

Are Natural Languages Codes?

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Abstract

Is a natural language a code, that is, a system for mapping one kind of representation onto another in a rule-governed manner? Or more precisely, does each language contain (a set of) codes? This paper contains a brief discussion of this issue with regard to three levels, pragmatics (utterances in relation to situated meanings), formal grammar (syntax in relation to formal semantics), and phonology (the nature of the “phonemic code”, and the relations between sounds and writing, or vice versa). The answers given are, in a nutshell, “no”, “more or less no” and “perhaps (although in a limited sense)”. Finally, the paper briefly discusses if analogies can be drawn from language to the so-called genetic code.

Keywords: language; code; genetic code; situated meaning; formal syntax; compositionality; phonology; phonological gesture; speech, writing.

Introduction

Roman Jakobson (1972) proposed the “code”, that is, the language system, as one out of six basic aspects of human communication. Like most other linguists, he saw language (= the code) as a set of conventions used to communicate meaning. As a first approximation, such a formulation is probably acceptable to most scholars of language. But in many contexts, a more precise definition of code will be necessary. In this paper I shall begin to probe the issue if, and in what sense, if any, a natural language (or some part of it) is a code.

A few words about my general starting-point: One may take the fundamental nature of language to be either *abstract forms* organised as systems (in phonology, syntax or semantics), or *actions* and processes (or patterns of such processes) that are part of situated sense-making practices. The theories developed within mainstream linguistics give priority to the first-mentioned perspective. In the old days, structuralist phonologists used to talk about some of this in terms of the priority of “form” over “substance” (embodied performance, e.g. in phonetic “realisations”) (e.g. Fischer-Jørgensen 1975). I want to reverse the priorities. A dialogical perspective, i.e. an approach that emphasises interactions and context-interdependences, must give priority to actions, processes and practices (Linell, 2009). In adopting this stance, I prefer the term “*linguaging*” to the more common one of “*language use*”, since the latter term clearly implies that the language system has priority over the use (Linell, 2012a). In accordance with this, Anward (2011) recommends that we start with how people are “*doing language*”, which would then comprise both the situated linguaging and the emergent language that results from the practices of linguaging. Similarly, Lindblom (this volume) adopts what he calls a “*performance-based*” perspective. He points out that this amounts to a non-structuralist approach, thus opposing the mainstream of modern

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linguistics (Saussure, Chomsky etc. and all their followers who have assumed that language structure must necessarily have a logical priority over performance, or in our terms: languaging). Admittedly, the formal perspective cannot be abolished altogether within a theory of languaging (see below, and Linell, 2013), but dynamics and interactions are more basic.

Is (a) language a code? I will discuss this with regard to three levels, pragmatics (the relation of utterances to situated meanings), formal grammar (the relation of syntax to formal semantics), and phonology (the relation of sounds to graphic representations, and vice versa). After some introductory remarks on the notion of “code”, I will discuss compositionality in language, which is one kind of tack on the position that language is a code. After that, I shall pay particular attention to phonology, and raise some issues pertaining to biology and culture, and to speech vs. writing and literacy. Finally, I shall add some brief remarks on the analogy between language and the so-called genetic code.

Codes

Key to most accounts of what one should mean by a “code” is its presumed function in the exchange of “information”, especially cognitive information. The code would primarily be seen as consisting of discrete expression-meaning pairings, or as a set of (formally) specified conventions for mapping, or translating, one kind of linguistic representation or “(en)coding” (e.g. speech) onto another (e.g. writing, that is, speech encoded in phonemes is re-encoded into graphic signs), or from one symbolic representation (linguistic expression) to semantic or pragmatic interpretations (“meanings”). The relations involved in these different cases are not quite the same.

