited above. The newer layer, with which the initial system would have co-existed until the laryngeals

---

[27] See [7.2.2]: non-Benvenistian *_h$_1$eh$_1$s-_ may result from earlier reduplication (< *_h$_1$e-h$_1$s-_ < *_h$_1$e-h$_1$es-_).

disappeared in their different environments[28] or were continued by direct (Anatolian) or indirect (Greek, Armenian, etc.) reflexes according to the branch involved, would have been composed of the traditional series of three stops (or manners of articulation): voiceless (*tenues*, e.g. **p*), voiced (*mediae*, e.g. **b*), and voiced aspirated (*mediae aspiratae*, e.g. **bh*), and four or, arguably, five distinct places of articulation (labial, dental, palatal, velar, labio-velar). It should however be recalled that the phonetic nature of the PIE laryngeals, famously subject to speculation from an early date (e.g. Möller 1880), is still unestablished; one view often found in the literature sees *h_1 as a glottal stop, *h_2 as a voiceless pharyngeal fricative and *h_3 as a voiced pharyngeal fricative, although Byrd maintains that the laryngeals were all fricatives (Byrd 2015: 11-12).

One further linguistic process which may have contributed to the fact that some PIE roots and derivatives are not reconstructed with a word-initial laryngeal is suggested by Hoenigswald's contentious though tantalizing (1952) hypothesis that prevocalic laryngeals preceded by "**s*-mobile" disappeared before (or without) colouring the following vowel, i.e. **sHV*- > **sV*- (e.g. **s*[h_2]*en*- '± old, ancestor' > Lat. *anus* '± old woman' beside Lat. *senex* '± old man'). However, this hypothesis is judged, doubtless a little hastily, as "entirely unacceptable" by Beekes (1969: 82).

The evolution from the earlier system to the later one would have involved a number of articulatory processes, one of which, if Esling et al.'s (2015) conclusions as to phonetic ontogeny and the acquisition of speech by infants are correct, may be termed "exteriorization", i.e. initial laryngeal and pharyngeal point/manner of articulation > later oral point/manner of articulation (while retaining a laryngeal base, i.e. oral-laryngeal coarticulation). Esling affirms that laryngeal and pharyngeal sounds are acquired by infants before oral sounds, and that if speech sounds were initiated ontogenetically in the larynx and pharynx, then there are grounds for surmising that they are phylogenetically prominent too (2012: 140, 143). In this case, he argues, speculations about oscillatory patterns of articulators such as those of MacNeilage need to take into account that these patterns would have developed in the larynx and pharynx first, before progressing to the jaw or the mouth.

Although impossible to demonstrate, there may exist at least two phonetic traces of this process of exteriorization in PIE, the first of which is the "hardening", under certain conditions, of word-initial laryngeals into **k* (see 5.). The second is the putative carry-over of the laryngeal feature [+aspiration] produced by the sudden release of impounded air subsequent to glottal occlusion from the laryngeal to the supralaryngeal cavity (e.g. **h* in homorganic **bh* in the *mediae aspiratae* series of stops), a carry-over which may have created not only innovative meanings, but also new symbolic values in the words concerned, such as in the four Russian kinship terms speculated on by Swadesh: "the older generation is designated by aspiration, the immediately related generation by nonaspiration" (2006: 195).

8. Conclusion

8.1 Theoretical speculation

Used to gain knowledge based on making observations, formulating laws and theories and testing theories or hypotheses by experimentation, scientific methods do not brook speculation, understood as introducing assumptions about objects and their behaviour without knowing that there is evidence for said assumptions. Yet this activity becomes crucial when attempting to

---

[28] For an early account of the loss of laryngeals in PIE, a topic which is outside the scope of this paper, see Lehmann (1972: 85ff.), and for a more recent discussion, Zair (2012: 160ff.).

elaborate an explanation of a group of observed phenomena (Achinstein, 2019: ix-x), and in forming theoretical hypotheses relative to the possible origins of the latter in the belief that doing so may ultimately lead to proper experimentation and evaluation, and hence to them being validated or not.

