Ampersand 8 (2021) 100073

Contents lists available at ScienceDirect

Ampersand

journal homepage: www.elsevier.com/locate/amper

Mind the (terminological) gap: 10 misused, ambiguous, or polysemous terms in linguistics

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ARTICLE INFO

Keywords:
Three factors
Labeling
E-Language
I-language
Neural signature
Reference

ABSTRACT

Linguistics is a relatively young field. The birth of a new, vibrant field of research often brings with it certain challenges such as the initial absence of an uncontroversial canon and a certain lack of terminological clarity. Following the example of closely allied disciplines, this work aims to register ambiguities in the use of ten terms in linguistics, with the overarching aim to aid field-internal coherence and field-external visibility. Among other issues, we discuss the influential 'three factors' model, labeling, reference, and E-/I-language. Addressing the challenge of looking back while moving forward, we compile a collection of definitions and/or presentations extracted from knowledge-rich contexts for each term, grounded in current usages. We first reflect on previous usages in order to present the first definitions of these terms and track terminological ambiguities that arose throughout their subsequent use. We then attempt to transition towards terminological clarity, providing specific recommendations for a more transparent use of these terms.

1. Introduction

Recently, the field of psychology saw an opportune effort to improve terminological clarity and coherence (Lilienfeld et al., 2015 2017). The unprecedented popularity of works that identified lists of inaccurate, ambiguous, misleading, and misused terms did not unify the entire field under a single narrative. Indeed, it may well be possible that such a unification is a chimera. However, fragmentation across distinct sub-disciplines is not directly at odds with field-internal coherence. Works that recognize the fragmented status of psychology are able to talk with a certain degree of confidence and clarity about some of the field's key notions, primitives, or methodologies: aspects of the physiology of the nervous system, perceptions, muscular reactions, and response times (Green 2015). If we focus on sub-disciplines, clinical psychologists have already gone the extra mile: disagreements on terminology were registered, and there was a move towards disambiguating certain labels (Bishop 2017).

This attempt to discuss issues that pertain to terminological fluidity did not occur simultaneously in all fields of psychology. For example, linguistics, which according to Chomsky (2007a) cannot be conceived in any other way but as part of psychology, is a field that until very recently had not attempted to identify terms that are currently used in inconsistent, ambiguous, or unclear ways. Quite representative of the non-uniformity that characterizes the field was also the reaction to the first effort of registering such ambiguities (Leivada, 2020). Some scholars recognized the need to keep track of the various uses of ambiguous terms (Uriagereka 2020), and suggested that a second instalment of polysemous, ambiguous, and misused terms in linguistics is necessary (Grohmann 2020)—a suggestion we intend to take up here. Others suggested that the identified terminological issues do not represent the current lay of the land in linguistics (Di Sciullo 2020).

An important question is whether there are more linguistic terms which demand similar evaluation. The original list (Leivada, 2020) identified only ten ambiguous or frequently misused terms: Universal Grammar and language universals; parameter; feature; linguistic genotype; faculty of language in the narrow sense; hardwired primitives/operations; the metaphors of language development; grammaticality judgment; bilingual advantage; and optimal/perfect design. This list looks quite small when compared with the lists of misused, ambiguous, and polysemous terms in psychology, which involve 100 entries, including terms from neuroscience, genetics, and clinical practice (Lilienfeld et al., 2015 2017). This pronounced difference is not due to the fact that linguistics has done a better job compared to other fields in resolving ambiguities—this is evidenced by the fact

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https://doi.org/10.1016/j.amper.2021.100073
Received 9 December 2020; Received in revised form 16 March 2021; Accepted 1 April 2021
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that some additions to the original list have already been proposed (e.g., Mendívil-Giró's 2020 discussion of the various meanings of the term 'language evolution').

Responding to the need to register the ambiguities of terms in the field, whilst also covering different subfields of linguistics, the present work presents ten different notions/concepts, frequently encountered in the field, together with examples of their inconsistent or unclear use. The latter is the outcome of the fact that concepts are open-ended and susceptible to change, resulting at times in considerable conceptual variation (Freixa and Fernández-Silva 2017). However, when a scientific discipline attaches largely contradictory meanings to the same concept, even among works that assume the exact same theoretical background, it is useful if this polysemy does not go unnoticed for reasons explained below. Indeed, as we will discuss, polysemy itself is a more widespread phenomenon in natural language than usually appreciated, with multiple senses often infiltrating even some of the most basic terms in linguistics.

It should be clarified that each of the terms discussed below is not necessarily satisfying all the characteristics of inaccuracy, ambiguity, and misuse. As such, the list does not include only inherently problematic terms, but also terms that are used in alternative or unclear ways. It is important to highlight that this polysemy is not without consequences. On the one hand, terminological polysemy can in fact *aid* naturalistic inquiry, permitting a broader range of applications of a given concept to distinct empirical and conceptual domains simultaneously. On the other hand, given the large number of different theoretical approaches in the field, if different groups work on notions x, y, or z, but differ substantially in the way they define these notions, problems of interaction will inevitably arise. This brings with it issues such as extreme sub-disciplinary fragmentation and niche specialization, which impede interdisciplinary visibility and collaboration.

Our discussion of the 10 selected terms does not present an individual perspective on what the definition of term X should be. Rather we put together a collection of various definitions that have been already associated with each discussed term in the relevant literature. As such, we neither re-define these terms nor favor one definition over others; instead, we look back in order to explain the original meaning of these terms in the contexts in which they were first used. In doing this survey of the literature, we approach the term "definition" in a loose way, using it to describe definitional and knowledge-rich contexts, that describe the meaning of the terms under analysis. Second, we provide specific examples of terminological inconsistencies or ambiguities that arose through their subsequent use. Last, we move forward towards achieving a better degree of terminological clarity and uniformity, through providing specific recommendations for a more transparent use of these terms.