In a coding relation, the source representation should be relevant and sufficient for deriving the re-coded form. Such mappings could be unidirectional (from system A to system B) or bidirectional (between A and B), preferably in one-to-one, but sometimes in one-to-many, many-to-one or many-to-many relationships (one can think of such simple things as homonymy and polysemy of words). A canonical example of a one-to-one coding relation is that between alphabetic writing and Morse code letters (dots and spaces), or vice versa. Another example would be written words (strings of letters) translated into an ASCII code (strings of bits). Parts of mappings from syntax to formal meaning (or vice versa) or from speech to writing (or vice versa) might be a bit more of one-to-one (but see below). The relations of linguistic utterances to situated meanings, or vice versa, would normally involve many-to-many relations. In a formal(ised) model, one would ideally set up algorithms for mapping. However, it is rather obvious that the relations between linguistic expressions and their meanings are not pairings like alphabetic letter–Morse signal. Indeed, the relations are at best metaphorically code-like.

The point that languages are not strictly codes has been made several times (e.g. Kravchenko, 2007; Love, 2007). In this paper, I will only make some variations on this theme.

Compositionality

In linguistic theory, the thesis of compositionality has been a common assumption. Briefly put, this thesis states that the meaning of a complex expression can be entirely derived from the meanings of the constituent expressions and the ways in which these are combined (the abstract structure of the sentence of which constituents are part). Preferably, the derivation of compositional meaning should be computable by a formal calculus (Pagin 2003). Compositionality is a way of giving substance to the idea that a language is a code, that is, a set (more precisely: an infinite set) of expression-meaning pairings. I shall discuss the applicability of compositionality at two levels, pragmatics and formal semantics.

Pragmatics

Usually, compositionality is seen as a property of semantics, i.e. the semantic properties tied to linguistic expressions, most often sentences seen as linguistic types rather than as situated utterances. Pragmatics, however, deals with the situated meanings, sometimes called utterance meanings, that are communicatively relevant for parties to the particular sense-making events (I will use the abbreviation SCRM for "situated communicatively relevant meaning"). The SCRM of a particular utterance or contribution to a communicative interaction usually involves imagining the speaker's "why of communication" ("why that now"; Bilmes, 1985); parties must understand how the particular utterance is intended, or could arguably be intended, as a contribution to a situated communicative project in progress. For example, an utterance like *I am married* will be interpreted in different ways in different situations, depending on how participants understand the reasons for the speaker saying precisely this. For example, if, in a situation of emergent attempts of seduction, the seducee utters *I am married*, there can be no compositionality principle mapping the semantic properties of the constituent words (and the syntactic structure) onto the possibly implied SCRM "There is no point in trying". In real life, we go beyond the information given in the linguistic make-up (Bruner, 1973); "pragmatic enrichment" (Carston, 2002) takes place.

In other words, language itself is merely allusive and indexical, in relation to SCRMs. The why of communication is often not explicitly expressed in so many words; contextual factors and other semiotic resources, such as manual gestures and facial expressions, are important too. Moreover, constructions and their situated interpretations cannot be specified before the utterances have been (at least partially) completed, since they are "co-genetic" with contexts. That is, relevant contexts cannot be predicted beforehand; they are made relevant as part of participants' communicative actions.

There are often differences between what is explicitly said and what is meant (SCRMs) in a situation. In some exceptional situation types (genres), however, there is a strive for a very close relation between linguistic expression and intended meaning, but this is the exceptional case, not the general principle. And even in a case such as law, the various legal rules must be interpreted in relation to specific cases; hence the need for a body of exemplary practical applications ("precedent cases"). One might also argue that a sentence in itself, such as *I am married*, taken in abstracto, has a decontextualised "linguistic meaning", but this meaning is hardly ever sufficient as an SCRM, except perhaps in games like exercises of logic or linguistic lessons, in which the purpose is to bracket (as completely as possible) considerations of normal SCRMs.⁵

Languaging in speech (including its non-vocal accompaniments) consists of embodied movements, gestures in time, with multimodal forms of expression. Activities of languaging are driven not only by cognitive incitements but also by interests, emotions, volitions, and of course environmental ("external") influences. They are dynamic movements, yet they are structured, and their progressions can therefore often be projected (Auer, 2005, 2009). However, projections can be changed in the course of (inter)action; they can be redirected, interrupted, restarted, and recycled with variations, due to e.g. impressions, sudden insights or whims, initiatives and counter-moves by interlocutors, affordances and obstacles of "external" objects and events (Linell, 2013). Linguistic resources (of language) must arguably be designed to fit these conditions of languaging. They must be accommodated to dynamics, the nature of embodied, temporal actions and movements etc.; plasticity, stretchability, fuzzy boundaries, and open potentialities to be exploited in contexts.