Obviously, the caveats pertaining to STEELS are many. For instance, interpretation of the often sporadic and patchy linguistic data that have come down to us via PIE rests on sometimes controversial assumptions in thorny areas such as Root Theory (Benveniste 1935, etc.), the "Laryngeal Theory" (Lindeman 1987, etc.) and that root-initial *s-/ø-* morphophonemic alternation known as "**s-* mobile" (Southern 1999, etc.). Also, the methodology employed by STEELS to backtrack submorphemic, phono-notional dyads from Modern English to PIE cannot be generalized to other language families without suitable adaptation. And even though the argumentation deployed is based on empirical or reconstructed data which are independently verifiable, and therefore falsifiable by linguistic means, the submorphemic approach that this requires does not currently form part of the *communis opinion*. This may be put down in particular to the fact that it entails a paradigm shift (Kuhn 2012: 67) which many linguists are not prepared to entertain, and that it dredges up significant anomalies in structuralist dogma such as the status of the morpheme as the smallest indivisible component of a word endowed with meaning.[29]

As to backtracking further, from PIE to the ultimate origins of these dyads, the argumentation used involves theoretical speculation, notably about the possible role of vocomimetic articulatory gestures and (neuro)cognitively-grounded conceptual mapping in the emergence of the linguistic sign. Although fuelled by premises stemming from the more empirically-based, initial phase of exploration (e.g. the polysemy displayed by certain '*kn-* words' in the phono-notional dyad {*kn-*/protuberance}), this argumentation can no longer be scientifically assessed, since the type of data it rests on is no longer empirically testable or refutable.

8.2 Paradigm shifts

Retracing and theorizing the possible origins of the linguistic sign cannot be accomplished within a strictly linguistic paradigm if these origins are held to be nonlinguistic (or prelinguistic, according to one's claims), as is the case of gestural accounts of the emergence of language such as STEELS. However, at least one of the modern evolutions of the traditional linguistic paradigm does provide a methodologically sound and innovative starting-point for such an investigation within a new paradigm, namely that of cognitive linguistics, the adoption of which implies moving on from the largely monodisciplinary approach of structural linguistics to an interdisciplinary approach to the study of language.

Another relatively modern evolution is submorphemics,[30] one of whose aims is to account for parts of morphemes that are construed as playing a role in the construction of "meaning" in a given language.[31] This sub-paradigm clearly appeals to the extralinguistic in its recourse to phonosemantic and phono-notional values attributable to those structurally isolatable segments of morphemes called "submorphemes" that exhibit a recurrent form-meaning relation in a given language (Crystal 2003: 301), and hence admits of an interdisciplinary vocation. Within submorphemics, paradigm overlap is provided by the concept of "phono-notional invariance" (Philps 2008: §3), where "phono-" appeals to the traditional concept of phonological units,

---

[29] Recall that, doubtless for conceptual reasons, the French word *morphème* was not used by de Saussure in his writings, even though it had been previously introduced from Russian and German by Jan Baudouin de Courtenay, with whose work de Saussure was familiar.

[30] See Bolinger 1950 for "sub-morpheme differentials".

[31] See Philps 2011: 1125-1126 for a brief discussion of the psychomechanical approach to meaning.

particularly word-initial consonant onsets such as /sn/ and /gr/ in English, and "notional" to conceptual representations.

The modelling of representations constitutes a key problematic in cognitive science, as recalled by Gärdenfors (2000, 2014), who develops a theory of conceptual spaces built on geometrical structures based on a number of quality dimensions as one possible response to this problem. Whatever the definition of notional or conceptual domains/spaces adopted, it is patent that this direction of exploration constitutes a bridge between the intralinguistic and the extralinguistic. As to "invariance", this is arguably, along with analogy, the most powerful principle of analysis employed in one form or another in the theoretical approaches alluded to above. It is mobilized notably by Culioli in his theory of enunciative linguistics (Culioli 1990), by Guillaume in his psychomechanical theory of language (Guillaume 1984), and by Lakoff in his theory of conceptual metaphor (Lakoff 1990). In my own approach to the study of the emergence and evolution of the linguistic sign, I have advocated extending this principle from the morphemic to the submorphemic level, although this was never envisaged by Culioli, Guillaume or Lakoff (Philps 2011: 1125).

