Interaction and iconicity in the evolution of language:
Introduction to the special issue

1. The role of interaction and iconicity in language evolution

Much of the research on language evolution focuses on two key questions: (i) How did the biological capacity for language emerge, i.e. how did language emerge from non-language? (ii) How does linguistic structure come about, i.e. why do natural languages have the properties they have, and which pressures shape language(s) over the course of cultural evolution? In the literature, two concepts have figured very prominently in answers to these questions: *interaction* and *iconicity*. In the remainder of this introduction, we will briefly sketch the current state-of-the-art in research on interaction and iconicity within the field of language evolution. Given the wealth of research on both of these concepts, our overview is necessarily incomplete and focuses on issues addressed in this special issue. The second part of the introduction then gives a brief overview over the contributions to the present issue.

Research on the emergence of fully-fledged language from animal communication systems has emphasized the role of cooperation and interaction (e.g. Dor, Knight and Lewis 2014, Levinson 2006, Scott-Phillips 2015, Tomasello et al. 2005, among others). As Knight (2000: 19) claims, language "evolved in the context of uniquely human strategies of social cooperation." Tomasello and colleagues argue that humans lead fundamentally interactive lives in that they take part in cooperative, declarative, and informative kinds of communication (cf. Tomasello et al. 2005; Tomasello 2008). According to this research paradigm, non-human primates have trouble understanding non-competitive, cooperative interactions and neither produce nor understand declarative, perspective-sharing pointing gestures. In human children, on the other hand, this ability and motivation is a crucial foundation for the development of communication and the acquisition of language (cf. Tomasello 2003, 2008). Therefore, cooperation and interaction seem to have played a unique role in human evolution (Tomasello 2009, for a critical review see Albiach-Serrano 2015).

In modern humans, the most important instrument for complex cooperation and interaction is certainly that of language (e.g. Levinson 2006). Evolutionarily speaking, language can be seen as a solution to the problem of complex, cooperative interaction and coordination. Conventionalized and socially shared linguistic constructions enable the sharing of information and the coordination of actions and perspectives through symbolic means. Linguistic symbols, then, serve as conventionalized coordination devices in interaction (cf. Croft 2017; Lewis 1969) Language is essentially a form of joint action (Clark 1996). As such, it "can only be properly understood in its social interactional context" (Croft 2017: 104). Successful communication and coordination via language is based on joint attention, shared intentionality and common ground

between interlocutors as well as our capacity for ostensive-inferential communication (see Scott-Phillips 2015; Tomasello 2008). Language serves essentially social and interactive functions (e.g. Dunbar 2017, Donald 2017). Pragmatic perspectives on language have become increasingly salient in language evolution research (e.g., Scott-Phillipps 2015). In these approaches, interlocutors co-create and negotiate meaning interactively in discourse, a process that is context-based, interactive, inferential and pragmatic in nature. But not only is language fundamentally interactive in nature, its evolution was also channelled through processes of joint meaning construction and conventionalization in interaction (Pleyer, in press). However, one of the key questions is how such a shared symbolic system used in social interaction got off the ground in the first place. This question is central to the origins of language, regardless of whether language emerged in the gestural or in the vocal modality, or whether it was multimodal from the start.

The question of language origins is often linked up with what Harnard (1990) has termed the *symbol grounding problem:* "How can the meanings of the meaningless symbol tokens, manipulated solely on the basis of their (arbitrary) shapes, be grounded in anything but other meaningless symbols?" A commonly proposed answer is that (proto-)language emerged from the use of iconic signs (see e.g. Számadó & Szathmáry 2012: 164, Tomasello 2008). Iconicity is a term stemming from Peircian semiotics, introduced into linguistics by Jakobson (1965). Somewhat simplified, it means "a resemblance between properties of linguistic form [...] and meaning" (Perniss & Vigliocco 2014), where some of these similarities can be more or less transparent (“imagistic iconicity”) while others are more abstract and relational (“diagrammatic iconicity”). According to Dingemanse et al. (2015: 604), iconic signs may relate form and meaning "by means of perceptuomotor analogies".

As Harnard (2012: 391) points out, "[i]f I first mime 'eating' and everyone recognizes that this gesture is associated with eating, then it is no longer necessary that the gesture should resemble eating in order to evoke that association." This gradual transition from iconic to *symbolic*, i.e. conventional, agreed-upon signs, has been observed in a number of different contexts, including homesign systems (Goldin-Meadow 2003), emerging urban signed languages such as Nicaraguan SIgn Language (Senghas, Kita & Özyürek 2004) and emerging rural sign languages such as Al-Sayyid Bedouin Sign Language (Sandler et al. 2014), Kata Kolok (Marsaja 2008) and others (cf. Zeshan & De Vos 2012; De Vos & Pfau 2015). It has also been observed in experimental paradigms using a "Pictionary" task (Garrod et al. 2007, 2010) or a silent gesture paradigm (Motamedi et al. 2016) to investigate the bootstrapping of graphic or gestural communication systems. A consistent theme across these studies is that signs gradually shed their initially iconic mappings. Instead, the amount of interdependency between signs rises, and sign-meaning mappings increasingly become underpinned by systematic rules. At first, strongly iconic sign systems have a number of obvious advantages. They facilitate the retrieval of forms (during production) or meanings (in comprehension; Cuskley 2013: 43). Gasser (2004), drawing on computational modelling results, demonstrates that while iconicity is advantageous for