2. Ten misused, ambiguous, or polysemous terms in linguistics, vol II

2.1. I-language

In her commentary on a recent list of misused terms in linguistics (Leivada, 2020) Di Sciullo (2020), suggests that "[w]ithin the generative enterprise, the biolinguistic program is concerned with language internal to the individual, the I-language, which is distinct from the external language, the E-language. It aims to provide an explanation for I-language by understanding through its biological basis". She also clarifies that because I-language is internal to the individual, it is not acquired. Although these descriptions may seem unambiguous, the definition of the term 'I-language' may differ depending on who you ask Uriagereka (2020). argues that "Noam Chomsky coined the term I-language in 1986, long before anyone, so far as I know, started to put "i" in front of just about anything. I am not sure whether that term is any less confusing." There are two separate issues that deserve to be unpacked here: (i) holding alternative definitions of the term 'I-language', such that the use of the term brings along a certain degree of ambiguity, and (ii) coining different terms that use the prefix 'I', without having settled one meaning for it, thus perpetuating ambiguity in more contexts.

Chomsky's primary objective in introducing the distinction between I- and E-language was to clarify the difference between the object of study of linguistics as part of cognitive science (i.e. a system of knowledge) and the object of study of linguistics as part of the social sciences (i.e. a social/cultural object; which, in fact, he believed could not be concretely defined as an object of naturalistic inquiry). A useful point to start is providing the first definition of these terms. 'I-language' and 'E-language' were first defined in Chomsky (1986) along the following lines: E-language treats language "independently of the mind/brain" (p. 20), and I-language "is some element of the mind of the person who knows the language, acquired by the learner, and used by the speaker-hearer" (p. 22). The problem of holding alternative definitions of the term 'I-language' is already evident: Di Sciullo presents the term as the language that is internal to the individual and *not acquired*, while in Chomsky's definition, the term refers to a capacity of the mind that reflects the language *acquired* by the learner. Precisely because I-language refers to the internalized knowledge of *some* language (a thesis that would render Di Sciullo's interpretation of the term untenable), and possibly more than one, it has been argued that it is important to study the potential range of I-grammars in bilingual and multilingual speakers/signers (Alexiadou and Lohndal 2018). The implies the position that bi-/multilingual speakers/signers have different I-languages for each language they know, such that it is meaningful to talk about "individual *learners*' I-languages" (Aboh and deGraff, 2016: 38; emphasis added) and not about a single, universal I-language that is not the product of a developmental learning process. In more recent work, Chomsky seems to affirm this interpretation by claiming that language acquisition is concerned with the interaction of Universal Grammar and learning mechanisms in the development of I-language (Chomsky et al., 2019: 231). Talking about learning mechanisms in the development of I-language entails a process of acquisition. This contradicts the position that I-language is not acquired (Di Sciullo 2020) as well as any conception of I-language as one universal human language (cf Neske 2010).

The second issue has to do with the attachment of the prefix 'I' to various other terms (e.g., I-linguistic system, I-idiolect, I-semantics, I-morphology). If the meaning of 'I' is not unambiguous, adding it "in front of just about anything", as Uriagereka (2020) puts it, perpetuates terminological unclarity. Without having agreed on defining this prefix in one way, unless all but one possible meanings are explicitly discarded each time it is used, it is unclear whether the terms on which it is attached denote a property or component that is (i) internal and universally uniform in the absence of pathology, (ii) internal, but acquired, and as such cross-linguistically variable, or (iii) a universal, species-typical prototype in the sense of Watumull (2012) which can be abstracted from shared properties of acquired I-languages for formal inquiry.

Given the proliferation of possible meanings and uses of the prefix 'I', the recommendation for its use is to accompany it with a clear presentation of the sense in which this term is employed in the specific context. That is to say, it implies that the component it is attached to is something internal to the mind/brain of the speaker, and not some external constellation of behaviors, traits or non-human physical properties, but further clarification is needed.

2.2. E-language

E-language has been presented as a set defined "independently of the mind/brain" (Chomsky 1986: 20). Offering a more complete definition, 'E' stands for extensional and externalized: "The definition is "extensional" in that it takes language to be a set of objects of some kind, and it is "externalized" in the sense that language, so defined, is external to the mind/brain. Thus a set, however chosen, is plainly external to the mind/brain" (Chomsky 1997: 7).

In rough terms, linguists have assumed a distinction between I-language and E-language that reflects language being approached from a biological versus a socio-cultural point of view respectively. Under this interpretation, E-language may be taken to denote similar internalized systems/idiolects (e.g., English). In another definition of the term, E-language denotes the full set of utterances that can be made in a speech community (Chomsky 1997 attributes this view to Bloomfield).

Both definitions come with problems. In the second definition, the set of utterances that a speech community can produce is an ill-defined set, as Chomsky (1997) puts it and has long argued. This conception of E-language as a uniform set that can be produced by *all* the members of a community presupposes the validity of the notions of an ideal speaker-listener and a completely homogeneous speech-community; two problematic terms that have been discussed in the first list of misused terms in linguistics (Leivada, 2020). Given that all communities allow variation across idiolects, the idea of a uniform set cannot be empirically defended. This happens because there is no way of determining whether sentences like *The child seems sleeping* form part of the set produced by an English-speaking community or not. Even the most homogeneous, monolingual communities show some degree of Personal Pattern Variation (Dorian 1994), which is variation that cannot be explained on either geographical or social grouping grounds.