⁵ The dialogical theory of communicative projects and activities, including a theory of situated meanings, is sketched in Linell (2009). It is important to note that, according to this theory, situated meanings (SCRMs) and "linguistic (semantic) meanings" (tied to expressions in abstracto) are not phenomena of the same kind. The latter would preferably be seen as abstract *meaning potentials*, i.e. resources that can be used in combination with various contextual resources by participants in communicative (or cognitive) activities when they "mean" something in situ (Norén & Linell 2007).

By way of summary, utterances cannot be assigned situated meanings solely on the basis of their linguistic composition. Thus, a principle of compositionality does not hold for situated meaning. In other words, in actual languaging, language (as a whole) *cannot be a code*. But what about the language system in a narrow sense? Does compositionality hold for the formal-semantic representations of sentences taken as linguistic entities? Let me briefly take up a few relevant aspects of this issue in the next section.

Formal syntax and structural semantics

This level is where the discussion of the compositionality of complex (syntactic) linguistic expressions usually takes place. Even if compositionality does not hold for the pragmatic level (SCRM) (section “Pragmatics”), it could perhaps be valid for the abstract linguistic sentences, such as the sentence *I am married* as an abstract *type* in a formally defined *system of sentences*, rather than as a token in a situated act of languaging? Pagin (2003), for example, claims that compositionality, evidently at this level, is functional, partly because it would have an *evolutionary value*; it is purportedly advantageous for human beings to have developed a communication system with compositionality, because this is more efficient than one without it.

Nobody would argue, I believe, that sense-making in complex activities is possible unless there is *some kind* of compositionality, at least in a loose sense. Yet, many, but hardly all, semanticists argue for at least some degree of context-sensitivity in linguistic semantics (semantics taken as dealing with the meanings tied to abstract expressions).⁶ In my own opinion, it would be strange if these linguistic resources were not influenced by the openness of actual languaging. Strict compositionality would not necessarily be an evolutionary advantage, as Pagin (op. cit.) suggests; why would it be advantageous to be constrained by a rigid language in a world in which new types of communicative demands (i.e. demands that cannot be sufficiently pre-specified in abstracto) tend to turn up continuously in the life of the single individual (and communities too)? It should also be noted that successful communication does not imply that participants arrive at completely shared understandings of things talked about (e.g. Linell, 2009). Instead, we need only sufficient understandings “for current practical purposes”. If serious problems of mutual understandings seem to come about, we may fortunately (although, alas, not in all social situations) appeal to strategies of repair, as has been amply demonstrated in Conversation Analysis.

The syntactic structures relevant to a theory of compositionality must be abstract and general. However, in actual communicative languaging the creation of SCRM is primary, and here we are faced with incremental processes both in speech production and speech perception (Linell, 2012b, 2013); in these context-interdependent processes (contexts involving both local sequential responsive-projective relations between contributions to discourse and assumptions about relevant topics and activity types) pragmatics comes in early, and some aspects of linguistic analysis only afterwards, rather than the other way around (as was often assumed in linear models of generative psycholinguistics). Now, if SCRM are determined in situ, and interdependent with interactional-sequential and activity-type-related aspects of situations, it would be natural to assume that linguistic resources too reflect this context-sensitivity; they ought to be designed to be used in particular types of context. All kinds of lexical items tend to be semantically polysemous and underdetermined (in relation to possible situated requirements) at the abstract lexical level, with their polysemy partially eliminated and their meanings enriched in particular situations. Many compound words have conventionalised (“lexicalised”) meanings that cannot be derived from their constituent semantic morphemes. For example, a compound like Swedish *kvinnohus* or German *Frauenhaus*, both literally meaning ‘women’s house’, refers to a place where women can get help or shelter, or simply be provided mutual assistance. Yet, it has been reported that persons who do not know Swedish or German language (and culture) well enough, have sometimes believed that these words denote something completely different, e.g. ‘brothel’.

⁶ Recanati (2004) accounts for several different kinds of semantics from context-independent (“insensitive”) alternatives to more contextual or context-interdependent ones.