learning, production and comprehension of a language with a small vocabulary, it can entail synonymies and ambiguities as the number of form-meaning pairs increases. This in turn can interfere with both learning and communication. Communicative systems governed by rules, on the other hand, may be more or less "arbitrary", in the sense that the link between form and meaning is only due to social conventions. This in turn makes a large vocabulary possible, which enables more complex forms of social coordination and interaction (see also Hurford 2012: 163). The coordination of perspectives in interaction thus might develop from being mostly iconicity-based to incorporating rules and symbols as coordination becomes more complex and less context-dependent. Despite this, as the papers in the present volume show, iconicity still plays a significant role in the structuring and evolutionary make-up of language.

Saussure's posthumous 1916 *Cours de linguistique* highlighted the essential role of arbitrariness in language has been largely influential in linguistics, leading to a growing body of research investigating the "arbitrary" nature of present-day (spoken) languages. Although Saussure's position was in fact much more complex, and Saussure himself saw iconicity as an important factor in language (see Joseph 2015), the emphasis on the arbitrariness of the sign/signifier relationship eventually became the received view or even "dogma" (Jakobson 1965). In the Chomskyan, generativist paradigm, there was also little interest in any possible iconic relationship between language and aspects of the external world. In contrast, the emphasis was on the nature of the "representational systems that derive from the structure of the mind itself and do not mirror in any direct way the form of things in the external world." (Chomsky 1981: 3, see Haiman 1985, Van Langendonck 2007: 397). Cognitive-linguistic, functional-typological and historical-linguistic approaches, on the other hand, have for a long time stressed the importance of iconicity in language in different linguistic domains (e.g. Haiman 1985; Van Langendonck 2007; Croft 2003, Givon 1991, Fischer 2010). In fact, the iconic structuring of certain aspects of language (such as word order, which may be more or less diagrammatically iconic with event structure) has become a standard topic in textbooks on Cognitive Linguistics (e.g. Dirven & Verspoor 2004: 8-12; Ungerer & Schmid 2006: 300-312) or linguistic typology (Croft 2003). This growing interest in iconicity in these and other disciplines in the language sciences is also reflected in book series like *Iconicity in Language and Literature* (ILL, e.g. Nänny & Fischer 1999; Elleström et al. 2013).

The strong emphasis on the arbitrary nature of language in mainstream linguistics has also been challenged in recent years by more empirically-oriented studies. For instance, Johansson & Zlatev (2013) found evidence for *sound symbolism* (i.e. non-arbitrary mappings between the phonological and semantic representations) in spatial deixis in 101 genetically and areally diverse languages. Dingemanse et al. (2016) showed that Dutch speakers can guess the meaning of ideophones from five languages (Japanese, Korean, Semai, Siwu, and Ewe) at an above-chance level.

The extent to which iconicity is present in signed and spoken languages is a matter of considerable debate. For instance, it has been argued that conventionalized iconic signs are ultimately arbitrary (e.g. Keller 1995: 156; Fitch 2010: 438). As Perlman, Clark & Tanner (2014: 229) point out, "[i]t is debated whether the iconicity in [conventionalized] forms is an active part of online processing." Even if this were the case, iconicity in signed languages as well as sound symbolism in spoken languages might be seen as pointers to the possible iconic roots of language:

> Synaesthetic sound symbolism offers a clue as to how the learning and propagation of the first learned symbols may have been facilitated by existing natural, in some sense innate, linkages between meanings and sounds. And the existence of conventional sound symbolism is also facilitatory in modern language, so there is some small but significant tendency for languages to evolve in such a way as to preserve some traces of sound-symbolism. (Hurford 2012: 133)

Furthermore, the potential for iconicity in present-day languages seems to differ across semantic domains. As Dingemanse et al. (2016: 607f.) argue, iconic signs can be found predominantly in the domain of perceptuomotor meanings, where percepts can be mimicked by the speech signal, whereas iconic signs in signed languages usually belong to the domains of motion, shape, and spatial relations. Thus, the question of the domains in which iconicity preferentially occurs can arguably also be very informative for scenarios of how fully-fledged language emerged from a gestural, vocal, or multimodal protolanguage.

2. From great apes to modern English: The present volume

The seven papers in the present special issue aim to shed new light on the respective roles of interaction and iconicity in the evolution of language. They reflect both the thematic breadth and the interdisciplinarity of current language evolution research, combining findings from comparative psychology, primatology, historical linguistics, typology, computational modelling, experimental semiotics, and empirically-informed theories.