A different problem emerges when one examines the first definition of E-language: E-language as a socio-cultural construct that exists independently of the mind. In order to illustrate the problem, let us consider the term E-language when it occurs in the phrase 'the I-language/E-language distinction'. This phrase involves a gray area, represented in the majority of the discussions in which it occurs with '/' or 'vs'. The meaning of this notation is usually not spelled out, but often it refers to the distinction between I- and E-language. However, this distinction is not absolute, and this is where the interpretation of E-language as a construct that exists independently of the mind/brain becomes problematic. Biologists have shown that our genes guide the way we respond to the environment, but these responses are in turn modified by the environment in a way that then informs (epi)genetic action. In the case of behavioral traits, genes codetermine the capacities of organisms, yet the degree to which these capacities will be manifested is determined also by the environment. As Lewontin (2000) puts it, humans have language because they have both the right genes and the right environment. This means that crucial properties of an I-language emerge partially as a result of environmental pressures (E-factors) to adapt and meet certain communicative needs (see Leivada, 2015 for examples of such properties). If one views the set of tokens that an I-language can generate and externalize as E-language as a set that occurs *independently* of the mind/brain, then one's account of the ontology of either component, I- or E-language, will fail to appreciate this *interaction* of biological properties with the environment (I- and E-factors, respectively). In other words, E-languages are not shaped independently of the mind/brain, instead they look the way they do due to the synergistic interplay of both the mind/brain and the environment (see also Boeckx et al., 2013).

In sum, the term 'E-language' is polysemous and both its definitions may raise issues. The first definition of E-language as a construct that can be defined separately from the mind is problematic, because the genetic front, which would be subsumed under I-, and the environmental front, which would be subsumed under E-, are not fully separable. All organism development and regulation is inherently interactive, which is why terms like 'genetically determined' and 'environmentally determined' have been argued to be imprecise (West-Eberhard 2003). The second definition (i.e. E-language as the full set of utterances that can be made in a speech community) runs into the problem of indeterminacy, because it presupposes the idea that the entire community (with 'community' also being an amorphous structure) speaks/signs in a way that does not permit variation. At best, the notion of a homogenous community is a convenient metaphor, and as such, it cannot be taken as a solid criterion for defining membership of a set.

Since the term 'E-language' is both polysemous and raises concerns in all of its definitions, the recommendation, in line with Chomsky (2007a), is to avoid its use, unless one's discussion of the term offers an unambiguous definition, while also explaining how the aforementioned problems are not relevant for a specific use of the term. Moreover, it is uninformative to talk about the I. vs E-language distinction, unless one specifies in what sense the two terms are taken to be distinct. A distinct approach that draws a sharp distinction between I- and E-language is likely not to appreciate the fact that linguistic properties are innate in terms of the capacity from which they evolve; however, their development is subject to environmental factors (e.g., time, input from previous cohorts, etc.) and reflects environmental properties (e.g., size of the community, distribution of speakers/signers, degree of interaction, etc.).

2.3. Third factor

Chomsky (2005) identified three factors relevant to language design and subsequent growth of language in the individual:

I. Genetic endowment that drives the child to interpret part of the environment as language-related
II. Experience (i.e. data through sensory epithelia)
III. Principles and operations of general cognition that are not specific to language

Although a few third factor principles have been proposed (e.g., No Tampering Condition (Chomsky 2008), Full Interpretation (Freidin and Lasnik 2011; Lohndal and Uriagereka, 2016), Input Generalisation (Holmberg and Roberts 2014), Maximise Minimal Means (Biberauer 2019), Equal Embedding (Murphy & Shim, 2020), their existence usually is linked to the discussion of exclusively linguistic properties, which is somewhat surprising given that they are meant to be "principles not specific to the faculty of language" (Chomsky 2005: 6). To explain this point, the No Tampering Condition suggests that the Merge of two syntactic objects X and Y leaves X and Y unchanged. Although this condition has been attributed to a third factor requirement for efficient computation (Chomsky 2008), this attribution does not entail that a cognitive/computational bias *not* specific to language is involved. By claiming that a linguistic constraint is due to a general cognitive bias because it participates in efficient computations, one attaches a third factor label to an already well-known linguistic constraint. However, in and of itself, such a claim does not identify a third factor principle, unless it (i) explains what efficient computation is, and (ii) shows that the biases into which this efficient computation translates are not specific to language (i.e. they are evident in other domains of cognition or perception).

Notice here that the phrase "principles of efficient computation", that is embedded in almost every discussion of third factor principles, lacks a definition in the literature. It is more of a programmatic guide. What criteria should a principle satisfy in order to be classified as a principle of efficient computation? How is the efficiency threshold established for the computation itself? As Lohndal and Uriagereka (2016) put it, Chomsky takes the notion of computational efficiency to be the hallmark of the third factor domain, but if the implicit assumption is that computations in general should be as efficient as possible, then efficiency is a property shared by all computations. The important question is whether it is meaningful to call every linguistic constraint a third factor principle, simply because it is involved in computations that tend to be efficient. Even leaving the lack of definition for efficiency aside, the term 'computation' is among the most highly polysemous and imprecisely discussed terms in cognitive science (Piccinini and Scarantino 2011).

In order to assemble the overall conception of the term 'principles of efficient computation', we performed a search aiming to determine the

presentation of this notion outside linguistics. The underlying assumption is that since principles of efficient computation fall under the third factor and are not specific to language, one will find uses, and hopefully definitions, of this phrase outside linguistics. On 02/11/2020, a Google search gave this phrase 112 results. The percentage of results that featured it in a context other than Chomsky's three factors was 0.8% (i.e. corresponding to one result, which concerned machine learning and automated decisions).[1] This distribution shows that by appealing to 'principles of efficient computation', linguists do not employ a term that is well-known or frequently used outside linguistics, which is perplexing given that the term is meant to pertain to a realm that is *not* specific to language. It may be fruitful to attempt to ground principles of economy/efficiency within certain other frameworks in cognitive science, such as the free-energy principle (as proposed in Murphy, 2020). Even within linguistics, the exact terminological status of the third factor principles as domain-general or domain-specific is unclear. On the one hand, Chomsky (2005: 6) defined the third factor as consisting of "principles not specific to the faculty of language". On the other hand, some studies described certain third factor principles in the exact opposite way: as domain-specific principles that apply to language computations, but not to other cognitive computations (Di Sciullo 2015 Rizzi 2016). Apart from the disagreement over domain-specificity, the term 'third factor' is so loosely defined in linguistics that it can cover almost anything (Johansson 2013): principles of data analysis, principles of efficient computation, architectural and computational constraints, principles of canalization and developmental stability, mechanisms of evolution (e.g., natural selection), physical and mathematical laws of form, conditions imposed by the interfaces, etc. If it is difficult to exclude almost anything from the third factor domain (Johansson 2013), the definition of this term should be registered at best as loose.