As with biolinguistics (e.g. Fujita & Boeckx 2016), STEELS pursues an exaptation scenario of the emergence of the speech faculty in its modelling of the possible origins of the linguistic sign, one which follows that proposed by MacNeilage, who posits that articulatory gesturing arose in *Homo* as an exaptation of the biphasic, articulated, close-open gestures made during oscillatory actions of the jaw as it performed ingestive cyclicities such as chewing. As mooted throughout this paper, the initial use made of the exapted human vocal apparatus appears largely pre-determined by dynamic, self-(re)organizing representations of the body *in action* including, I submit, those making use of the Valsalva mechanism.

The starting-point leading towards this scenario, reached by backtracking the linguistic sign from modern Indo-European languages, paramountly English, to PIE, is situated on the margins of the traditional linguistic paradigm, specifically in that sub-paradigm known as submorphemics, which has the advantage of providing paradigm overlap. This capacity is methodologically crucial if it is held that the origins of the linguistic sign are nonlinguistic, as it allow one to break out from the epistemologically-bounded contours of Saussurean linguistics into the extralinguistic, while yet respecting the fundamental advances of structuralism.

Since it is widely accepted that the conditions underpinning the origins of human language cannot be accessed by methodologies based solely on a linguistic paradigm (e.g. by tracing ascent or descent) using the Comparative Method, a further paradigm shift is necessary if one is to bridge the indeterminably long gap between PIE and the period during which human language emerged as *Homo* became *sapiens* and then *sapiens sapiens*. In order to accomplish this, STEELS turns, as stated in 1.1, to articulatory phonology which, although not developed as a theory of the origins of speech, views gestural events consisting of the formation and release of constrictions in the vocal tract as the basic abstract units of phonological structure. Once again, this approach provides a paradigm overlap, "phonology" in the term "articulatory phonology" appealing to the traditional, static representations of this branch of linguistics, and "articulatory" to the basic, dynamic units of vocal tract action–a gesture of the lips, for instance, involves a functional synergy comprising the upper lip, lower lip, and jaw articulators.

In final conclusion, and in echo to Kuhn's analysis of paradigm shift (Kuhn, 2012: 85), the transition from an older paradigm (in the sense of "exemplar") such as structural linguistics to newer ones, such as cognitive linguistics or submorphemics, is achieved less by an articulation or extension of the older paradigm than by a reconstruction that may call into question some of the original field's basic theoretical generalizations, as well as many of the methods and applications associated with it.

References

ACHINSTEIN, Peter (2019). *Speculation: within and about science*. New York : Oxford University Press.

AKSELROD, Michel, MARTUZZI, Roberto, SERINO, Andrea, VAN DER ZWAAG, Wietske, GASSERT, Roger & BLANKE, Olaf (2017). Anatomical and functional properties of the foot and leg representation in areas 3b, 1 and 2 of primary somatosensory cortex in humans: A 7TfMRI study. *NeuroImage*, *159*, 473-487.

ALLPORT, Floyd (1924). *Social Psychology.* Boston : Houghton Mifflin.

ALLWOOD, Jens & GÄRDENFORS, Peter (eds.) (1999). *Cognitive Semantics: Meaning and cognition*. Amsterdam and Philadelphia : John Benjamins.

ALPENFELS, Ethel (1955). The anthropology and social significance of the human hand. *Artificial Limbs*, *2* (2), May, 4-21.

ANDERSEN, Elaine (1978). Lexical universals of body-part terminology. In J. Greenberg (ed.), *Universals of Human Language*, *vol. 3: Word Structure* (335-368). Stanford : Stanford University Press.

BARASINSKI, Chloé, LÉMERY Didier & VENDITTELLI, Françoise (2016). Do maternal pushing techniques during labour affect obstetric or neonatal outcomes? *Gynécologie Obstétrique et Fertilité*, Elsevier Masson, *44* (10), 578-583.

BEEKES, Robert (1969). *The Development of the Proto-Indo-European Laryngeals in Greek*. The Hague and Paris : Mouton.

BEEKES, Robert (2011). *Comparative Indo-European Linguistics. An Introduction*. 2nd edition. Amsterdam and Philadelphia : John Benjamins.

BENVENISTE, Émile (1935). *Origines de la formation des noms en indo-européen, 1*. Paris : Adrien-Maisonneuve.

BENVENISTE, Émile (1964 [1939]). Répartition des consonnes et phonologie du mot. In *Études phonologiques dédiées à la mémoire de M. le Prince N.S. Trubetzkoy*. Preface by C. E. Reed. Travaux du cercle linguistique de Prague (27-35). Alabama : University of Alabama Press.