In Construction Grammar (e.g. Croft & Cruse, 2004), it is usually assumed that grammatical constructions, like the lexicalised compounds above, tend to have construction-specific semantic properties that cannot be derived by rule. Yet, some (Kay & Michaelis, *forthc.*; cf. also Croft & Cruse, *op.cit.*: 250ff) have raised counter-arguments on the ground that there are semantic regularities in the make-up of compounds and (some) idiomatic constructions that language users can exploit. For example, in *kvinnohus* and *Frauenhaus* one will obviously see the relations to the constituents *kvinna/Frau* ‘woman’ and *hus/house* ‘house’. However, Croft & Cruse (p. 250-252), following Nunberg, Sag & Wasow (1994), even argue that there is a kind of compositionality involved in an idiom like *spill the beans*, meaning ‘to divulge information’, because one could map the verb *spill* (and its meaning) onto ‘divulge’, another verbal unit, and similarly *the beans* onto ‘information’ (noun phrases). Contrary to this argument, it can hardly be denied that one must know the expression as a whole (*kvinnohus*, *spill the beans*) and its meaning (potential) in order to produce “correct” (“idiomatic”) utterances in the language in question. The fact that we can sometimes understand utterances involving non-compositionality (more or less correctly) does not demonstrate their compositionality (in a strict sense), since after all we use available contextual information in the process of understanding. What is undoubtedly there is merely some semantic regularities (or partial compositionality, if you prefer that concept).

Yet another reason for doubt in semantic compositionality is that those who insist on it tend to analyse regimented sentences, rather than practitioners’ often “illogical” ways of expressing themselves in spontaneous, interactional languaging. In fact, these latter modes of expression are often quite normal in authentic languaging, and yet they are either ignored or regarded as ungrammatical in normative written-language-biased grammars (cf. Linell, 2005, 2009, 2013). Such phenomena include incomplete utterances, composite utterances (e.g. language, manual gestures and gaze) (Enfield, 2009) and utterances involving in-course-of-progression changes of speech act status.

In short, it seems reasonable to doubt the claims of compositionality, that is, the idea that a language must be a code, also at the level of formal semantics. It seems probable that linguists’ often unquestioned belief in the need for semantic representations of whole sentences is a reflection of an assumption that language must be a code (at least in some sense) in order to function in actual communication (cf. Pagin, *op.cit.*). But in a reasonably strict sense it simply cannot be true. Indeed, in the light of the importance of contextual resources (by definition outside of the linguistic utterances themselves), one may even conjecture that participants in communicative practices do not need semantic representations at all; it would be sufficient with meaning potentials of lexical items and grammatical constructions in combination with the contextual factors. Compositionality of complex expressions in a strict sense might hold for exceptional types of genres and activity types, in which the exact wording of sentences, primarily in writing, is crucial. But such cases are relatively rare, and cannot be taken as basic in languaging.

Perhaps, the search for compositionality is best motivated by the need for explicit representations in computer-based applications. Of course, it *could* be the case that partial computations of *some* semantic compositional structures is part of utterance understanding more generally. Therefore, it seems worth trying out how far you can get in working with explicit semantic representations. Yet, there are still good reasons to assume that human beings, with their embodiment and socio-cultural embeddings, are not so computer-like.

Phonology

Let us now turn to phonology. Is there a “phonemic code” in languages? This is a rather different issue than the above-mentioned issues of semantics and pragmatics. Phonology is another kind of level of “linguistic articulation”, one at which the elements (“phonemes”) do not carry (referential, conceptual, emotional or coordinative-interactive) meanings by themselves (though prosodies may be a boundary case).