In sum, 'third factor' is a term that (i) has been defined in contradicting ways within linguistics and (ii) evokes notions that are often not defined at all (e.g., efficiency). Currently this term is a popular buzzword in linguistics, however the premises that warrant its use are often not presented at all (though they can indeed be justified and can be shown to be a useful guide in exploring the neural basis of language; Murphy, 2020). The recommendation is to avoid attaching a third factor label to linguistic constraints without an explanation that is grounded in theories of general cognition, biology, or evolution.

2.4. First factor as residue

Chomsky (2005) first factor in language design is one of the most popular notions in generative linguistics. The first factor, which was explicitly identified in Chomsky (2005) as the topic of Universal Grammar, was defined as the genetic endowment for language, that drives the child to interpret part of the linguistic environment as linguistic.

The portion of the definition that refers to *genetic* endowment was already discussed in the first list of misused terms in linguistics (Leivada, 2020). What has not been addressed, however, is the overall definition of the first factor in relation to the third factor within the three factors model. The issue we wish to bring forward here boils down to the conception of the first factor as the *residue* that remains when third factor effects are abstracted (Chomsky 2007b Biberauer 2019). The notion of residue in this conception of the first factor suffers from the problem of approaching the third factor and the first factor as fully separable components. However, as Trettenbrein (2015) suggests, it is possible that many first factor principles derive from cognitive precursors, such that asking whether a principle that looks tailored to module-specific purposes is truly module-specific (i.e. first factor) seems inappropriate, as purpose "is manifold and indeterminable" (p. 3).

To illustrate the problem of abstracting one set of factors from a superset, let us consider a specific example of a cognitive principle. The Elsewhere Condition (Anderson 1969) suggests that when multiple rules are available and can be applied, the most specific rule wins. This principle is involved in language acquisition (Boeckx and Leivada, 2014), however it is not exclusive to the linguistic domain. To use the example Yang (2005) introduces, a full house in poker is a hand that contains three cards of one rank and two cards of another rank. While poker rules do not explicitly disallow a description of full house as two pairs, it is standardly assumed that the most specific applicable description should be preferred, hence nobody describes a full house as two pairs. Having established that the Elsewhere Condition finds applications outside language acquisition, it is still unclear whether it can be classified as a third factor principle or as a first factor residue. As Yang (2005) suggests, one can offer hypotheses both ways: It could be that the Elsewhere Condition is a principle that plays a role in language but also in other cognitive domains (hence it would fall under the third factor). Alternatively (though much less plausibly), it is also possible that the Elsewhere Condition is phylogenetically linguistic in origin and re-used in other cognitive domains *through language* (hence it would belong to the domain-specific residue). At present, none of these hypotheses can be discarded.

If the three sets of factors work together, the idea of abstracting one set to get a domain-specific residue is not an easy one to work out. The reason has to do with how specificity is understood. The term is ambiguous in denoting either a property evolved by natural selection for serving a domain-specific (i.e. language-related) purpose or a domain-general property that morphed into a domain-specific one when interacting with the language system (Culbertson and Kirby 2016). The second possibility suggests that the two sets of factors *interact* in the course of evolution such that the development of properties that are domain-specific (i.e. first factor) may well be inextricably linked to both domain-general and domain-specific precursors. If the first factor is to some degree evolutionarily rooted in domain-general principles, it is not easy to abstract one set from another in order to get the residue.

Our recommendation is to not use the term 'residue' to describe domain-specific language principles and to avoid defining the first and the third sets of factors in language design as fully separable components: they work together, not side by side or successively.

2.5. Semi-grammaticality or partial (un)grammaticality

The first list of ambiguous terms in linguistics (Leivada, 2020) involved the term 'grammaticality judgments'. It was argued that if grammaticality is constantly redefined through ever-changing acceptability (and there is no doubt that it is, since the syntax of any extant language is not identical to that of its earliest ancestor), but also reflects biases of general cognition (Leivada and Westergaard, 2020), asking a speaker/signer to provide grammaticality judgments means asking them for introspective judgments about the workings and the interactions of all cognitive and linguistic factors that determine the limits of grammar. No speaker/signer has a list of these factors, and to the best of our knowledge, no linguist has that either. Thus, it was suggested that the term 'grammaticality judgment tasks' should be avoided unless it refers to grammar tests that aim to determine how well a speaker/signer remembers the official grammar rules (Leivada, 2020).