BLOCH, Susana, LEMEIGNAN, Madeleine, AGUILERA-TORRES, Nancy (1991). Specific respiratory patterns distinguish between basic emotions. *International Journal of Psychophysiology*, *11*, 141-154.

BOLINGER, Dwight (1950). Rime, assonance and morpheme analysis. *Word*, *6* (2), 117-136.

BOHAS, Georges & SAGUER, Abderrahim (2012). *Le son et le sens. Fragment d'un dictionnaire étymologique de l'arabe classique*. Beyrouth : Presses de l'Institut français du Proche-Orient.

BOTTINEAU, Didier (2008). Language and enaction. In J. Stewart, O. Gapenne & E. Di Paolo (eds.), *Enaction – Toward a New Paradigm for Cognitive Science* (1-67). Cambridge (Mass.) : The MIT Press.

BOTTINEAU, Didier (2009). La théorie des cognèmes et les langues romanes : l'alternance *i/a* dans les microsystèmes grammaticaux de l'espagnol et de l'italien. *Studia Universitatis Babes Bolyai - Studia Philologia*, Universitatea Babeş-Bolyai, LIV (3), 125-151.

BRAMBLE, Dennis & CARRIER, David (1983). Running and breathing in mammals. *Science*, 219, 251-256.

BRICEÑO GUERRERO, José (1970). *El origen del lenguaje*. Caracas : Monte Ávila Editores.

BROWMAN, Catherine & GOLDSTEIN, Louis (1992). Articulatory phonology: an overview. *Phonetica*, *49*, 155-180.

BROWN, Steven, NGAN, Elton & LIOTTI, Mario (2008). A larynx area in the human motor cortex. *Cerebral Cortex, 18*, 837-845.

BROWN, Steven, LAIRD, Angela, PFORDRESCHER, Peter, THELEN, Sarah, TURKELTAUB, Peter & LIOTTI, Mario (2009). The somatotopy of speech: phonation and articulation in the human motor cortex. *Brain and Cognition,* June, *70* (1), 31-41.

BYRD, Andrew (2015). *The Indo-European Syllable.* Leiden and Boston : Brill.

CARLISLE, Robert (2001). Syllable structure universals and second language acquisition. *International Journal of English Studies*, *1* (1), 1-19.

CRYSTAL, David (2003). *A Dictionary of Linguistics and Phonetics*. 5th edition. Oxford : Blackwell.

CULIOLI, Antoine (1990). *Pour une linguistique de l'énonciation. Opérations et représentations, 1.* Paris : Ophrys.

DAMASIO, Antonio (2010). *Self Comes to Mind. Constructing the Conscious Brain*. New York : Pantheon.

DARWIN, Charles (1998 [1872]). *The Expression of the Emotions in Man and Animals*. London : HarperCollins.

DAUDE, Jean (1994). Le *k*- initial flottant de l'indo-européen. In D. Conso, N. Fick & B. Poulle (eds.), *Mélanges François Kerlouégan* (179-194). Besançon : Université de Franche-Comté.

DIAMOND, Arthur (1959). *The History and Origin of Language*. London : Methuen.

DICKSON, David & MAUE-DICKSON, Wilma (1996). *Anatomical and Physiological Bases of Speech*. Boston and Oxford : Butterworth-Heinemann.

DONALD, Merlin (1990). *Origins of the Modern Mind. Three Stages in the Evolution of Culture and Cognition.* Cambridge (MA) : Harvard University Press.

DONALD, Merlin (2001). *A Mind So Rare. The Evolution of Human Consciousness*. New York and London : W. W. Norton.

DURIE, Mark & ROSS, Malcolm (eds.) (1996)*, The Comparative Method Reviewed: Regularity and Irregularity in Language Change*. New York : Oxford University Press.

ENGELMANN, George (1883). *Labour among Primitive Peoples: Showing the Development of the Obstetric Science of To-Day, from the Natural and Instinctive Customs of All Races, Civilized and Savage, Past and Present*. 2nd edition. St. Louis : J. H. Chambers & Co.

ESLING, John (2012). The articulatory function of the larynx and the origins of speech. In *Proceedings of the Annual Meeting of the Berkeley Linguistics Society*, *38* (121-149). Linguistic Society of America.