Before turning to structuralist approaches to phonology, let me just point out that a dialogist approach (Linell, 2009) to practices and processes in language and languaging would arguably lead us to look at phonetic behaviour in terms of *gestures* and actions (e.g. Fowler, 2010). Such a perspective would be less interested in static signs, sounds, phonemes, or other entities and abstract objects. Phonological gestures are:

- dynamic *gesturings* rather than static forms (expressions portrayed as stable "signs");
- parts of embodied actions, with goals and meanings, i.e. they are not involuntary movements;
- defined by target values⁷, which are partly segment-oriented;
- parts of temporally distributed and sequentially ordered, multimodal, larger wholes, with prosodies and coarticulations; at the phonological level, such sequences are packaged as word gestalts (phonological words and phrases), i.e. they must be recognisable as words in the language;
- vary in execution/performance;
 - in their combinations with prosodic gestures;
 - emotional differences expressed by prosodies and voice quality variations;
 - in terms of hyper/hypo-articulation; gestures need not be completely executed, in fully articulated forms;
 - with regard to other sociolectal variants: "lects" contribute to speakers' social identities and voice exploitations (speakers can imitate other people's voices or dialects).

Phonology is centred around segments and invariants (at some level of abstraction: phonemes). Lindblom (this volume) emphasizes the combinatorial structure of sound patterns in phonologies, something which makes the amazing size of vocabularies in different languages possible. Words appear to be based on combinations of "units". In my terminology of above, these units come in the shape of segment- and syllable-based packages of articulatory gestures (each package involving a coordination of many muscular actions: lip-, tongue- and jaw-movements, etc.). The reality of such packages seem to be proved, for example, by permutations (such as our *queer old dean* for intended *dear old queen*) and other "slips of the tongue". Thus, segments have a natural basis in the biology of speech, yet the phonemic analysis appears to have been enhanced by alphabetic writing (see below).

As regards *variation*, it is a universal and controlled aspect of languaging. It is partially intentional, as in different speech styles, but also automatised in individual and social habits ("voices" and idiolects vs. dialects). These habits are highly functional in that they allow listeners to identify individuals and their social-group membership(s). Variation must therefore be explained as part of language and languaging. Does the same also hold for the *invariants*? How should we understand invariants? Where and what are they? Are phonemes invariants? Is an invariant an abstract entity, an exactly defined linguistic value, a point in the acoustic space, or a fuzzily defined range of variation, a cloud of points defined by their equivalence with regard to linguistic function in words? Are invariants a result of thinking in terms of linear input-output models in the psychology of perception (cf. Järvilehto et al., 2011)? Are invariants also a heritage from structuralism and the "written language bias" (Linell, 2005) of linguistics? There don't seem to be any ready-made answers to such questions. But one point should be made; variation is also part of language, despite the attempts of many structuralists to exclude it from their models.

Basic phenomena in languaging are dynamic embodied processes from which "basic units", in phonology and other domains of language emerge (Lindblom, Diehl, Park & Salvi, 2011; Lindblom, this volume);

⁷ Compare the notion of "motor equivalence" (Lindblom, this volume). This reflects, if you will, the "formal" (structural) aspect of *languaging* (constraints on languaging, cf. Rączaszek-Leonardi, 2011).

they are not innate pre-specified systems of units, as generativists have proposed.⁸ This emergentism might entail a refutation of classical structuralism (Lindblom, this volume). But we should equally put a question mark around *elementarism*: the idea that larger units are always built from-bottom-up (elements at one level being constituents at the next level higher up). Note that this is often presented as an aspect of structuralism too. But if, instead, we approach human activities from the phenomenological end, we conclude that they have gestalt properties of human sense-making, which calls for a partial top-down, moderately holistic approach. That is, speakers and listeners start out from some pragmatic assumptions about what their communicative projects as larger wholes are about (section “Pragmatics”). This is *partial holism*, not wholesale (abstract) holism which is what one usually finds in linguistic structuralism (Linell, 2009). On the other hand, we may perhaps argue that structuralism and self-organisation suit phonology better than syntax, lexicon and (especially) interaction norms (pragmatics).

Lindblom et al. (2011; Lindblom, this volume) have shown how general constraints on phonological systems emerge from general principles. But phonological elements are distinctive of whole words, rather than by themselves. Saying a word, e.g. Engl. *pat*, does not mean that one chooses sound by sound: /p/, then /æ/, then /t/. In addition, we cannot assume that linguistic expressions are composed only of phonemes, just as written words consist of letters and diacritics. But perhaps we could say that phonological gestalts are composed by phonemes and prosodies, i.e. that some kind of compositionality is at hand.