Here we will discuss a different, but related, terminological problem. The focus is not on the tasks and what they tap into, but on the notion of

[1] A PubMed search (pubmed.ncbi.nlm.nih.gov, November 2020) for the term 'principles of efficient computation' gives just one result, and this comes from Chomsky's work (Yang et al., 2017). A search for 'computation' and 'efficiency' separately yields over 3,000 search results in PubMed, many of which pertain to neurobiology. The crucial difference between the use of these notions in linguistics vs. other fields is that in the latter, efficiency characterizes a specific aspect of a computation and is used most often in relation to a newly developed tool (e.g., a new algorithm). On the contrary, in the three factors model, the appeal to efficiency is a general notion with limitless scope, which can potentially be attributed to all principles that participate in computations.

ungrammaticality itself. As mentioned when discussing the various definitions of E-language, Chomsky's (1997) presentation of the term makes reference to semi-grammatical sentences such as *The child seems sleeping*. However, the soundness of the terms 'partial (un)grammaticality' or 'semi-grammaticality' can be contested on the basis of the definition of the term 'grammaticality'. To take a textbook definition, the grammaticality of a sentence refers to whether the sentence conforms to the rules of a given language (Fromkin et al., 2003: 14). Under this definition, a sentence either conforms with the rules of grammar, so it is grammatical, or not. Some scholars have assumed gradable ungrammaticality, but a definition of the latter that clarifies the notion of gradability and explains how the different degrees are established is still lacking.

Studies from the field of experimental syntax provide results that suggest that it is meaningful to talk about partial/gradable acceptability and categorical grammaticality (Sprouse 2007). In this context, our recommendation is to avoid the use of the ill-defined term 'partial ungrammaticality' or 'semi-grammaticality'.

2.6. Labeling

Moving to a sub-field related to grammaticality, consider the notion of labeling in syntax. Labeling is the mechanism which defines the syntactic category of a phrase, and is hence crucial to the recursive generation of phrase structures. Though initially framed as an 'endocentric' structure (Chomsky 1995), effectively a residue of X-Bar theory, whereby the categorial identity was established through an independent 'projection', it is now often seen as an 'exocentric' process, in line with minimalist assumptions about no new material being generated by the syntax during binary set-formation (Chomsky et al., 2019). Early minimalism (1990s) held that when Merge targets two syntactic objects, α and β, forming a new object, Γ, the label of Γ is either α or β. That is, when two lexical items (LIs) are merged, one of them 'wins' (so to speak) and is projected as the head or label: $\mathbf{M}(\alpha,\beta) = \{\alpha\{\alpha,\beta\}\}$ or $\{\beta\{\alpha,\beta\}\}$ (Murphy, 2015a).

More recently, syntacticians have pursued the idea that labeling is established via a 'Labeling Algorithm' that must provide a syntactic identity to the outputs of (capital) MERGE in order for interpretation to be licensed at the interfaces (Chomsky, 2013; Narita 2014; Shim 2014; see Murphy & Shim, 2020 for a review). As such, it is crucial in syntactic theorizing to acknowledge that the 'jump' from lexical items to MERGE and ultimately to phrases is mediated by an independent —and for some accounts (Lenneberg 1967, 1975; Leivada, 2017) even interface-external and contextual— operation: labeling. Nevertheless, labeling is often seen as a side effect of MERGE with no unique computational (and hence cognitive) status. A monograph by Citko (2011) bears the title *Symmetry in Syntax: Merge, Move, and Labels* —the pluralization in 'labels' reflects this tendency to relegate the labeling operation itself and focus on its products. Admittedly, this is often due to the ambiguity in the use of the term label vs labeling, i.e. the product vs the operation. These respectively seem to map onto endocentric and exocentric views of syntax, although there is no necessary link between them. Further, the often-changing definition of core syntactic operations, such as Merge/MERGE and agreement, has also impacted how labeling is framed, which seems to have increased any lack of clarity.

Clarifying this notion further, notice that labeling is distinct from concatenation. Hornstein and Pietroski (2009: 113) elaborate that COMBINE(A,B) consists of LABEL [CONCATENATE(A,B)]. Concatenation takes two objects and forms from them an ordered set, {α β}. Moving forward from this formulation, MERGE is itself now seen as not just binary set-formation, but more specifically it is an operation on a workspace (Chomsky et al., 2019), although for the time being this proposal remains more programmatic than specific (i.e. it remains an open question as to what the format of the workspace MERGE operates on is, and what the features it manipulates are). Our recommendation, therefore, is for researchers to make explicit which formulation of Merge (exo-/endocentric; composite Merge or 'Simplest Merge' or workspace-centric MERGE) they are concerned with (see also Adger 2019) when discussing the closely related notion of labeling.

2.7. The neural basis of X

Studies that seek to identify the 'neural basis of syntax' or the 'semantic map of the cortex' or the 'neural signature of phonological processes' have dominated the neurolinguistics literature since the late 1980s, providing substantial insights to our understanding of brain organization (Poeppel 2017). However, the classical localization example, the Broca-Wernicke model, has proven to be inadequate (Petersson et al., 2012; Murphy, 2015b), and yet the idea of localizing different levels of linguistic analysis to different areas of the brain has continued to be pursued.

The phrase 'the neural/brain basis of syntax', for instance, is ambiguous. It may mean that a region of the brain is implicated in a task that taps into syntax, as evidenced through a specific methodology or neuroimaging technique, or it may mean that a brain area is uniquely or consistently associated with syntax. Under the first meaning, the use of this term is somewhat misleading, because various brain bases of X may be found through different experiments/methodologies, such that in most cases it is not fully accurate to talk about *the* basis. For example, apart from Broca's area (which has been often referred to as the seat of syntax; see Murphy, 2020 and references therein), posterior temporal regions, the left anterior temporal lobe, and the arcuate fasciculus have all been implicated in syntactic processing (Fedorenko et al., 2012). Under the second meaning, the term is problematic, because it is difficult to discern what neural circuitry might be unique to any X, or even to humans in general (Poeppel 2017). The notion of uniqueness or specialized specificity is important in this context. Language may be special and different from the cognitive systems of other species at some level (i.e. labeling), but it is unclear whether this uniqueness can be traced to deeper levels of representation. Paraphrasing Bates (1994), have we evolved neural tissue that is reserved for (some computation of) language and language alone? According to Poeppel (2017), the answer is that we do not know. What we do know is that a region identified as the brain basis for X is also the brain basis for Y: for example, apart from semantic/syntactic processing, the ventral anterior temporal regions are also implicated in face processing (Collins and Olson 2014). In sum, the functions localized to discrete brain areas are neither levels of linguistic analysis nor modules that are specific to language, but elementary operations that subserve many cognitive processes (Kandel et al., 1991; Forseth et al., 2020; Murphy, 2020).