ESLING, John, BENNER, Allison & MOISIK, Scott (2015). Laryngeal articulatory function and speech origins. In H. Little (ed.), *Proceedings of the 18th International Congress of Phonetic Sciences (ICPhS 2015) Satellite Event: The Evolution of Phonetic Capabilities: Causes constraints, consequences*, (2-7). Glasgow : ICPhS.

FELDMAN, Jerome (2006). *From Molecule to Metaphor. A Neural Theory of Language*. Cambridge (Mass.) : The MIT Press.

FÓNAGY, Ivan (1999). Why iconicity? In M. Nänny & O. Fischer (eds.), *Form Miming Meaning. Iconicity in Language and Literatur*e (3-36). Amsterdam and Philadelphia : John Benjamins.

FORTESCUE, Michael (2017). *The Abstraction Engine. Extracting Patterns in Language, Mind and Brain*. Amsterdam and Philadelphia : John Benjamins.

FRIDLUND, Alan (1994). *Human Facial Expression. An Evolutionary View*. San Diego and London : Academic Press.

FRITZ, Matthias (1996). Das urindogermanische Wort für 'Nase' und das grundsprachliche Lautgesetz *R̝HV > R*. *Historische Sprachforschung*, *109* (1), 1-20.

FUJITA, Koji & BOECKX, Cedric (2016). *Advances in Biolinguistics. The Human Language Faculty and its Biological Basis*. Abingdon and New York : Routledge.

GALLESE, Vittorio & LAKOFF, George (2005). The brain's concepts: the role of the sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology*, *22* (3-4), 455-479.

GAMKRELIDZE, Thomas & IVANOV, Vjačeslav (1995). *Indo-European and the Indo-Europeans*, vols. I and II. Translated by J. Nichols. Berlin : Mouton de Gruyter.

GÄRDENFORS, PETER (2000). *Conceptual Spaces. The Geometry of Thought*. Cambridge (Mass.) : The MIT Press.

GÄRDENFORS, PETER (2014). *The Geometry of Meaning. Semantics Based on Conceptual Spaces*. Cambridge (Mass.) : The MIT Press.

GENTILUCCI, Maurizio, BENUZZI, Francesca, GANGITANO, Massimo & GRIMALDI, Silvia (2001). Grasp with hand and mouth: a kinematic study on healthy subjects. *Journal of Neurophysiology*, *86* (4), 1685-1699.

GRÉGOIRE, Michaël (2012). *Le lexique par le signifiant. Méthode en application à l'espagnol*. Sarrebruck : Presses académiques francophones.

GRIMM, Jacob (1819-1837). *Deutsche Grammatik*. Göttingen : Bei Dieterich.

GRINE, Frederick, FLEAGLE, John & LEAKEY, Richard (eds.) (2009). *The First Humans - Origin and Early Evolution of the Genus Homo*. Contributions from the Third Stony Brook Human Evolution Symposium and Workshop, October 3 - October 7, 2006. New York : Springer.

GUILLAUME, Gustave (1984). *Foundations for a Science of Language*. Translated by J. Hewson and W. Hirtle. Amsterdam and Philadelphia : John Benjamins.

GUYŐRI, Gábor & HEGEDŰS, Irén (2011). A cognitive approach to the methodology of semantic reconstruction: the case of English *chin* and *knee*. In K. Allan & J. Robinson (eds.), *Current Methods in Historical Semantics* (313-332). Berlin and Boston : Walter de Gruyter.

HALE, Mark (2014). The Comparative Method: theoretical issues. In C. Bowern & B. Evans (eds.), *Routledge Handbook of Historical Linguistics* (146-160). London : Routledge.

HAMP, Eric (1980). IE *$kweh_2s$- "cough". In K. Čolakova (ed.), *Studia Linguistica in Honorem Vladimir I. Georgiev* (130-134). Sofia : Academia Litterarum Bulgarica.

HEINE, Bernd (1997). *Cognitive Foundations of Grammar*. New York : Oxford University Press.

HOENIGSWALD, Henry (1952). Laryngeals and *s* movable. *Language*, *28* (2). April-June, 182-185.

JELLINEK, Ernest (2006). The Valsalva manoeuvre and Antonio Valsalva (1666-1723). *Journal of the Royal Society of Medicine*, *99*, 448-451.