One area in which there has been talk about “the code” revolves around learning to read. Children who have acquired an ability to map letters and letter combinations onto sounds and words, and vice versa, are said to have “broken the code”. But notice that this is only one prerequisite for reading and writing. The overall goal is that of reading for content, and writing about something. The “why” of communication (section “Pragmatics”) remains to be accounted for.

Accordingly, even if we may talk about a kind of compositionality at the phonological level, this would be quite a limited kind of compositionality. We are no longer talking about expression-meaning pairings. Another point is that what is derived by general constraints (Lindblom et al., op.cit.) is not the language-specific phonological system, but a general phonology. When we move on to language-specific phonologies, we must include the sociocultural aspects. Before proceeding to the idea of genetic codes, I shall dwell for a while on cultural language.

The cultural side of language

When we talk about the “natural languages” of the world, we must not forget that these have not emerged exclusively from “natural”, e.g. biological or Darwinian, processes in phylogenetic evolution. They are also cultural, especially in those cases where they have literate, written counterparts, emergent in and through a sociocultural history (“glossogenesis”, Rączaszek-Leonardi, 2011). Thus, linguistic forms “reflect cultural preoccupations and ecological interests [...], as well as general biological and psychological constraints [...].” (Hodges, 2011: 148). Yet, despite the impact of literate society on language-specific phonetic (phonological) processes, we often assume that spoken languaging must be explained solely in natural-science-based terms. But actually, our ideas about language are penetrated by experiences of writing (Linell, 2005), as argued below.

Writing is selective; of the many phonetic properties present in speech, only relatively few are codified. Phonetician Robert Port (2006, 2011) argues that phonemes are “conceptual blends” (Fauconnier & Turner, 2003) of letters and speech sounds. The evolution of the alphabet involves selecting a few aspects of phonetic structure according to the schema: Invariance & variation in natural speech >> selection in

⁸ As MacNeilage (2008) argues, Chomsky and generativists in general take the stance that language “just is there” and that no cogent explanations of its evolution can be produced. See also Lindblom (this volume) and Anward (this volume).

order to provide economical writing systems >> various kinds of spelling >> conventionalisation/standardisation of orthography >> repercussions on meta-awareness of language (phonology) and actual speech.

Learning to write and read has always been and is still an intense learning process both socio-historically and ontogenetically. It involves institutionalised schooling. Research into the sociohistorical genesis of literacy has shown that beginnings often involve different scribal practices (e.g. Johnson, 2003), which are later unified into national standards. Such standards can select different solutions. Relatively similar languages, such as Danish and Swedish, have chosen different ways of spelling stressed short vowels followed by (relatively) long consonants: Sw. *att, hatt, pick och pack, späck* -- Dan. *at, hat, pik og pak, spæk*; long consonants have double signs in written Swedish (<ck> above is the conventional orthography for /k:/ or /kk/), but not so in Danish.

Conventional orthographies are often rather far removed from being strict encodings of phonemes in speech. Hockett (1958: 541) calls English spelling a “horrible example”. For example, the phonemic unit /əu/ in English can be spelled <o> (as in *go*), <ow> (as in *blow*), <oa> (as in *boat*), <ough> (as in *though*), etc. Conversely, the polygraph <ough> corresponds to several phonemic units, besides /əu/ (*though*), /u:/ (as in *through*), /ɔ/ (as in *ought*), /ɔf/ (as in *cough*), /ʌf/ (as in *tough*), and several others. And so on, in many many-to-many relations.

Once conventional orthographies have been reasonably well established, writing may have repercussions on spoken language (so-called “spelling and reading pronunciations”; e.g. Telemann, 2003: chapter 5): in Swedish, certain nominal plural endings change from [ər] in *kvinner* ‘women’ to [ʊr] (cf. standard orthography: *kvinnor*), a distinction between the supine form (*skriv -it*) and the perfect participle (*skriv-et*), both corresponding to English ‘written’, is introduced, first in writing and then in talk, and there are other examples of new “spelling pronunciations”: *av* (instead of *å(v)*, ‘of, from’), *åk* (instead of *å [ɔ] och* ‘and’), etc.