The discussion of this term has implications that relate both to clinical and theoretical linguistics. At the clinical level, terms like 'Broca's aphasia' may be thought of as misleadingly entailing a robust association between one pathology and one brain region. This is not always the case. Even though in the classical aphasia literature, it is assumed that damage to Broca's area is responsible for the clinical manifestations observed in Broca's aphasia, recent findings have shown that the overwhelming majority of Broca's aphasia patients present extended brain damage, significantly reaching beyond Broca's area (Ardila et al., 2016). More generally, a clinical perspective forces us to further acknowledge that, for many higher cognitive processes (unlike lower-level sensory processes, which exhibit more uniformity in localization across brains), there are only brain regions which are more statistically likely to be implicated in certain higher-order computations, rather than being innately determined to be involved in them. What appears to be innate is the capacity to implement through subcortico-cortical interactions a particular neural code for syntactic processing, involving the capacity for distinct forms of phase-synchronization and cross-frequency coupling across neural ensembles (Murphy, 2020).

At the theoretical level, terms like the 'brain basis of syntax' or the 'brain basis of semantics' are often undidactic umbrella-terms, that if

taken literally denote *all* the operations that take place in a level of linguistic analysis. They are undidactic because they do not refer to the neuroanatomical underpinnings of a well-established set of processes. The reason for this is that there is no consensus about the allocation of operations in different levels of analysis (e.g. labeling is variably viewed as a process that takes place in syntax proper, as an interface condition, or as an extralinguistic, contextual requirement for interpretation). Also, syntax, semantics, and the other levels of linguistic analysis are not undecomposable modules that work autonomously. From this perspective, even if one suggests that a specific syntactic operation is distinctly located in a specific region, it is quite likely that one would still have not identified a uniquely specialized brain locus, because any linguistic operation draws on memory, executive control, retrieval of stored representations, and other capacities. Since syntactic and semantic relations are often intertwined, separating the two in the time-frame of milliseconds, captured through brain imaging techniques, is not easy (Friederici 2017) and is also theory-dependent in terms of how rigid the distribution of labor between syntax and semantics is taken to be in a given theory. Even if the focus shifts from specific loci to broader networks, localization problems persist. For example, it is hard to localize the brain basis of the semantic network, because the implicated regions cover large portions of both the left (Binder et al., 2009) and the right hemisphere (Zhang et al., 2020).

Our recommendation with respect to the use of terms such as 'the brain basis for syntax' is to avoid oversimplified depictions of the neuroanatomical underpinnings of any phenotypic trait, while keeping in mind that localization/"boxology" is a slippery terrain. If one wishes to refer to a brain area that is activated in a task, it is better to avoid presenting this as '*the* brain area/neural signature' for something. More recently, interest has turned to developing lower-level neural codes for decomposed linguistic computations, such as labeling (Murphy, 2020) or the sub-stages of speech prediction (Forseth et al., 2020). Claims about the identification of either the area or a genuine neural signature for something would necessitate the discovery of a specialized, unique locus or a pattern of neural responses that displays sensitivity and specificity for a given condition (Lilienfeld et al., 2015).

2.8. Entrainment

In recent years, linguists concerned with moving beyond pure "boxology" (i.e. the localizationist agenda discussed in the previous section) have begun to turn their attention to a particular phenomenon discussed in the cognitive neuroscience of speech processing, termed "entrainment". This refers to the idea that cortical brain oscillations (or populations of rhythmic neural activity Giraud 2020) track properties of acoustics and sub-lexical features (e.g. phonetic features). Entrainment denotes the phase-locking of a neural oscillation to the phase of some external stimulus, such as certain speech properties (e.g. syllables) (Giraud and Poeppel 2012). Briefly, entrainment involves the synchronization of external quasi-periodic stimuli and internal neural activity (Forseth et al., 2020). The degree of neuro-acoustic entrainment can modulate intelligibility (Peelle et al., 2013). We include entrainment here since it is a relatively novel concept for many linguists concerned with understanding recent developments in cognitive neuroscience.

Certain oscillations are assumed to entrain because their frequency (e.g. 10 Hz) happens to map onto the amplitude edges or peaks of particular stimuli; that is, the rates of presentation of certain stimuli features. While there has been some confusion over the initial delineation of what computational role entrainment may have (e.g. Ding et al., 2016 found natural language sentences and phrases entrain to the delta frequency, but this is not to say that "sentences = delta oscillations"), in recent years efforts have been made to clarify the precise scope of entrainment, i.e. *what* exactly can language-sensitive oscillations entrain to? Moreover, some authors have used terms like "tracking" interchangeably with "entrainment" to denote synchronicity to acoustic and abstract (e.g. word) units (Jochaut et al., 2015), while others use "tracking" to denote only synchronicity to abstract units (Ding et al., 2016). As suggested in Murphy (2016; 2020), much of this supposed tracking likely indexes the initial generation of linguistic representations. In addition, following suggestions in Murphy (2020) and Giraud (2020), it is possible that brain regions involved in more abstract representational processing are involved in intrinsic synchronicity, while regions involved in perceptual tracking of external acoustic information may lean more towards entrainment, and, further, that these regions may overlap and coordinate via cross-frequency coupling, phase-locking, and other such mechanisms.