JESPERSEN, Otto (1922). *Language. Its Nature, Development and Origin.* London : Allen and Unwin.

JÓHANNESSON, Alexander (1949). *Origin of Language*. Reykjavík : H. F. Leiftur.

JOHNSON, Mark (2012). Action, embodied meaning, and thought. In J. Schulkin (ed.), *Action, Perception and the Brain. New Directions in Philosophy and Cognitive Science* (92-116). London : Palgrave Macmillan.

KIMBEL, William (2009). The origin of *Homo*. In F. Grine, J. Fleagle & R. Leakey (eds.), *The First Humans - Origin and Early Evolution of the Genus Homo* (31-37). Contributions from the Third Stony Brook Human Evolution Symposium and Workshop, October 3 - October 7, 2006. New York : Springer.

KLOEKHORST, Alwin (2008). *Etymological Dictionary of the Hittite Inherited Lexicon*. Leiden and Boston : Brill.

KORTVÉLYESSY, Lívia (2011). A cross-linguistic research into phonetic iconicity. *Lexis*, *6*, *Diminutives and Augmentatives in the Languages of the World*, 27-39.

KROONEN, Guus (2013). *Etymological Dictionary of Proto-Germanic*. A. Lubotsky (ed.), Leiden Indo-European Etymological Dictionary Series. Leiden and Boston : Brill.

KUHN, Thomas (2012 [1962)]). *The Structure of Scientific Revolutions*. 50th anniversary edition, with an Introductory Essay by I. Hacking. Chicago and London : The University of Chicago Press.

LAKOFF, George (1990). The invariance hypothesis: is abstract reasoning based on image-schemas? *Cognitive Linguistics*, *1* (1), 39-74.

LAKOFF, George (2008). The neural theory of metaphor. In R. Gibbs, Jr. (ed.), *The Cambridge Handbook of Metaphor and Thought* (17-38). Cambridge : Cambridge University Press.

LAKOFF, George & JOHNSON, Mark (2003 [1980]). *Metaphors We Live By*. Chicago and London : The University of Chicago Press.

LEHMANN, Winfred (1952). *Proto-Indo-European Phonology*. Austin : University of Texas Press and Linguistic Society of America.

LEMOS, Andrea, DEAN, Elizabeth & DORNELAS DE ANDRADE, Armèle (2011). The Valsalva maneuver duration during labor expulsive stage: repercussions on the maternal and neonatal birth condition. *Revista Brasileira de Fisioterapia*, *15* (1), January/February, 66-72.

LIEBERMAN, Philip (2007). The evolution of human speech: its anatomical and neural bases. *Current Anthropology*, *48* (1), February, 39-66.

LINDEMAN, Fredrik (1987). *Introduction to the 'Laryngeal Theory'*. Oslo : Norwegian University Press.

LONGO, Matthew (2016). Types of body representation. In Y. Coello & M. H. Fischer (eds.), *Foundations of Embodied Cognition, Volume 1: Perceptual and Emotional Embodiment* (117-134). London : Routledge.

LOUCKS, Torrey, POLETTO, Christopher, SIMONYAN, Kristina, REYNOLDS, Catherine & LUDLOW, Christy (2007). Human brain activation during phonation and exhalation: Common volitional control for two upper airway functions. *Neuroimage*, 36, 131-143.

MA-KELLAMS, Christine (2014). Cross-cultural differences in somatic awareness and interoceptive accuracy: a review of the literature and directions for future research. *Frontiers in Psychology*, *5*, December, n° 1379, 1-9.

MACNEILAGE, Peter (1998). The frame/content theory of evolution of speech production. *Behavioral and Brain Sciences*, *21*, 499-511.

MACNEILAGE, Peter (2008). *The Origin of Speech*. Oxford : Oxford University Press.

MAJID, Asifa & VAN STADEN, Miriam (2015). Can nomenclature for the body be explained by embodiment theories? *Topics in Cognitive Science*, *7*, 570-594.

MALLORY, James & ADAMS, Douglas (eds.) (1997). *Encyclopedia of Indo-European Culture*. Chicago and London : Fitzroy Dearborn.

MARTINET, André (1975). *Évolution des langues et reconstruction*. Paris : Presses Universitaires de France.