A "big-picture" theoretical perspective is taken by **Casey Lister & Nicholas Fay**, who review findings from different areas and integrate them into a simple theoretical model that posits three key processes in the evolution of a human communication system: (1) the use of motivated signs, (2) behaviour alignment between interactants using these signs, and (3) sign refinement and symbolization. In a way, this model sums up what can probably be considered the "standard scenario" of language evolution in most empirically-oriented approaches: On this view, motivated signs are very likely to have paved the way from animal communication to "proto-language".

This, however, raises the question which modality these pre- or proto-linguistic iconic signs may have belonged to, as the vocal modality, which most of today's languages of the world make use of, does not seem to afford iconicity as readily as the gestural one. Therefore, "gesture-first" hypotheses have enjoyed much popularity in language evolution research over the last decades (e.g. Corballis 2003, Tomasello 2008; also see the extensive list of references cited in Perlman, this issue). In recent years, however, in line with the growing emphasis on multimodality in linguistic research in general (e.g. Vigliocco et al. 2014) and in language evolution research in particular (e.g. Wacewicz & Zywiczynski 2017), gesture-first hypotheses have been complemented by the idea that language may have been multimodal from the start. This idea is supported by **Marcus Perlman**'s review of recent findings from comparative research, including his own work with the enculturated gorilla Koko (e.g. Perlman & Clark 2015). He presents evidence that apes have considerable capacity for vocal learning and flexible vocal control. Thus, he argues against the assumption that all vocal behaviour of nonhuman primates is innate, inflexible, and involuntary. He also reviews recent experimental studies showing the human potential for iconic vocalizations, arguing against the assumption that vocalization does not afford sufficient iconicity to bootstrap meaning.

The same issue (gesture-first vs. multimodal-first) is addressed by **Jordan Zlatev, Sławomir Wacewicz, Przemysław Żywiczyński & Joost van de Weijer**, albeit from a different perspective. Drawing on experiments using an event reenactment task, they discuss the iconic potential of the gestural and vocal modalities. Intriguingly, their study shows that communicative success is higher when participants are asked to identify events reenacted by actors exclusively by pantomime than if they rely on both pantomime and non-linguistic vocalizations. This sheds new light on the long-standing discussion on the respective roles of the bodily and vocal modalities in the origin of linguistic communication. The authors argue that these results provide evidence for what they have termed a *pantomime-first* scenario as opposed to a multimodal-first scenario.

Hannah Little, Heikki Rasilo, Sabine van der Ham & Kerem Eryılmaz discuss a related topic. Summarising their ongoing experimental work, they investigate the emergence of combinatorial speech as a result of cognitive biases, addressing the question whether these biases are domain-specific. While recent literature addressing issues regarding speech has largely concentrated on the evolution of the physiological apparatus for speech (e.g. Fitch 2000, Lieberman 2007, MacLarnon 2012), Little et al focus on the role of cognitive adaptations required for combinatorial speech. They highlight three important factors in the emergence of human-like phonetic systems: articulatory effort, auditory and articulatory sensory discriminability, as well as lexical and language transmission constraints.

The question of how modality might affect the process of conventionalization lies at the heart of the paper by **Hannah Little, Kerem Eryılmaz & Bart de Boer**. Following up on the seminal

study by Garrod et al. (2007), who show that interaction influences the evolution of *graphical* signs from iconic to symbolic, they have conducted an artificial signalling experiment using continuous auditory signs produced with a "leap-motion" hand-tracking device (Eryılmaz & Little 2016). In their experiment, interaction did not have an effect on the degree of iconicity exhibited by the individual signs. They therefore argue that conventionalization might work differently in different modalities.

Seán Roberts and Stephen Levinson investigate the emergence of linguistic structure on a more abstract level, namely syntax. They argue that the structure of language adapts to what can be considered the primary ecology of language: interaction. The authors investigate this in an agent-based model linking together word order patterns with processing pressures imposed by turn-taking. The findings suggest that, when planning for the next turn is constrained by the position of the verb, the distribution of word orders in the model approximate the real world, typological distribution. Cognition and interaction should therefore figure more largely in an explanatory models of language structure and language evolution.

Bodo Winter, **Marcus Perlman**, **Lynn K. Perry**, and **Gary Lupyan** analyze the iconicity of 3000 English words using native speaker ratings. Their results suggest higher iconicity for English verbs and adjectives compared to nouns, and higher iconicity for words with perceptual compared to abstract meanings. Moreover, iconicity is distributed unevenly across the different sensory modalities, with touch and sound-related words being the most iconic. The results furthermore show that iconicity, as operationalized through native speaker ratings, is more strongly related to sensory semantics than systematicity (any form of statistical correspondence between word form and meaning).

In sum, this special issue illuminates several of the most relevant, albeit controversial topics in current language evolution research: (i) the interplay of iconicity and conventionalization, (ii) the importance of cooperation and (iii) the role and interaction between different perceptuomotor modalities.

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