Syntactic information does not have a counterpart in the external world, and so "pure" exogenous entrainment is plainly insufficient for syntactic processing; indeed Meyer et al. (2020), present this observation as a novel proposal, but it has been understood since Chomsky (1957) that properties of exogenous linguistic stimuli do not provide indexes for hierarchical symbolic information. Yet there remains talk in the literature of entrainment *to* syntactic information. It is possible that linguistic entrainment is not entrainment proper but rather what Meyer et al. (2020) call "disguised" entrainment. The absence of invariant amplitude cues below the rate of syllables suggests that rhythmicity results from perceptual inference of higher-level structural meaning, i.e. endogenous information. In other words, it is likely (as argued in Murphy, 2020) that only minimal levels of exogenous entrainment are needed (likely only in auditory and sensory cortex) to activate higher-order endogenous oscillations which index syntactic processing, which 'take over' immediately from the speech stream Meyer et al. (2020). Elaborate a general framework for how language comprehension likely involves internal synchronicity, but do not provide any concrete examples or a model of endogenous linguistic computation to match against the literature on exogenous entrainment; they only point towards the existence of endogenous activity responsible for guiding language comprehension, and, even here, their talk of 'synchrony' should more accurately be interpreted as 'partial synchrony', following core principles of non-linear dynamics (e.g. see Guevara Erra et al., 2017). As such, partial synchrony permits phase shifts between synchronized signals, referring to how correlated the activity of these underlying networks is.

A question which remains open is how partially synchronous endogenous mechanisms influence or direct entrainment. What might appear to be entrainment on the outside might simply reflect a phase resetting based on the internally synchronized behavior of endogenous oscillations. Indeed, future work could explore to what extent there is a dynamic interplay between exogenous entrainment and endogenous synchronicity, with both mechanisms being used flexibly based on the nature of current input. As discussed in Murphy (2020) and Ghitza (2020), it is possible also that initially exogenously entrained low frequencies could immediately transition to endogenous cyclicity, with some properties of speech (e.g. prosody) aiding the generation of internal symbolic boundaries.

Despite these limitations in applying entrainment to complex syntactic and semantic processes, entrainment is highly likely to be involved at least in tracking speech rhythm (Peelle et al., 2013), and putatively works in tandem with internal partial synchronicity—and possibly other endogenous mechanisms. We recommend the establishment of a careful distinction between types of possible entrainment and internal (partial) synchronicity when discussing this issue, in addition to an explicit discussion of the possible computational role of these processes (as opposed to purely correlational observations about certain frequency bands being associated with particular experimental manipulations in the absence of any conceptual proposals accounting for these associations) in order to ground more firmly linguistic theory in the brain. It is likely that cortical stimulation mapping and other forms of invasive manipulation can help establish the causal role of particular networks and frequency bands in lower-level linguistic processes—routes which most researchers are unable to pursue, but ones which crucially need further investigation.

2.9. Polysemy

What would be more appropriate a candidate for discussion in an article about ambiguity than *polysemy* itself? Within recent research into polysemy, there are a number of ambiguities about specific types of meaning/sense alternations, which we will outline briefly here.

Though less central to mainstream generative concerns, which today focuses on the *creativity of syntax*, polysemy can provide some insight into the *creativity of semantics*. Unlike Fregean and Russellian logicians, who were primarily interested in language's role in judgment formation, nineteenth-century semanticists and semasiologists saw polysemy as an integral part of linguistic creativity Bréal (1897): saw it as reflecting most clearly the conceptualizing capacities of humans. Consider, for instance, the Newspaper Stamp Duties Bill and the Blasphemous and Seditious Libels Bill (part of the Six Acts), passed on December 30th, 1819 in the United Kingdom. This defined a *newspaper* as something containing "Public News, Intelligence or Occurrences, or any Remarks or Observation thereon". If such an object was published at least once every 26 days and cost less than six pence, it was taxed four pence. This definition seems precise enough, but the British government may not have been aware of the semantic paradox inherent in this choice of definition: How can information be *taxed*? A *newspaper* can be funny and educational but also wet (the physical object) and respected (the institution). The richness of even the simplest polysemy examples is not reflected in most textbook definitions of the coarse polysemy/homonymy distinction, which does little to expose the vast combinatorial possibilities evident in natural language semantics relative to non-linguistic forms of conceptualization.

An estimated 40% of frequent English words are polysemous (Durkin and Manning 1989), and approximately 4% of words are homonyms (Dautriche 2015). Polysemous words are single phonological forms coding multiple semantically related senses, e.g. *key to the puzzle*; *key to the safe*. 'Standard' polysemy includes words with multiple meanings of the same semantic category, as in the polysemy of *man* (individual/species). This is in contradistinction to homophones and homonyms, which are single phonological forms coding multiple semantically unrelated meanings, e.g. *pupil*. It is also possible for certain words to cross these dimensions: *bill* can act as a homophone between the bill of a duck and a dollar bill, but can also act as a polyseme (*dollar bill* or *electric bill*), while *bank* is homophonous between the financial meaning and the riverbank meaning, but can also act as a polyseme (*sue the bank* or *build the bank*). Further, discussions of polysemy often refer interchangeably to 'senses' and 'meanings', but the former typically is associated with the One Representation Hypothesis while the latter with the Sense Enumeration Lexicon Hypothesis (Frisson 2015).

Polysemy is much more widespread than typically appreciated. For instance, consider Travis's (1997: 90) famous sentence "The leaf is green" when a red leaf is painted green. When spoken by a child looking at a red leaf painted green, this sentence is true, but when spoken by a botanist it is false. The word *leaf* can bear multiple senses (and is hence polysemous) not because it is an indexical (shifting its meaning based on context) or because its meanings are coerced or because of pragmatic processes, but simply because it is polysemous between its physical features and mode of origin. The inherent *generative* power of simple, inherent polysemy is considerable. And yet, as Vicente (2015: 54) points out, polysemy is a neglected phenomenon within philosophy of language and many quarters of formal semantics: "Part of this neglect is due to the fact that philosophical and a good part of linguistics semantics have been focused on sentential, truth-conditional, meaning, instead of on lexical meaning for a long time. But another part has to do with … the idea that, barring homonymy, each word-type has a unique simple denotation". We will expand on this critique in the next section.