MATISOFF, James (1978). *Variational Semantics in Tibeto-Burman: The "organic" approach to linguistic comparison*. (Occasional Papers of the Wolfenden Society on Tibeto-Burman Linguistics, 6). Philadelphia : Institute for the Study of Human Issues.

MCUNE, Lorraine, VIHMAN, Marilyn, ROUG-HELLICHIUS, Liselotte, BORDENAVE DELERY, Diane & GOGATE, Lakshmi (1996). Grunt communication in human infants (*Homo sapiens*). *Journal of Comparative Psychology*, *110*, 127-37.

MEIER-BRÜGGER, Michael (2003). *Indo-European Linguistics*. Translated by Ch. Gertmenian. Berlin and New York : Walter de Gruyter.

MÖLLER, Hermann (1880). Germanisch *ā ē ō* in den endungen des nomens und die entstehung des *o* (a_2). *Beiträge zur Geschichte der deutschen Sprache und Literatur*, *7*, 482-547.

MUELLER, Sophia, WANG, Danhong, FOX, Michael D., YEO, B. T. Thomas, SEPULCRE, Jorge, SABUNCU, Mert R., SHAFEE, Rebecca, LU, Jie & LIU, Hesheng (2013). Individual variability in functional connectivity architecture of the human brain. *Neuron*, February 6, *77* (3), 586-595.

MÜLLER, F. Max (trans.) (2001). *The Upanishads*, parts I & II. Abingdon and New York : Routledge.

NOIRÉ, Ludwig (1877). *Ursprung der Sprache*. Mainz : V. v. Zabern.

ONIANS, Richard (1988 [1951]). *The Origins of European Thought about the Body, the Mind, the Soul, the World, Time, and Fate*. Cambridge : Cambridge University Press.

PAGET, (Sir) Richard (1930). *Human Speech*. London : Kegan Paul, Trench, Trubner.

PARRY, William (1985). Stuttering and the Valsalva mechanism: a hypothesis in need of investigation. *Journal of Fluency Disorders*, *10*, 317-324.

PARRY, William (2013). *Understanding and Controlling Stuttering. A Comprehensive New Approach Based on the Valsalva Hypothesis*. 3rd edition. Merion Station : self-published.

PHILPS, Dennis (2008). Introduction to lexical submorphemics. *Lexis*, *2*, *Lexical Submorphemics*. Available at https://journals.openedition.org/lexis/685

PHILPS, Dennis (2009). Conceptual transfer and the emergence of the sign: a semiogenetic approach to PIE **ĝenu-* 'jawbone, chin' and **ĝenu-* 'knee'. *CogniTextes*, 2. Available at http://cognitextes.revues.org/index180.html.

PHILPS, Dennis (2011). Reconsidering phonæsthemes: submorphemic invariance in English '*sn-* words'. *Lingua*, *121*(6), 1121-1137.

PHILPS, Dennis (2012). Submorphemes: backtracking from English '*kn*- words' to the emergence of the linguistic sign. *Miranda*, *7*, *Ceramics/Submorphemics*. Available at https://journals.openedition.org/miranda/4244

PHILPS, Dennis (2017). The emergence of the linguistic sign: vocomimesis, symmetry and enaction. *Signifiances/Signifying 1* (3), *Enaction, émergence du langage, production du sens*, 115-132.

POKORNY, Julius (1959). *Indogermanisches etymologisches Wörterbuch*, vols. 1 and 2. Bern : Francke.

POYATOS, Fernando (2002). *Nonverbal Communication across Disciplines*, *volume II: Paralanguage, kinesics, silence, personal and environmental interaction*. Amsterdam and Philadelphia : John Benjamins.

PROVINE, Robert (1996). Contagious yawning and laughter: significance for sensory feature detection, motor pattern generation, imitation, and the evolution of social behavior. In C. M. Heyes & B. J. Galef, Jr. (eds.), *Social Learning in Animals. The Roots of Culture* (179-208). San Diego and London : Academic Press.

PSTRAS, Leszek, THOMASETH, Karl, WANIEWSKI, Jacek, BALZANI, Italo & BELLAVERE, Federico (2016). Review: The Valsalva manoeuvre: physiology and clinical examples. *Acta Physiologica*, *217* (2), June, 103-119.