Another kind of evidence comes from children’s spontaneous spellings, that is, self-made spellings that children use before they have acquired standard orthography. Swedish children, for example, regularly notice the difference between the tense, aspirated, unvoiced stop consonant in e.g. *par* ‘pair’ and the lax, unaspirated, voiced stop in e.g. *bar* ‘bar’, a phonemic distinction in Swedish. But what about the unaspirated, voiceless variant in e.g. *spar(a)* ‘to save’? Well, it is not so seldom that we find the alternative *sbar* in children’s spellings; they have then noticed the absence of aspiration (and perhaps some laxness) in the stop, and chosen a spelling which we do not use in conventional orthography. Once, speakers have learnt to spell properly, they start to treat the labial stop consonant in *spar* as if it was simply a /p/ or [p]. Indeed, they acquire adults’ belief that it *is* a /p/. Other examples are the vocalic bursts after the stop and before the /r/ (in casual, rather than hyper-articulated, speech) that we believe are there in e.g. Swedish *opera, kamera, Monstera* but not in e.g. *Sandra, ockra, umbra, Kleopatra*.

An alphabet writing system reinforces our belief in the phonemic principle. A syllabic writing system, on the other hand, may suggest a syllabic principle in phonological theory (as in prosodic or autosegmental phonology). The matter is partly confounded, however, since actual writing systems are seldom purely segment-based. In general, the selection of phonetic affordances for phonological use in specific language systems cannot be completely predicted in an algorithmic manner.

To sum up, phonology, like other domains of language, must be approached from two, diametrically opposed ends:

- biology/physiology (a researcher’s perspective): the theory of bodily mechanisms and processes of the human organism;
- socioculture and phenomenology (partly a participant’s perspective): how we experience languaging and assign meanings in everyday reality. This features a “constructionist” aspect, for example, as regards how the social environment reacts to (“hear”) the words and sounds that the

child makes. Socioculture and phenomenology are also very much about (the theory of) the content of sense-making, which is largely about the world outside organisms.

On the other hand, how we assign weight to these different interests depends on the kinds of phonological problems we deal with. For those interested in *general* principles of phonological systems, and underlying processes of self-organisation, evolutionary biology takes the lead. If, by contrast, our research endeavours focus on *language-specific* details of phonologies, specific sociohistorically grounded cultural properties bring in the latter dimension too.

Linguistic codes?

Let me try to sum up some conclusions: Can we find code-like relations in language and languaging? To bring some order to this discussion, we had better distinguish between expression–expression relations and expression–meaning relations. I start with the former.

In the domain of natural language, are (strings of) units of expression strictly encoded into (strings of) other units of other kinds or at other levels? For example, the make-up of lexical units (morphemes, words) seems to be built (exhaustively encoded and hence decodable) in terms of combinations of units drawn from a finite set and limited set of unit types (phonemes and prosodies). But this encoding involves a considerable abstraction in that it neglects individual and social variation. Furthermore, it ignores the fact that words (and larger expressions) are associated with meaning potentials that cannot be derived from phonology or phonetics. In languaging, participants express themselves in words, grammatical constructions and contributions to communicative projects, not in terms of the constitutive phonological units.

Phonology involves phonological–phonetic gestures and phonological gestalts. That is, whole word forms, sometimes extended by means of cliticisation of function words, often make up complex phonological gestalts (cf. “phonological words”), in which the segments of the corresponding citation forms may be eliminated or only leave traces in the form of colouring (nasalisation, palatalisation etc.) of syllables and their remaining segments in presto speech or “sloppy pronunciations”. Yet, the forms can be recognised and “understood” by language-competent listeners (gestures need not be fully realised, see section “Phonology”). But the relation of phonemic structure and situated realisations in speech is not strictly code-like.

Is written representation of speech a case of recoding speech into writing? Well, there are clearly regular rules for how to spell words and for how to read text aloud, but these do not live up to requirements of a strict code. Written forms are not a code for phonemic forms, nor do letters map on to phonemes. As compared to writing, spoken language has a marginally but still significantly different encoding in terms of constituent units (phonemes and prosodies vs. letters and diacritics). In neither direction is the speech <–> writing translation strictly code-like; it is not like the mapping of letters onto Morse signals. But notice that the idea of codes becomes considerably more plausible as soon as we restrict ourselves to writing-internal relations! This is a case of something much wider, the “written language bias in linguistics” (Linell, 2005).