While polysemy may be widespread, what is commonly and synonymously (and confusingly) termed 'logical', 'complex' or 'inherent' polysemy has been somewhat sidelined (Apresjan 1974; Ostler and Atkins 1992; Pustejovsky 1995 Pustejovsky and Batiukova 2019). This type of polysemy occurs when different senses are deemed an essential, inherent part of an entity and are not 'accidental', as when a *book* can be both *funny* (abstract) and *blue* (concrete). This form of, essentially, combinatorial creativity (combining semantic representations of distinct categories into a unified lexical entry) is perhaps even more mysterious than syntactic generativity (see Pietroski 2018).

2.10. Reference

Lastly, a follow-up topic from the notion of polysemy is the concept of linguistic reference, which has been defined as pertaining to how words refer to things in the world. We believe that much of the confusion in the use of this term, and its deep levels of ambiguity, can be solved by assuming that, in fact, it is only *people* that refer; words alone cannot. As such, we think that Strawson (1950) and Chomsky (2000) are essentially correct that reference is an *action*, not an abstract relation or component of lexicality, etc. It is very commonly assumed that words refer to objects/events (e.g. such that *table* necessarily refers to some object that satisfies whatever physical features are assumed to be common to tables), but there are very common lexical items like *lunch* which can simultaneously refer to both types of meaning, as in *The lunch was **delicious** but **delayed***. Consider also *newspaper*, mentioned above: *The **left-wing** newspaper that I **held** in my hand this morning has been **sued** by the government*. Since there cannot be any entity in the world which hosts these properties (what would a *newspaper* look like which satisfies these semantic conditions?), we cannot maintain that lexical items denote 'things in the world' or 'states of the world'. Instead, lexical items provide perspectives on the world – they are effectively hypotheses about the structure of experience, rather than labels for specific entities Moltmann (2013). argues that reference to abstract objects is exceedingly rare in ordinary discourse – yet these and other common nominals (*book, construction, letter, city*) host simultaneously concrete and abstract meanings, posing a quandary for classical models of reference.

Consider Dölling's (1995) set of ontological relations for reference: *Entity* is divided into *Kind* and *Object*, with *Object* being divided into *Physical Object* and *Social Object*. The former is categorized into *Stuff* and *Aggregate*, while the latter is categorized into *Group* and *Institution*. *Person* is defined as a sub-type of *Aggregate*, and is 'associated with' *Institution*. This is only the very beginning of a comprehensive ontology (what exactly *Stuff* is remains classically unclear), with the number of possible relations between nodes extending far beyond what Dölling sketches out. As such, the ambiguity of *reference* will forever be tied up with the level of formal/ontological clarity a particular theory of semantics adopts: one has to refer to *something*, after all, and the precise definition of what this something is will ultimately determine the meaning of reference.

It is very often the case that nominal representations do not have anything remotely like a real-world referent, and the language faculty can trick the rest of the mind into thinking that cities, banks, lunches and newspapers are mind-external entities. Collins (2017a: 236) notes that "extra-linguistic concepts have a rich structure independent of both perceptual capacity and grammatical categorisation". Relatedly, Pietroski (2017: 207) observes that Diet Coke has a higher percentage of H_2O than "the stuff from my well". He adds that "Diet Sprite® and club soda are even more like H_2O" yet are not deemed water for reasons to do purely with "intended purposes". Both children and adults have great difficulty teasing apart these physicalist and telic notions of water-as-scientific-concept and water-as-ordinary-concept (as shown empirically in Murphy, 2017). Collins (2017b: 683) effectively concurs with Pietroski's conclusions, noting that "many of the kinds of things we readily sanction as external have individuation conditions shot through with human-specific categories and are sensitive to our various conceptions and interests". What exactly these "interests" and "intended purposes" are and how they impact language processing is a topic ripe for future experimental research – and exploring this issue will shed some light on the notion of *what* people can refer to using natural

language.

3. Outlook

Since polysemy is more common in natural language than many people often maintain (Bréal 1897 Srinivasan et al., 2019), it should not be a surprise that there is also internal polysemy with respect to a range of technical terms in linguistics. While we have made our own recommendations for a number of specific terms (which we readily admit may be open to re-evaluation and disagreement), what we want to stress here is not so much the technical details we have presented so much as the motivating *methodology* of carving out a clear path towards a robust and generalizable use of a given term.

A final comment is due with respect to the motivation behind registering issues of terminology, which is the aim of the present work. The objective of this work is to track the different meanings ascribed to the discussed terms in different contexts and/or by different scholars. Scholars who may have been working for decades with some understanding of the terms we have critically discussed above may have some reservations in admitting that such terminological issues exist. However, we think that these issues are not traced to specific works, but arise when a more general overview of the entire field is put together. As such, the responsibility to keep an open eye for such terminological issues is also a responsibility of the field: a *collective action problem* (Haspelmath 2020). There is no doubt that we all have biases, but for the sake of clarity, coherence, and progress, we should often stop and wonder whether what we put on print is biased, inaccurate, ambiguous, misused or overlooking progress—and if it is, what is the cost the discipline pays in the long run. As Richard Feynman said in his 1974 Caltech Graduation Address on Integrity, scientists cannot afford to be complacent about their own theories: "The first principle is that you must not fool yourself—and you are the easiest person to fool."

Funding information

This work received support from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement n° 746652 (to EL) and from the Spanish Ministry of Science, Innovation and Universities under the Ramón y Cajal grant agreement n° RYC2018-025456-I (to EL). The funders had no role in the writing of the study and in the decision to submit the article for publication.

Declaration of competing interest

The authors declare that they have no competing interests.

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