RIX, Helmut, KÜMMEL, Martin, ZEHNDER, Thomas, LIPP, Reiner & SCHIRMER, Brigitte (2001). *Lexikon der indogermanischen Verben*. 2nd edition. Wiesbaden : Reichert.

RIZZOLATTI, Giacomo & SINIGAGLIA, Corrado (2008). *Mirrors in the Brain. How Our Minds Share Actions and Emotions*. Translated by F. Anderson. Oxford : Oxford University Press.

ROUSSEAU, André (1990). L'alternance **k-/ø-* à l'initiale des mots en indo-européen. In J. Kellens (ed.), *La reconstruction des laryngales* (149-180). Paris : Les Belles Lettres.

DE SAUSSURE, Ferdinand (1879). *Mémoire sur le système primitif des voyelles dans les langues indo-européennes*. Leipsick : B. G. Teubner.

SCHERER, Ronald (1994). Laryngeal function during phonation. *NCVS Status and Progress Report*. University of Iowa, *7*, December, 171-186.

SOUTHERN, Mark (1999). *Sub-grammatical Survival: Indo-European s-mobile and its Regeneration in Germanic*. Washington (DC) : JIES Monograph n° 34/Institute for the Study of Man.

STIPPICH, Christopher (ed.) (2015). *Clinical Functional MRI: Presurgical Functional Neuroimaging*. 2nd revised edition. Berlin and Heidelberg : Springer-Verlag,

SVOROU, Soteria (1994). *The Grammar of Space*. Amsterdam and Philadelphia : John Benjamins.

SWADESH, Morris (2006 [1971]). *The Origin and Diversification of Language*. J. Sherzer (ed.). Abingdon and New York : Routledge.

SWEETSER, Eve (1990). *From Etymology to Pragmatics. Metaphorical and cultural aspects of semantic structure.* Cambridge : Cambridge University Press.

USÓ-DOMÉNECH, José-Luis & NESCOLARDE-SELVA, Josué Antonio (2015). What are belief systems? *Foundations of Science*, *21* (1), February, 147-152.

VALSALVA, Antonio (1704). *De aure humana tractatus*. Bologna : Constantino Pisaro.

DE VIGNEMONT, Frédérique, TSAKIRIS, Manos & HAGGARD, Patrick (2005). Body mereology. In G. Knoblich, I. Thornton, M. Grosjean, & M. Shiffrar (eds.), *Human Body Perception from the Inside Out* (147-170). Oxford : Oxford University Press.

WARREN, Donald, DRAKE, Amelia, DAVIS, Jefferson (1992). Nasal airway in breathing and speech. *The Cleft Palate-Craniofacial Journal*, *29* (6), December, 511-519.

WIDDICOMBE, John (2003). A brief overview of the mechanisms of cough. In K. Fan Chung, J. Widdicombe & H. Boushey (eds.), *Cough: Causes, Mechanisms and Therapy* (17-23). Oxford : Blackwell.

WILKINS, David (1996). Natural tendencies of semantic change and the search for cognates. In M. Durie & M. Ross (eds.)*, The Comparative Method Reviewed: Regularity and Irregularity in Language Change* (264-304). New York : Oxford University Press.

WODTKO, Dagmar, IRSLINGER, Britta & SCHNEIDER, Carolin (2008). *Nomina im indogermanischen Lexikon*. Heidelberg : Universitätsverlag Winter.

WRIGHT, Joseph (ed.) (1898-1905). *The English Dialect Dictionary, vol. III*. London : H. Frowde.

ZAIR, Nicholas (2012). *The Reflexes of the Proto-Indo-European Laryngeals in Celtic*. Leiden and Boston : Brill.

Reference works

EDD: *The English Dialect Dictionary* (Wright 1898-1905)

EIEC: *Encyclopedia of Indo-European Culture* (Mallory & Adams 1997)

GI: *Indo-European and the Indo-Europeans* (Gamkrelidze & Ivanov 1995)

HIL: *Etymological Dictionary of the Hittite Inherited Lexicon* (Kloekhorst 2008)

IEW: *Indogermanisches etymologisches Wörterbuch* (Pokorny 1959)

LIV: *Lexikon der indogermanischen Verben* (Rix et al. 2001)

NIL: *Nomina im indogermanischen Lexikon* (Wodtko et al. 2008)

OED: *Oxford English Dictionary*. 2nd edition. CD-Rom, version 3.1 (2004).