None of these en/de/re-coding relations involve full-fledged expression-to-meaning mappings, let alone in the other direction (meaning-to-expression). There are no code relations between complex expressions and situated meanings (SCRMs), and no code relations between meaning potentials and SCRMs, since the latter are also crucially dependent on contextual resources, the relevance of which cannot be predicted in the specific cases.

Language and genetic codes

It follows from the previous sections that we ought to be very cautious in making analogies between language and the genetic code. Possibly, the case of phonology might be a less dangerous analogy. But the notion of “genetic code” itself seems conceptually dubious. Some people talk about “reading the genetic code”. Freedman (this conference) and others (Willson, 2011) are more cautious, talking about transcribing and translating, when referring to molecular biology, and, in particular, the relations between DNA, RNA and proteins.

It has been common to talk about genetics in terms of “codes” and often the analogy with natural language has been suggested (e.g. by François Jacob and Roman Jakobson) (cf. Linell, 2012a). The “genetic code” has been seen as a kind of instructions for the organism to use in governing the development of organs and their functions. The question arises what kind of model of language comes to mind in such a context? As Markoš & Faltýnek (2011) point out, it seems to be one of strings of letters to be “read” or at least decoded. As these authors go on to argue, this is a strange idea, given that we are faced with causal, metabolic processes involved in living, self-organising systems. They therefore suggest that we need a model of spoken languaging rather than written language. The discourse about “reading the genetic code” is a case of the “written language bias” (Linell, 2005), in this case in a genre of popularising scientific discourse.

A neurophysiological structure, or system of processes, cannot be “read”. Who would be the reader in such a case? A homunculus sitting somewhere in the brain? The root metaphor of “reading the genetic code” has its source in the human being reading a text. But that text has a “content”; it represents something in the (real or fictive) discourse world, the topics that the text is “about”. In the normal type of reading, people use marks on paper or a computer screen *to make sense about something else* than the text itself; we are not just reading off the marks (identifying categories of letters, or computing a purely “linguistic meaning”). Nor is reading just the de- and recoding of marks as in a scanning machine. (In this context one should also be aware of the conceptual difference between information and knowledge.)

“Translation” is also a metaphor, when it is used about the transduction between biochemical substances as in molecular biology (Willson, 2011), or between different material representations and procedures in digital technology. The source of the metaphor is arguably that of translation of texts between different human languages. Metaphors always build upon a selection of (often abstract) similarities between sources and targets. It is important to explore these similarities carefully; what does the metaphorical as-if relation really involve? All too often are models in science taken to be factual accounts, when actually they are at best reasonably good metaphors, analogies or as-if comparisons.

When we try to compare “genetic codes” with “language”, it is therefore important to determine more exactly what we mean by “language”, “translation”, “code” etc. Written language is not a viable alternative. In view of the arguments raised above about, in particular, situated communicatively relevant meanings pertinent also to spoken, interactional languaging, I am also inclined to refute the attempts to use spoken language as a possible metaphor source (thus casting doubt on Markoš & Faltýnek’s proposal too). Nor am I convinced that biosemioticians (e.g. Barbieri, 2011) have explained the putative difference between information and meaning in biology. What we perhaps can do, however, is to draw analogies between self-organisation in phonology and other self-organising systems in human biological evolution.

Conclusions

I have drawn renewed attention to the fact that so-called natural languages are interdependent with both nature (biology) and culture (sociohistory). Cultural environments, such as the use of alphabetic writing, implies that specific features of phonetic realities are selectively attended to. They also have a considerable impact on the scientific development of linguistics, including phonology.

There are strong reasons to assume that no natural language is a code, that is, a set (or several sets) of fixed expression-expression or expression-meaning pairings. This implies that analogies between natural language and the so-called genetic code need to be used with great caution. However, it may be that phonological systems are, as far as natural language is concerned, a primary case of self-organisation, which is one property associated with some codes. However, it is not the only one.

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